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Motivational patterns for engaging in heritage bus city tours among youth tourists (Generation Y and Z): an unsupervised machine learning analysis

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Abstract. In the evolving tourism landscape, the rising dominance of Generation Y and Z tourists presents a paradigm shift, characterized by inherent preferences for nature and adventure attractions. Their support for heritage conservation-based sustainable tourism may change with this transformation. This research seeks to understand Generation Y and Z heritage bus city tour participants' motives to link their interests with cultural heritage. The study analyses 100 targeted individuals' responses using unsupervised machine learning and advanced algorithms. Questionnaires explored various motivations, including historical explanations, tourism information, entertainment factors, and the round-the-city experience. The outcome reveals three distinct and discernible motivational clusters within young participants. This study plays a pivotal role in addressing the potential disconnection between Generation Y and Z tourists and heritage conservation. Understanding their motives makes heritage bus city tours more appealing and helps create tailored initiatives. Such strategies aim to foster a genuine appreciation for heritage attractions and encourage active participation in cultural heritage conservation. This research bridges the gap between these cohorts' interests and cultural heritage sustainability in tourism by connecting the findings with their characteristics. It ensures Generation Y and Z appreciate heritage places and become responsible stewards of conservation, promoting sustainable tourist practices to preserve cultural heritage.

1. Introduction

In the changing landscape dominated by Generation Y and Z, understanding their motivations is crucial for shaping the future of cultural heritage engagement. Concerns arise about the sustainability of heritage attractions as these generations, more inclined towards natural and technology-based attractions [1] as well as both generations prioritize destination attractiveness factors such as cultural experiences, adventure, and relaxation [2]. For which may not provide sufficient support, posing potential challenges for heritage preservation in the realm of sustainable tourism. Existing research underscores these generations are 'digital tourists' who uses technology extensively, focusing on culture and culinary areas during travel [3]. Also, a study noted a preference for international Indigenous tourism among Gen Y [4]. While, there's little evidence of similar interest in heritage attractions. In Bandung, the rising popularity of heritage bus city tours as a means of heritage attraction exploration accentuates the need to unravel the motivations of Generation Y and Z participants—whether their interest gravitates toward historical explanations or other dimensions remains uncertain.

The urgency lies in the imperative of sustaining tourism through heritage conservation. With Generation Y and Z assuming increasing prominence, understanding their motivations for participating in heritage bus city tours is not merely a scholarly pursuit but a strategic necessity. This inquiry stands as a pivotal endeavor to align conservation strategies with the dynamic preferences of these generations, thereby laying the foundation for a sustainable paradigm in heritage tourism in Bandung and beyond.

In Bandung, Indonesia, the Bandros tour (Bandung Tour On The Bus), operated by the Indonesian Tour Guide Association (HPI), offers tourists the opportunity to explore the city's heritage-listed buildings through well-planned routes. Accompanied by knowledgeable local tour guides, tourists



receive informative commentary during the excursion, enhancing their understanding of the city's history and culture (figure 1).



Figure 1. A unit of Bandros (Bandung Tour on The Bus) managed by HPI.

Tour guides in the Bandros HPI city tour should prioritize offering relevant and captivating interpretive materials, accurately conveying the historical knowledge of heritage buildings. However, participants in this tour come from diverse backgrounds. Consequently, not all engaged with the extensive historical narratives provided by the guides. Resolving that situation, some guides employ alternative interpretive techniques, focusing more on entertainment aspects. Recognizing the motivations driving youth tourists in heritage bus city tours extends beyond the realm of marketing and operations; it is inherently tied to the preservation of cultural heritage. The insights gained from understanding these motivations contribute to the effective delivery of cultural heritage information by tour guides. This, in turn, plays a pivotal role in fostering an appreciation for the city's heritage among young individuals [5-7]. By ensuring that the information provided aligns with the interests and preferences of the youth demographic, heritage tourism becomes a powerful conduit for not only attracting visitors but also actively engaging them in the preservation of the city's rich heritage tapestry. In essence, unraveling the motivations of youth tourists becomes a strategic imperative for cultivating a lasting connection between the younger generation and the preservation of cultural heritage. Although youth tourism is a significant and growing sector, comprehensive information and statistics about these tourists are lacking [8,9], and there is the need for further research to understand and engage these generations [10]. Studies indicate that youth travelers prioritize leisure time, itinerary flexibility, immersive cultural experiences, and visually captivating destinations. However, limited evidence suggests a specific inclination towards heritage attractions among this demographic [11].

