

Customer Sentiment and Spatial Clusters of Michelin-Starred Restaurants in Busan

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Abstract

This study examines the spatial and sentiment dynamics of 28 Michelin-starred restaurants in Busan, South Korea, to elucidate how geographic location and service attributes influence customer perceptions in the context of culinary tourism. A mixed-methods design, integrating Geographic Information System (GIS) spatial analysis and qualitative sentiment analysis, was employed. Michelin-starred restaurants in Busan were geocoded using QGIS. A total of 9,898 online reviews were processed through KH Coder to extract frequently occurring terms and co-occurrence relationships, and spatial heat maps were generated to visualize the clustering of positive sentiments across urban districts. The results revealed a significant concentration of highly rated restaurants and positive customer sentiment focusing specifically on the top two sentiments, "good" and "delicious" in Haeundae and Busanjin, where attributes such as *food quality*, *ambiance*, and *service* interact synergistically to enhance customer satisfaction. The integration of spatial and textual analyses provides empirical evidence that geographic concentration contributes to perceived restaurant value and reinforces district-level culinary reputation. The findings carry practical implications for urban planners, tourism policymakers, and restaurateurs, suggesting that strategic investment in culinary clusters and supporting infrastructure can strengthen Busan's position as a premier gastronomic destination and promote sustainable urban development within the fine-dining sector.

Categories: Branding in tourism and hospitality, Consumer Behavior, Decision Support
Keywords: michelin-starred restaurants, co-occurrence network analysis, online reviews, spatial analysis, perceived customer

Introduction

In the restaurant industry, the Michelin Guide, renowned for its prestigious rating system, plays an important role in highlighting establishments that are of exceptional quality (Lane, 2013). Since the publication of the Michelin Guide Seoul in 2016, South Korea has experienced an increase in Michelin-starred restaurants, which reflects the country's rich culinary heritage and its growing prominence in international gastronomy (The Michelin Guide, 2025). The Michelin star, often regarded as the gold standard for culinary excellence, has become a symbol of quality and prestige, not only enhancing the reputation of individual establishments but also contributing to the branding of cities and regions as premier culinary destinations.

Michelin-starred restaurants are increasingly recognized as key players in South Korea's cultural and economic landscape. However, despite their importance, there has been limited application of Geographic Information Systems (GIS) to examine their spatial distribution and broader socioeconomic impact. Prior research has examined the economic effects of Michelin ratings (Batat, 2020) and utilized GIS to investigate various aspects of tourism and hospitality services (Gungor et al., 2024). Nonetheless, there remains a significant gap in exploring the spatial analysis of high-end dining establishments within the specific context of South Korea.

Understanding the spatial distribution of Michelin-starred restaurants can facilitate the identification of urban economic clusters, accessibility challenges, and cultural hotspots (Angelini et al., 2025). Such insights are invaluable for urban planners, policymakers, and stakeholders in the tourism and investment sectors, enabling them to make informed decisions that can shape urban development, enhance tourism strategies, and identify lucrative investment opportunities. Moreover, analyzing the spatial characteristics of these restaurants provides insights into patterns of inequality of the distribution, accessibility, and the influence of location on customer experience.

This study aims to address the gap by utilizing GIS techniques to analyze the spatial distribution of Michelin-starred restaurants in South Korea. By combining a geographic approach with an examination of their relationship to socioeconomic factors, this research seeks to contribute to a deeper understanding of urban geography and the dynamics of the hospitality industry (Jang and Kim, 2022). The findings are intended to offer practical insights for enhancing tourism, urban planning, and restaurant positioning strategies, while also contributing to the broader theoretical discourse on place-based marketing and urban economics in the era of digital transformation.

Literature review

Michelin-starred Restaurant

Michelin Guides are widely regarded as tastemakers of contemporary food culture, with symbolic and material power across the global restaurant industry (Huang and Hall, 2023). Michelin stars have been shown to enhance a restaurant's reputation and economic performance, as increased demand allows for

premium pricing; however, maintaining such standards can also increase operational expenses (Batat, 2020). A high level of customer expectation is expected in these establishments, with service quality, ambiance, and authenticity playing a crucial role in determining customer satisfaction and loyalty (Rathnasiri et al., 2025).