Considering the aforementioned background, it is critical that we analyze the underlying factors behind why visitors choose to participate in the Bandros HPI heritage city tour of Bandung.

2. Literature review

This section presents a concise literature review on the motivational patterns for youth tourists (Generation Y and Z) engaging in heritage bus city tours. It synthesizes relevant scholarly works and empirical studies, exploring the motivations and preferences of youth tourists in the context of heritage tourism experiences.

Key findings and theoretical frameworks are highlighted to establish a foundation for understanding the significance of motivational factors in shaping their engagement. The literature research serves as the foundation for this study's following analysis of motivational patterns.

2.1. Generation Y and generation Z

For decades, the Pew Research Center's meticulous analysis has revealed that Generation Y, commonly referred to as Millennials, spans birth years from 1981 to 1996, while Generation Z encompasses those born between 1997 and 2012 [8,12], as shown in table 1. By employing generational cohorts as a lens, researchers not only gain insights into the dynamics of changing attitudes but also unveil the intricate interplay between historical context and personal experiences that contribute to shaping these perspectives.

Table 1. Generational characteristics and preferences toward heritage tourism attractions in 2023.

Generation	Birth year span	Age Range in 2023	General Characteristics	Characteristics Toward Heritage Tourism
Generation Y	Born 1981 – 1996	ages 27 – 42	Tech-savvy, value experiences over possessions, diverse and inclusive, civic-minded	Seek authentic and immersive experiences, value cultural diversity [13], interested in interactive and tech-enhanced exhibits [14] [15]
Generation Z	Born 1997 – 2012	ages 11 – 26	Digital natives, entrepreneurial mindset, socially conscious, diverse and inclusive, prefer authenticity	Prefer experiences over material possessions [16], desire interactive and personalized encounters, and value sustainability [3]

Furthermore, generational cohorts serve as a valuable framework for comprehending societal shifts and cultural transformations. As individuals progress through different stages of life, their perspectives are continuously molded by a myriad of factors. By examining the collective outlook of a generation during their formative years, researchers can delineate how pivotal events, economic landscapes, technological advancements, and social norms influence the values and beliefs held by a specific cohort. This holistic approach illuminates the intricate relationship between individual experiences and broader cultural shifts, fostering a nuanced understanding of how generations contribute to the evolving tapestry of society.

In conclusion, the concept of generational cohorts, as advocated by the Pew Research Center is a crucial analytical tool that allows researchers to explore the evolution of viewpoints over time and delve into the intricate interplay between personal experiences, historical events, and cultural shifts. By examining how different generations perceive and engage with the world, researchers gain valuable insights into the forces that shape societal attitudes and contribute to the ongoing narrative of human development.

2.2. City tours increase the attractiveness to heritage tourism

Implementing city tours is an effective means to increase the attraction for heritage sites. City tours are planned and guided tourist activities that take place within a city and attempt to offer a thorough knowledge of its cultural, historical, and architectural features. These trips follow predefined routes and can be taken on foot, by bus, or by other means of transportation. Tours are frequently accompanied by knowledgeable guides or educational video materials that explain notable sites, attractions, and local points of interest. City tours allow tourists to immerse themselves in a city's particular environment, learn about its history, and acquire insights into its local culture and traditions.

These tours may be themed, such as heritage, architecture, or local traditions, and are intended to increase tourists' awareness and appreciation of the city's cultural and historical value. During city tours,

tourists are given insightful commentary, interesting tales, and interactive experiences that help them connect with the area more deeply. Tourists use city tours to learn the attractions of a location and acquire insights into its local identity. As a result, city tours may be a worthwhile tourist experience, broadening visitors' understanding of the place they are visiting [17-19].

2.3. Tourists' motivations for participating in city tours

Numerous motives have been identified as fundamental causes influencing tourists' interest in engaging in city tours based on considerable study. Understanding these reasons is critical for the proper management of city tours with the goal of improving the overall visitor experience. Therefore, recognizing and valuing these reasons may be a useful reference for tour operators and destination managers when improving their services. Thus, the next section discusses significant motives that are likely to affect tourists' decision to participate in city tours:

- a. *Knowledge Enhancement Motivation.* One of the stated motives is the desire to enhance knowledge. Tourists can learn about the history, culture, architecture, and unique qualities of the city they are visiting during a city tour [20,21].
- b. *Recreational and entertainment purposes.* Tourists seek recreational and entertainment experiences on heritage city tours, allowing them to discover historical and cultural places while enjoying a sense of pleasure and excitement [22-24].
- c. *Social Interaction.* Tourists' willingness to participate in heritage city tours can be influenced by their desire to engage with fellow tourists, tour guides, and the local community. Tourists are interested in sharing experiences, meeting new people, and expanding their social networks [25-27].

2.4. City tour guide

The role of city tour guides is to elucidate and provide information on the landmarks, attractions, history, culture, and traditions of the visited city. They contribute to establishing the historical and cultural context of each location, imparting intriguing details, and narrating enriching stories that enhance the travel experience. Furthermore, city tour guides also serve as entertainers, adopting interactive methods to engage and enliven the journey. They may employ anecdotes, humor, or even captivating mini-performances to emotionally involve guests and create an enjoyable experience during the city tour. City tour guides also facilitate interactions among tourists. Throughout the journey, they provide opportunities for tourists to interact with one another, share experiences, and form social connections. By offering informative and engaging information, city tour guides can enhance the quality of the tourism experience within a city tour [28,29].

2.5. Tourist Experience

Tourist experience encompasses the behaviors, perceptions, cognitions, and emotions of tourists throughout the pre-visit, during-visit, and post-visit stages. Ultimately, the tourist experience becomes the product of tourism. This product is realized when the tourist consumes the product itself. When participating in a tourist experience, this involvement is referred to as tourist behavior. Tourist participation is used to depict the behavior and profile of tourists. Co-creation, attention, engagement, and experiential memory are some additional concepts that may be employed in understanding the concept of tourist experience. Moreover, mindset and business strategies involving consumer participation in the steps of product production and development, including services, are typically encompassed within the framework of co-creation approach [30].

3. Methodology

This research utilizes Unsupervised Machine Learning to uncover hidden patterns in unlabeled data. Unsupervised learning does not rely on predefined targets, allowing for the identification of structures and clusters within the data. The K-Means clustering algorithm is employed to group the data based on

specified means. Evaluation methods, including membership values, cluster validity, and data visualization, are employed to assess the results of the clustering process [31].

The population of this study consists of tourists who have participated in heritage city tours using the Bandros HPI bus in Bandung. The sample for the research can be randomly selected from recent participants of these tours.

Unlike conventional research methods, unsupervised machine learning does not require specific sampling guidelines as it does not rely on labeled data or predefined targets [32,33]. However, for the purpose of this study, the population is defined as comprising two generational groups: Generation Y, and Generation Z with a total target of 100 respondents (an exceeding 105 respondents actually returned the questionnaire).

The inclusion of a specific age-related question in the questionnaire and clear communication with participants about the eligibility criteria ensures that the sample is representative of Generation Y and Z. This transparency in participant selection facilitates the replicability of the study by allowing future researchers to adopt a similar approach when recruiting participants from heritage bus city tours. The use of this innovative approach not only adds a layer of sophistication to the study but also introduces a replicable framework for researchers interested in exploring complex motivations within similar contexts.

Following is the Data Analysis Framework for this research:

3.1. Data preprocessing

The initial stage of this study encompassed a meticulous data preprocessing process, comprising the following key steps:

- a. *Data Cleaning and Preparation.* Efforts were made to ensure the integrity and coherence of the dataset through rigorous data cleansing and organization.
- b. *Encoding Categorical Variables.* Categorical variables were systematically encoded to numerical values, facilitating subsequent computational analyses.
- c. *Normalization of Ordinal Data.* To establish a uniform scale for the dataset, ordinal data underwent normalization using the well-established Min-Max normalization technique.