Additionally, they contribute significantly to the development of gastronomic tourism and the preservation of cultural heritage, enhancing the image of destinations and promoting local cuisines (Gündüz et al., 2024). In order to enhance operational efficiency and personalize customer experiences, technologies, such as artificial intelligence and data analytics, are becoming increasingly prevalent (Vashishth et al., 2024). Moreover, the COVID-19 pandemic has prompted restaurants to adapt through innovations that include gourmet takeaway services and virtual dining experiences (Chong, 2024) and (Gössling et al., 2020). It is also possible to gain insight into urban economic clusters and cultural hotspots by examining the spatial distribution of Michelin-starred restaurants (Huang et al., 2024), which will be useful for the planning of urban development projects and tourism promotions.

Spatial Analysis

The restaurant industry is part of tourism and hospitality, and the majority of restaurant services are produced and consumed in the same location, thereby making them geographically dependent. Having customers, whether they are residents, part-time residents, or visitors from outside the region, is the key to restaurants' success in an area (Walter et al., 2022). Due to economic development and urbanization, the number of urban residents increases, thereby stimulating the production of catering services as a basic service sector in cities (Tian and Shen, 2024). In tourism and restaurant research, GIS and spatial analysis have been integrated to enhance our understanding of spatial patterns, tourist behaviors, and strategic location decisions.

The use of GIS has been used to analyze the spatial distribution of restaurants and tourist attractions to provide insights into how factors such as accessibility, clustering, and urban dynamics influence the hospitality sector (García-Palomares et al., 2015). An active role that spatial analysis plays in tourism studies is its ability to track tourist movements and identify hot spots, which is crucial to the successful management and planning of destinations. As a whole, GIS has been relatively underutilized by tourism researchers and practitioners considering its analytical capabilities (Kang et al., 2014). In order to understand tourist behavior and enhance tourism experiences, scholars have utilized GIS technologies. Using real-time data, Kim and Fesenmaier (Kim and Fesenmaier, 2015) demonstrated the importance of spatial analysis in improving tourism product design through the measurement of tourists' emotions and experiences.

According to Tian and Shen, spatial analysis has been applied to the restaurant industry to assess location strategies and competitiveness, demonstrating the importance of spatial positioning relative to competitors and accessibility to customers when determining a restaurant's success (Tian and Shen, 2024). It is possible to identify optimal locations for new restaurants by integrating GIS with spatial statistical methods as well as learn what factors influence restaurant clustering and customer accessibility by integrating GIS with spatial statistical methods. The use of GIS is vital to the tourism and restaurant industries because it enables strategic planning, enhances customer experiences, and contributes to sustainable urban development.

Research Method

The methodological approach was employed to investigate Michelin-starred restaurants in Busan by using a combination of spatial analysis and online review data. The study aims to provide insights into consumer sentiment and the spatial distribution of these culinary establishments, focusing specifically on the top two sentiments: "good" and "delicious." The research methodology includes data collection from online reviews, the identification of Michelin restaurants, spatial analysis through QGIS, and co-occurrence network analysis using KH Coder (version 3).

Data collection

The data collection process involved gathering qualitative data from two main sources: online reviews of 28 Michelin-starred restaurants in Busan and geospatial data related to their locations (The Michelin Guide, 2025). Customer comments were collected from Google Reviews to gauge user sentiment toward Michelin-starred restaurants in Busan in total of 9,898 reviews (Google Maps, 2024). The dataset was compiled on 12 December 2024 and includes reviews of Michelin-starred restaurants in Busan posted between 2014 and 2024 (The Michelin Guide, 2025) and (Google Maps, 2024). These reviews provided qualitative insights into customer experiences, allowing for the identification of frequently used keywords such as "good" and "delicious." The names and locations of Michelin-starred restaurants were gathered from the official Michelin Guide website, which served as the basis for the spatial analysis and sentiment examination (The Michelin Guide, 2025) and (Michelin Guide Busan, 2024). Latitude and longitude information for each restaurant was also obtained from Google Maps and geocoded as part of the geospatial analysis, which was integrated into QGIS to facilitate spatial visualization and analysis (Google Maps, 2024).