3.2. Unsupervised machine learning

This phase of the research involved the application of unsupervised machine learning techniques to uncover latent patterns within the data. The methodology encompassed the following key components:

- a. *Conducting K-means Clustering.* A pivotal step in the analysis entailed the implementation of K-means clustering, a powerful technique for grouping respondents based on congruent motivations and satisfaction patterns.
- b. *Interpreting K-means Results.* An intricate interpretation of the K-means clustering outcomes was undertaken. This provided insights into distinct respondent clusters, shedding light on their inherent motivations and satisfaction profiles.

In determining the optimal number of clusters, three robust methodologies were employed:

- Silhouette Score Analysis: Silhouette scores were meticulously computed for various cluster configurations (e.g., 2, 3, 4, etc.), offering a quantitative benchmark to identify well-defined and distinct clusters.
- Elbow Method: The within-cluster sum of squares (inertia) was graphically assessed against different cluster counts to discern the point of diminishing returns, aiding in the selection of the most meaningful cluster configuration.
- Principal Component Analysis (PCA): is a statistical technique used for dimensionality reduction in high-dimensional datasets. It identifies and constructs new uncorrelated

variables, known as principal components that capture the most significant variability in the original data, allowing for visualization, noise reduction, and improved analysis while retaining essential information. PCA is often utilized to evaluate the distinctiveness of clusters within data; it can help assess whether clusters exhibit clear separation and if the reduced dimensions effectively highlight meaningful patterns in the data.

3.3. Interpretation and insights

Subsequent to the unsupervised learning analyses, an incisive interpretation and extraction of insights were undertaken. This phase encompassed the following facets:

- a. *Analysis of unsupervised learning outcomes:* A thorough analysis of the outcomes derived from the unsupervised learning techniques was conducted. This endeavor sought to unravel the preeminent motivations and satisfaction patterns prevalent among distinct generational segments.
- b. *Identification of generational motivation trends:* Discerning whether specific motivations exhibited a pronounced prevalence within particular generational cohorts formed a pivotal aspect of this analysis. Exploring the underpinning rationales for these trends was also of paramount interest.

This structured methodology amalgamated data preprocessing, unsupervised machine learning, and comprehensive interpretation to glean profound insights into the nuanced dynamics of motivations and satisfaction levels across different generations.

4. Results and discussions

A dataset comprising responses from 105 respondents was collected, capturing various aspects of tourist engagement, including motivations, experiences, and satisfaction levels. We diligently addressed missing values and prepared the dataset for analysis by cleansing and structuring the data. String-to-numeric conversion and normalization ensured the data's suitability for further analysis. To enable an effective PCA and clustering analysis, the features were standardized using the StandardScaler technique, ensuring each feature contributed equally to the analysis.

The K-Means clustering algorithm was employed to group tourists into clusters based on similar attributes. A critical reevaluation has been undertaken regarding the optimal number of clusters to be employed within the purview of this research endeavor. While the silhouette score manifests at 0.326 for the configuration comprising three clusters, it attains a higher value of 0.3645 when the number of clusters is increased to four. Nonetheless, upon meticulous examination of both the Elbow model and the scatter plot visualization facilitated by PCA analysis, it becomes discernible that the configuration encompassing three clusters exhibits a heightened level of distinctiveness among the constituent groupings. Consequently, a judicious decision has been reached to proceed with the utilization of three clusters as the most representative and meaningful division for the analysis.

4.1. Data results

The combined application of PCA and clustering analysis produced compelling insights into the distinct behaviors and preferences of tourists engaging in heritage tourism. Following is the comparative analysis of two Principal Component Analysis (PCA) outcomes. As depicted, the PCA visualization for a configuration involving three clusters shown below (figure 2), it also showcased the PCA for a four-cluster configuration (figure 3). Notably, it demonstrates a discernibly more distinct pattern among the three clusters, whereas there is increased overlapping tendencies among the four clusters.