Data analysis

A GIS approach was used to perform spatial analysis, employing QGIS to map the distribution of Michelin-starred restaurants across Busan and explore potential spatial patterns. The analysis focused on visualizing the locations of restaurants and understanding their spatial clustering across various districts. Michelin restaurants were mapped as points using QGIS, with a series of layers created to distinguish between different types of cuisines (e.g., Japanese, French, Indian). A heat map was generated to identify

hotspots of Michelin-starred restaurants in Busan, providing a visual representation of areas with a higher concentration of culinary establishments. The visual variables used in this analysis included the total number of reviews, as well as the frequency of the words "good" and "delicious," represented as a heat map. The spatial distribution was then analyzed to determine if there were any correlations between the location of restaurants and certain attributes such as ratings and popularity.

In addition to spatial analysis, the collected review data were processed using KH Coder to perform co-occurrence network analysis. This technique helped identify relationships among frequently used keywords, shedding light on customer perceptions and preferences. Reviews collected from Google were preprocessed to remove stopwords and irrelevant information, and the cleaned dataset was then fed into KH Coder for text analysis. KH Coder generated a co-occurrence network that displayed the relationships between keywords frequently appearing together in the reviews. This network helped identify the primary aspects of customer satisfaction for each Michelin-starred restaurant. The analysis revealed that the two most frequently mentioned keywords across the reviews were "good" and "delicious." These keywords were then integrated into the spatial analysis using QGIS to examine whether specific spatial patterns were associated with these sentiments.

To comprehensively understand the distribution of customer sentiment, the top two keywords, "good" and "delicious," were mapped onto the spatial visualization of Michelin-starred restaurants. QGIS was used to layer sentiment data over the geographic locations of the restaurants. This integration allowed for the identification of spatial patterns linked to positive customer feedback, providing insights into which areas in Busan are perceived more favorably by customers. This study employed a mixed-methods approach, combining spatial analysis and sentiment analysis to explore Michelin-starred restaurants in Busan. The use of QGIS enabled the visualization of spatial distribution, while KH Coder provided insights into customer sentiments through co-occurrence network analysis. This comprehensive methodology allows for an in-depth understanding of both the geographic and qualitative aspects of the dining experience at Michelin-starred restaurants in Busan.

Results And Discussion

Co-occurrence network analysis

The co-occurrence network analysis visualized in Figure 1 provides insights into how frequently certain keywords were mentioned together in customer reviews of Michelin-starred restaurants in Busan. The network diagram reveals a rich web of associations between restaurant names and descriptive terms, highlighting key aspects of customer experiences and preferences. The degree of relationship indicates how closely a word is related to its neighboring words. And the frequency refers to the number of times a certain word appears in a review (Park and Jeong, 2019).

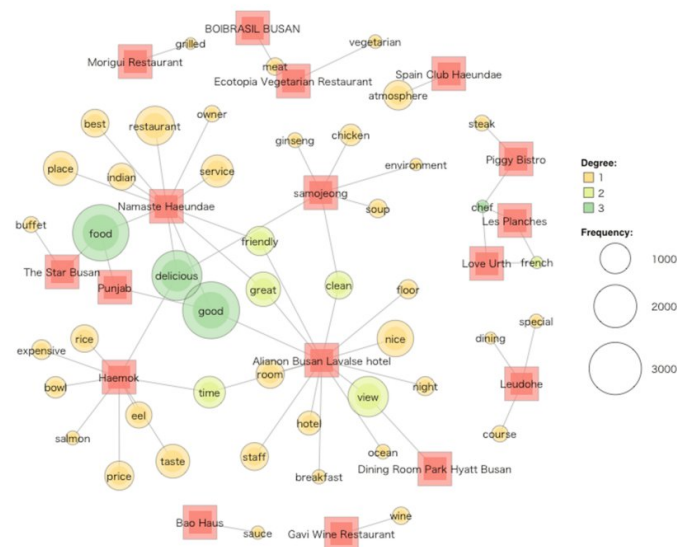


FIGURE 1: Co-occurrence Network Analysis of Michelin-Starred Restaurants in Busan

Source: Author

From the analysis, it is evident that terms like "food," "delicious," and "good" are prominently associated with multiple restaurants, indicating their significance in shaping customer satisfaction across the board. Restaurants such as Namaste Haeundae, The Star Busan, and Alianor Busan Lavalse Hotel are linked with terms that reflect the quality of their offerings. For example, words such as "food," "delicious," and "good" are closely linked to Namaste Haeundae, suggesting that these attributes were central to the positive dining experiences of customers. Similarly, Alianor Busan Lavalse Hotel is associated with terms like "view" and "nice," indicating that customers appreciated not only the food but also the ambiance and

overall dining environment.

Another interesting finding is the presence of unique attributes associated with particular restaurants, which suggests specialization or differentiation in the dining experience. For instance, Ecotopia Vegetarian Restaurant is linked with terms like "vegetarian" and "atmosphere," indicating a niche positioning that caters to specific dietary preferences and emphasizes a distinct dining atmosphere. This points to the importance of restaurants catering to particular customer needs in order to create unique value propositions in the highly competitive fine dining landscape.

Moreover, the analysis highlights the competitive dynamics of Michelin-starred restaurants in Busan. The interconnectedness between various attributes such as "food," "service," and "atmosphere" suggests that Michelin-starred restaurants must excel in multiple aspects to meet the high expectations of their customers. In particular, the associations between restaurants and keywords such as "special," "unique," and "great" indicate that differentiation in service and offerings plays a crucial role in attracting and retaining customers.

The frequency analysis embedded within the co-occurrence network also reveals the prominence of certain attributes over others. For instance, terms such as "food" and "delicious" were frequently mentioned across many restaurants, which reinforces the centrality of food quality in determining customer satisfaction in fine dining contexts. On the other hand, attributes like "view," "environment," and "friendly" were also highlighted, indicating that customers value a well-rounded dining experience that goes beyond just the food.

Spatial visualization analysis

The analysis of the spatial distribution and ratings of Michelin-starred restaurants in Busan, as depicted in Figure 2 and Figure 3, offers a comprehensive view of the geographical and qualitative aspects of these establishments. The first image, displaying the distribution of Michelin-starred restaurants with violet-colored dots, reveals a clear pattern of concentration in specific districts, particularly in Haeundae and Busanjin. These areas, known for their vibrant cultural and commercial environments, provide ideal locations for high-end culinary experiences that attract both local patrons and tourists.

In Figure 3, the green star symbols in the second image indicate the rating of each restaurant, with the legend providing further details on the rating categories. The ratings range from 0 to 4.8, with the majority of Michelin-starred restaurants achieving high ratings, which indicates a generally positive reception among customers. The spatial distribution of these ratings aligns closely with the areas of high restaurant density, suggesting that these popular districts not only attract more restaurants but also maintain high levels of customer satisfaction.

The clustering of highly rated restaurants in specific districts implies that these areas offer favorable conditions that contribute to the quality and success of Michelin-starred establishments. Factors such as accessibility, proximity to tourist attractions, and a supportive commercial environment play a significant role in enabling these restaurants to achieve and maintain high ratings. Moreover, the spatial proximity of these restaurants may create a competitive atmosphere, where restaurants are incentivized to maintain high standards to attract discerning customers. This competitiveness could be one of the driving forces behind the high ratings observed in these clusters.



FIGURE 2: Distribution of Michelin Restaurant in Busan

Source: Author



FIGURE 3: Rating Visualization of Michelin Restaurant in Busan

Source: Author

Additionally, the analysis reveals that areas with fewer Michelin-starred restaurants tend to have slightly lower ratings compared to those with a higher density. This could be attributed to several factors, including reduced visibility, less foot traffic, or limited access to complementary businesses that enhance the overall dining experience. For example, Michelin-starred restaurants in Gijang and Yeonjae, which are located away from the main culinary clusters, tend to face challenges in attracting foot traffic and achieving similar visibility to those in high-density areas. Restaurants in less dense areas may face greater challenges in attracting customers, which could impact their ability to generate positive reviews and maintain high ratings.