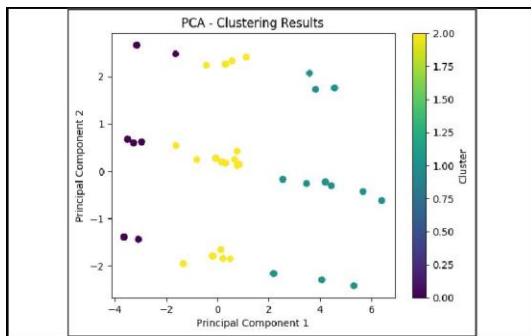


Figure 2. Principal Component Analysis (PCA) visualization for three clusters: enhanced distinctiveness of cluster patterns.

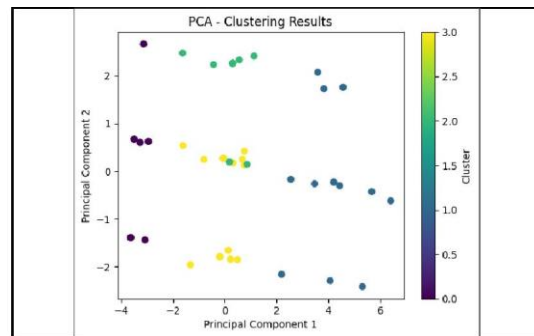


Figure 3. Principal Component Analysis (PCA) visualization for four clusters: observing cluster overlapping phenomena.

The clustering analysis yielded insightful results that shed light on distinct patterns of tourist behavior and satisfaction within the heritage tourism context. Each cluster displayed unique characteristics, contributing to a deeper understanding of tourists' preferences and experiences (table 2):

Table 2. Cluster characteristics values for different tourist groups.

Feature	Cluster 1	Cluster 2	Cluster 3
Generation Y	0.12967	0.086031	-0.070796
Generation Z	-0.12967	-0.086031	0.070796
Male	-0.08113	0.331061	-0.063955
Female	0.08113	-0.331061	0.063955
Normalized Motivation for Historical Info	1.249598	-0.470468	-0.316755
Normalized Motivation for Tourist Info	1.152191	-1.309252	-0.045842
Normalized Motivation for Guide Entertainment	1.245439	-1.456443	-0.037955
Normalized Motivation for City Tour	1.215999	-1.330863	-0.062694
Normalized Satisfaction with Historical Info	1.041732	-1.626633	0.083118
Normalized Satisfaction with Tourist Info	1.166649	-1.786249	0.083118
Normalized Satisfaction with Guide Entertainment	1.147265	-1.56999	0.029261
Normalized Satisfaction with City Tour	1.223439	-1.512033	-0.014414
Number of respondents belong to the cluster	64	23	18

In pursuit of further elucidation, the ensuing data clarifies the preeminent motivating factors discerned among the survey respondents. The findings reveal that:

- For Generation Y, the predominant motivation is attributed to their desire for historical information (1.249598).
- In contrast, Generation Z exhibits a distinct inclination, with their primary motivation centered on acquiring tourism-related information (0.083118).

These results underscore the notable divergence in motivational factors between the two generational cohorts. Generation Y is primarily driven by an interest in historical narratives, fueling their participation in heritage city tours. Conversely, Generation Z's motivation primarily hinges on their aspiration to access tourism-related knowledge during city tours, reflecting a distinct perspective on heritage exploration.

This differentiation in motivational factors underscores the nuanced and evolving dynamics in the tourism sector, signifying the importance of tailoring tour experiences to cater to the preferences of distinct generational groups.

4.2. Discussions

In order to explain the contents of the table provided above (table 2), it is essential to undertake a thorough analysis of the features depicted in the clustering description. This analysis will shed light on the distinct characteristics present within the clustering context. The description reveals the presence of four distinct clusters, each with its own set of defining traits.

First of all is to see the Silhouette Score of approximately 0.3262. This is a positive score, which indicates that, on average, data points within clusters are more similar to each other than to data points in neighboring clusters. This suggests that the three-clustering solution has some degree of separation between clusters, meaning that the clusters are reasonably distinct.

The distinctive motivational patterns observed between Generation Y and Generation Z within the context of heritage bus city tours offer valuable insights into the nuanced preferences of these two generational cohorts (table 2). The notable emphasis of Generation Y on historical information aligns with existing research highlighting their inclination towards experiential and authentic travel encounters. This preference suggests a heightened interest in understanding the historical narratives associated with the destinations they explore, reflecting a desire for enriched cultural experiences [34].

The subsequent sections will focus on breaking down and explaining these clusters, uncovering the subtle differences that emerge as a result of the clustering process. The results provided are the cluster centroids or cluster centers for a K-means clustering analysis with three clusters. These centroids represent the average values for each feature (variables) within each cluster.

- **Cluster 1:**

Generation: This cluster is slightly skewed towards Generation Y, with a positive value indicating a higher proportion of Generation Y participants.

Gender: It appears to have a slightly higher proportion of females (positive value) compared to males.

Motivation and Satisfaction: Cluster 1 demonstrates notably high motivation and satisfaction scores across all categories, including historical information, tourism information, entertainment by the guide, and the desire to go around the city. These scores are considerably above average.

- **Cluster 2:**

Generation: This cluster is again skewed towards Generation Y but to a lesser extent than Cluster 1.

Gender: Cluster 2 has a higher proportion of males compared to females, as indicated by the positive value for males and negative value for females.

Motivation and satisfaction: In contrast to Cluster 1, Cluster 2 exhibits lower motivation and satisfaction scores across all categories. Participants in this cluster seem to be less motivated by historical and tourism information, entertainment by the guide, and city exploration. Their satisfaction levels are notably lower.

- **Cluster 3:**

Generation: This cluster is slightly skewed towards Generation Z, with a negative value for Generation Y.

Gender: The gender distribution appears balanced, with both males and females represented in this cluster.

Motivation and satisfaction: Cluster 3 shows moderate motivation and satisfaction scores across most categories. It does not exhibit extreme preferences or dissatisfaction, and participants seem relatively neutral in their motivations and satisfaction.

In order to gain a deeper understanding of the dataset, it is imperative to provide an interpretation of the aforementioned results for each cluster. Following is the interpretation of the above findings:

Cluster 1: Enthusiastic heritage tourists

Cluster 1 appears to represent a distinct group of tourists who exhibit high levels of motivation, particularly driven by historical and tourism information, and report exceptional satisfaction with their tour experiences. This cluster seemingly encapsulates tourists with a profound enthusiasm for heritage city tours in Bandung. Notably, the majority of respondents in this cluster are females belonging to Generation Y. This segment comprises 64 respondents, constituting a significant 60.95% of the total respondents across all clusters.

Cluster 2: Less satisfied participants

Cluster 2 portrays a contrasting profile, characterized by lower motivation and reduced satisfaction levels across various aspects of their tour experience. A noteworthy observation is the preference for male participants within this cluster. This particular segment may signify tourists who, potentially, did not find their experience as enjoyable. The cluster encompasses 23 respondents, accounting for 21.90% of the total respondents within all clusters.

Cluster 3: The neutral tourists

Cluster 3 captures a group of respondents displaying moderate levels of motivation and satisfaction, along with a balanced distribution across generations and gender. This segment signifies tourists who adopt a more neutral stance towards the tour, neither exceptionally motivated nor dissatisfied. This cluster comprises 18 respondents, representing 17.14% of the total respondents across all clusters.

Please note that these interpretations are based on the cluster centroids, and individual responses within each cluster may vary. Further analysis could involve exploring the demographics and motivations of respondents within each cluster to gain deeper insights into their characteristics and preferences.

In interpreting the silhouette score of 0.3262 obtained from our clustering analysis, it's important to consider the degree of separation and cohesion among the identified clusters. The silhouette score serves as a measure of how well-defined and distinct the clusters are from one another. A score closer to 1 indicates well-separated clusters, while a score closer to 0 suggests overlap and ambiguity in cluster boundaries.