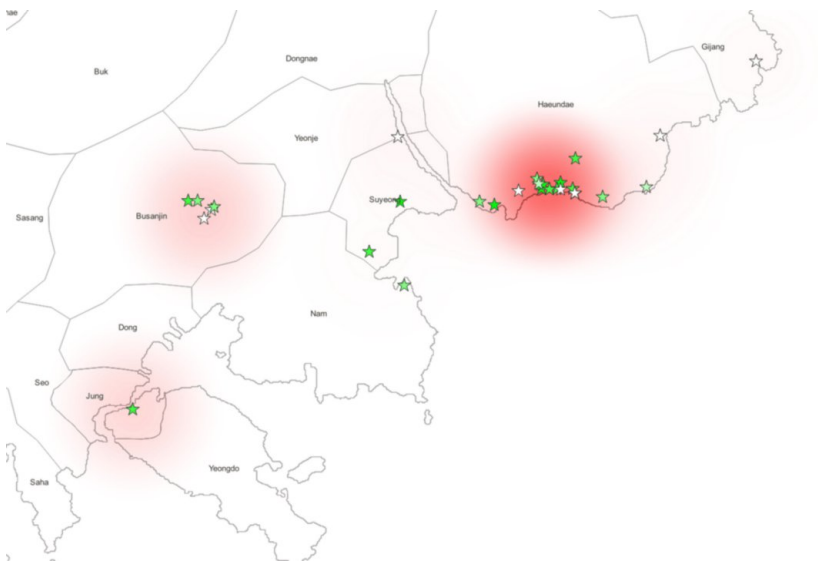


FIGURE 4: Density Map of Total Review with Rating

Source: Author

The spatial analysis between the rating and heat map of total reviews, as visualized in Figure 4, further underscores the relationship between customer satisfaction and visibility. The heat map, representing the total number of reviews, shows a strong concentration of customer engagement in districts like Haeundae-gu and Busanjin-gu, which also host highly rated restaurants. This correlation suggests that restaurants with higher ratings tend to attract more reviews, likely due to their popularity and reputation. The heat map indicates areas of high customer interaction, which aligns with the locations of highly rated Michelin-starred establishments, reinforcing the notion that positive reviews and high customer engagement go hand in hand. In contrast, restaurants in Suyeong and Nam-gu, while having high ratings, tend to have a lower total number of reviews. This could be due to these areas being less frequented by tourists or lacking the same level of visibility as culinary hotspots like Haeundae and Busanjin, which results in fewer opportunities for customer engagement and lower review counts.

The implications of this spatial relationship are significant for restaurateurs and urban planners. For

restaurateurs, the analysis highlights the importance of both achieving high ratings and maintaining visibility through customer engagement. Restaurants that receive high ratings are more likely to benefit from increased word-of-mouth promotion, which, in turn, drives more reviews and attracts new customers. This cycle of positive feedback is particularly evident in districts with high densities of Michelin-starred restaurants, where visibility and customer engagement are mutually reinforcing.

For urban planners, understanding the spatial relationship between restaurant ratings and customer engagement can help in developing policies that support the fine dining sector. By investing in infrastructure and amenities that enhance the customer experience in areas with high culinary activity, urban planners can create environments that further promote customer interaction and satisfaction. This, in turn, can lead to increased economic activity and contribute to the overall appeal of these districts as premier culinary destinations.

The spatial analysis combines the ratings of Michelin-starred restaurants with heatmaps of word frequency in customer comments to provide deeper insight into customer perceptions of these establishments and is shown in Figure 5 and Figure 6. The red heatmap represents the frequency of the word "good," which generally refers to the overall quality of the restaurant, including aspects like ambiance, service, and value. In contrast, the blue heatmap depicts the frequency of the word "delicious," which specifically refers to the quality of food offered by the restaurant.

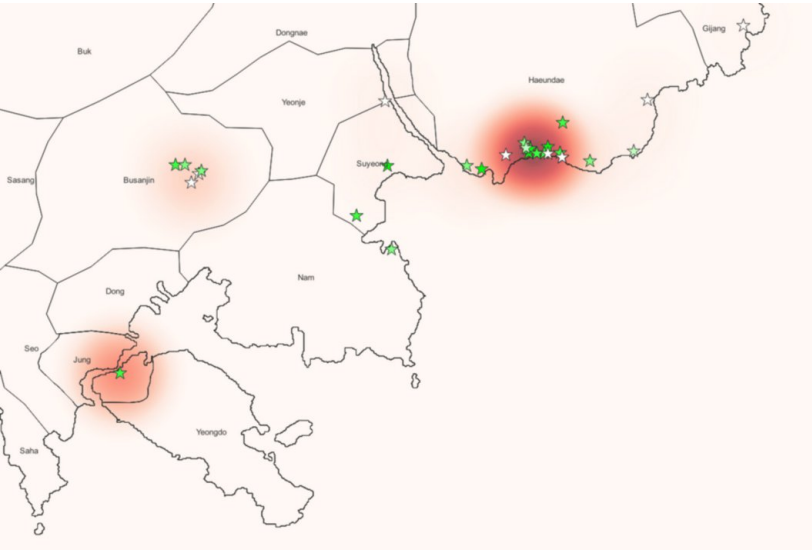


FIGURE 5: Density Map of Word "good"

Source: Author

The analysis reveals interesting spatial patterns between customer comments and restaurant ratings. In areas such as Haeundae, there is a strong overlap between high ratings and a high frequency of the word "delicious," indicating that these restaurants are perceived as having superior food quality, which contributes to their high overall ratings. This suggests that customers in these areas highly value the culinary experience, and their reviews often emphasize the deliciousness of the food.

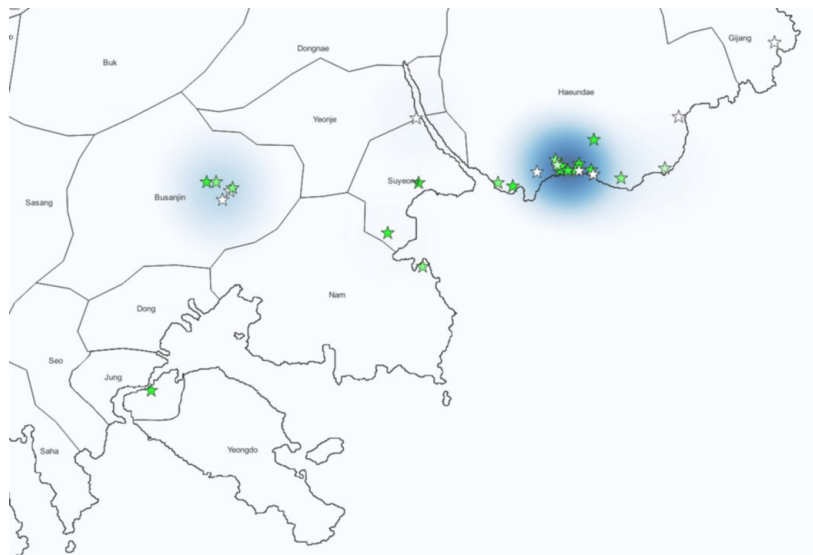


FIGURE 6: Density Map of Word "delicious"

Source: Author

On the other hand, the frequency of the word "good" is also prominent in the areas with high-rated restaurants, particularly in Busanjin and Jung. This implies that, while food quality remains a critical component of the dining experience, other factors such as service, atmosphere, and general customer satisfaction are also significantly contributing to positive perceptions of these Michelin-starred establishments. The presence of both heatmaps overlapping in these areas suggests that a well-rounded dining experience that combines excellent food with overall quality is key to achieving high customer ratings.

In areas such as Suyeong and Nam, while restaurants receive high ratings, the frequency of the words "good" and "delicious" is relatively lower compared to other districts. This could imply that, although customers rate these restaurants highly, they may not be as vocal in their reviews, possibly due to fewer visitors or the more exclusive nature of these dining experiences. The findings indicate that customer satisfaction in these areas is still strong, but the volume of word-of-mouth promotion may be more limited.

Discussion

The findings of this study offer compelling insights into how spatial patterns and customer sentiment collectively shape the success and perception of Michelin-starred restaurants in Busan. By combining GIS-based spatial analysis with sentiment analysis of online reviews, this research bridges quantitative location-based assessment with qualitative customer feedback that focuses an approach that contributes to the growing discourse on experiential dining, urban spatial economics, and culinary tourism (Walter et al., 2022) and (Tian and Shen, 2024).