In our case, the silhouette score of 0.3262 indicates a moderate level of separation, implying that while the clusters do exhibit certain distinct characteristics, there may also be areas of overlap or similarity between them. This suggests that some respondents might share attributes that place them on the boundary between clusters, leading to a slightly lower silhouette score. While the silhouette score may not be exceptionally high, it's crucial to remember that clustering real-world data, especially in complex domains like tourism, can often result in some level of overlap due to the diverse and multifaceted nature of human behavior and preferences. Therefore, our analysis takes into account this nuanced interpretation, allowing us to better understand the intricate relationships and trends within the data, even amidst some cluster overlap.

Considering the nuanced findings of highlighting additional factors influencing Generation Y's heritage tourism preferences [35], it becomes essential to acknowledge the potential impact of variables such as party size, social experiences, and ethnicity on the observed clusters in our research. Previous study also shows that additional attraction to heritage site (such as coffee experience) could strengthen the motivation of Generation Z to be interested in heritage attraction [36]. While our clustering analysis successfully identified distinct motivational profiles based on age, gender, and satisfaction levels, the intricate interplay of these additional factors could contribute to variations within each cluster. For instance, the enthusiastic heritage tourists in Cluster 1 may find their motivations further shaped by the social dynamics of larger party sizes or specific ethnic backgrounds. Similarly, the less satisfied

participants in Cluster 2 might exhibit varying responses when considering social experiences during heritage bus city tours. Integrating these nuanced factors into the discussion would offer a more comprehensive understanding of the motivations and preferences within each cluster, aligning our findings with the broader literature on Generation Y's intricate relationship with heritage tourism.

This study plays a pivotal role in unraveling the motivations behind Generation Y and Z tourists' participation in bus city tours. By understanding the specific drivers that attract these generations to such experiences, we lay the groundwork for crafting targeted strategies that resonate with their preferences and interests. Beyond the immediate goal of enhancing the appeal of these tours, the ultimate purpose is to seamlessly link this newfound appreciation for heritage attractions with sustainable tourism through cultural heritage conservation.

Furthermore, we might be able not only to attract their interest but also cultivate a genuine love for heritage conservation. The alignment of heritage attractions with their specific motivations creates an opportunity to not only draw them to these sites but also to instill in them a sense of responsibility and connection to the preservation of cultural heritage. This transformative approach contributes directly to sustainable tourism by fostering a lasting commitment among Generation Y and Z tourists to actively support and engage in the conservation efforts that safeguard our cultural heritage for generations to come.

5. Conclusion and recommendations

5.1. Conclusion

The integration of Principal Component Analysis (PCA) with clustering analysis has provided illuminating insights into the behaviors and preferences of tourists in the realm of heritage tourism. While our analysis yielded meaningful clusters with distinct characteristics, the silhouette score of 0.3262 reminds us of the intricacies inherent in clustering real-world data. The moderate level of separation indicates that while clusters exhibit uniqueness, certain overlaps and similarities persist, reflecting the multifaceted nature of tourist engagement.

5.2. Recommendations

While not central to the primary scope of this study, it is noteworthy that a marketing recommendation is included, facilitated by a research partner specializing in this domain. This inclusion stems from the desire to offer a comprehensive perspective on potential strategies for effectively engaging diverse clusters of heritage tourists. Although the research primarily centers on interpreting and analyzing the identified clusters based on their motivational patterns, the incorporation of marketing considerations extends the pragmatic utility of the study's findings. The subsequent section delineates marketing strategies tailored to each cluster's distinct characteristics and preferences, bridging academic insights with practical implementation for enhanced heritage tourism experiences:

a. *Marketing recommendations for enthusiastic heritage tourists*

Segmentation Understanding: Cluster 1 represents highly motivated and satisfied tourists, predominantly from Generation Y and with a female majority. They are enthusiastic about heritage city tours in Bandung. This segment seeks in-depth historical and tourism information and values a high-quality experience. *Tourist Guide Preference:* Develop comprehensive historical narratives, focusing on the rich heritage of Bandung. Also craft engaging stories that highlight the historical significance of each location. Capitalize on the enthusiasm of this cluster by offering personalized heritage tours. Tailor experiences to cater to their keen interest in historical and tourism information. Possibly provide in-depth guided tours, historical lectures, and exclusive access to heritage sites.

Promotional materials: Share detailed historical and cultural content through blogs, videos, and social media. Create content-rich marketing materials focusing on the historical and cultural significance of Bandung. Utilize social media, blogs, and videos to engage and educate this

segment. Highlight the unique aspects of Bandung's heritage that align with their interests. Utilize platforms popular among Generation Y, such as Instagram and YouTube, for visual storytelling.

b. *Marketing strategy recommendations for the less satisfied participants*

Segmentation Understanding: Cluster 2 comprises tourists with lower motivation and satisfaction levels, with a preference for male participants. This group may not have had a satisfactory experience.

Tourist guide preference: Offer concise, engaging materials focusing on surprising and intriguing aspects of Bandung's heritage. Emphasize unique and offbeat narratives to spark interest. Provide live guided tours with an energetic and entertaining guide. Also, focus on improving the overall tour experience for this cluster. Identify pain points and areas of dissatisfaction, then make necessary adjustments. This could include better-trained guides, more engaging activities, or improved facilities.

Promotional materials: Share short, intriguing snippets showcasing Bandung's hidden gems and experiences. Utilize platforms with a broad reach, such as Facebook and TikTok, to capture attention. Also, consider encouraging satisfied visitors from other clusters to refer friends and family in Cluster 2. Reward both referrers and new customers to stimulate growth in this segment.

c. *Marketing strategy recommendations for the neutral tourists*

Segmentation understanding: Cluster 3 represents tourists with moderate motivation and satisfaction levels, spanning different generations and genders. This group holds a neutral stance toward tours.

Tourist guide preference: Offer a balanced mix of historical and contemporary content to cater to diverse interests. Create flexible narratives that allow tourists to choose their tour focus. Create a diverse range of tour interpretation options that cater to various interests within this cluster. Provide options for historical enthusiasts, adventure seekers, and those interested in local culture.

Promotional materials: Highlight Bandung's versatility as a destination, showcasing both its historical and modern facets. Use platforms like TripAdvisor and travel forums to reach a broad audience seeking varied experiences. Tailor marketing messages to be gender-neutral, avoiding stereotypes. Highlight the inclusivity and versatility of Bandung's heritage tours.

Looking ahead, future research endeavors can expand upon these findings by broadening the sample size, thereby enhancing the statistical robustness of our conclusions. A larger and more diverse dataset would allow for a more comprehensive exploration of the causal relationship between motivation and satisfaction among youth tourists participating in bus heritage city tours. The application of regression analysis on an expanded dataset would help unveil potential causal links, shedding light on the factors that drive tourist motivations and subsequently influence their satisfaction levels. By delving deeper into the intricate dynamics between motivation and satisfaction, we can not only refine our understanding but also pave the way for more informed and targeted strategies in the management and design of heritage tourism experiences.

This study, characterized by its fusion of advanced analytical techniques and domain-specific insights, signifies a stepping stone towards a more comprehensive understanding of tourist behavior. Through the pursuit of further research, we can unlock the untapped potential of youth engagement in heritage tourism, enriching the industry and fostering tailored experiences that resonate deeply with a diverse array of travelers.

6. Appendices

In the pursuit of unraveling the intricate fabric of tourist behavior and satisfaction within heritage tourism, a crucial component of our research lay in the application of unsupervised machine learning techniques. Leveraging the versatility and power of the Python programming language in Google

Colab, we harnessed the capabilities of the scikit-learn library to perform a K-Means clustering analysis. This unsupervised approach allowed us to partition our dataset into distinct clusters based on shared attributes, revealing underlying patterns that might not be immediately evident. The data preprocessing stage involved careful handling of missing values, followed by feature scaling to ensure equitable contribution of features. Further enriching our analysis, Principal Component Analysis (PCA) was employed to transform the feature space, reducing dimensionality and enhancing the interpretability of our results. By conducting this analysis in Google Colab, we seamlessly integrated data preparation, transformation, and modeling, enabling a comprehensive examination of tourists' motivations and satisfaction levels.

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