From a theoretical perspective, this study reinforces the view that customer satisfaction in fine dining is shaped by a holistic interplay of factors, including geographic accessibility, food quality, ambiance, and service (Choi et al., 2024) and (Kim and Fesenmaier, 2015). The co-occurrence of terms such as "good" and "delicious" alongside location-based clustering in districts like Haeundae and Busanjin suggests that customer perceptions are not solely influenced by cuisine, but by a well-rounded experience supported by the spatial context of the restaurant (Huang et al., 2024). These findings support the notion that restaurant success is embedded in both emotional and spatial dimensions, aligning with previous research emphasizing the spatial dependence of service-based industries (Kang et al., 2014).

Practically, the study provides valuable implications for restaurateurs, tourism stakeholders, and urban policymakers. The visualization of review-based sentiment and spatial clusters demonstrates the importance of cultivating high-quality customer experiences in areas of high footfall and touristic appeal (García-Palomares et al., 2015). For restaurant operators, investing in not only exceptional cuisine but also enhancing ambiance and service can generate more favorable reviews and increase visibility through digital word-of-mouth, reinforcing findings from Okumus et al. (Okumus et al., 2018) on the role of gastronomic experiences in destination branding.

For urban planners, the identification of high-performing culinary clusters underscores the potential of promoting specific districts as gastronomic tourism zones. Supporting infrastructure, such as accessibility, signage, and public amenities, can further enhance customer satisfaction and attract investment. In less dense areas like Suyeong and Nam-gu, targeted development strategies could help foster new culinary hotspots and mitigate regional disparities in tourism flow (Walter et al., 2022).

Conclusions

In conclusion, this study emphasize how spatial distribution and customer sentiment jointly shape the reputation and success of Michelin-starred restaurants in Busan. By integrating GIS-based spatial analysis with online review sentiment, the research highlights that fine dining experiences are not determined solely by cuisine quality but also by the interplay of location quality, service, taste such as delicious, and visibility. The clustering of highly rated restaurants in districts such as Haeundae and Busanjin illustrates how geographic positioning reinforces both customer satisfaction and market competitiveness.

The findings underline the importance of considering spatial ecosystems in which restaurants operate, as proximity to cultural and commercial hubs amplifies both visibility and customer engagement. From a managerial perspective, restaurant operators are encouraged to invest not only in exceptional food but also in holistic dining experiences that generate positive digital word-of-mouth. From a policy standpoint, urban planners and tourism stakeholders can leverage culinary clusters as strategic assets for destination branding, supported by infrastructure that enhances accessibility and customer flow.

Overall, this research advances the understanding of how spatial and experiential factors intersect in shaping the perception of high-end restaurants. It offers both academic contributions to the study of culinary tourism and practical guidance for industry practitioners and policymakers seeking to strengthen Busan's position as a premier gastronomic destination.

Limitations and further research

Despite the valuable insights gained from this study, several limitations should be acknowledged. First, the data used for sentiment analysis were solely obtained from Google Reviews, which may not represent the entire customer base or provide a fully unbiased perspective. Reviews on other platforms or direct customer surveys could provide a more comprehensive understanding of customer sentiment. Second, the spatial analysis was limited to the geographic scope of Busan, which restricts the generalizability of the findings to other regions or cities with different culinary dynamics. Third, the use of GIS and sentiment analysis inherently involves subjective interpretation of qualitative data, which may introduce biases in the results. Additionally, the study only considered Michelin-starred restaurants, which may not reflect the broader dining landscape in Busan, and thus limits the applicability of the findings to non-Michelin establishments. Future research could address these limitations by incorporating other spatial analyses, such as examining the proximity of public transportation to the restaurants, as well as incorporating a broader range of data sources, expanding the geographic scope, and including a more diverse set of restaurants to enhance the generalizability of the results.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Acquisition, analysis, or interpretation of data: Rianmahardhika Sahid Budiharseno, Narariya Dita Handani, Mohammad Sayed Noor

Drafting of the manuscript: Rianmahardhika Sahid Budiharseno, Mohammad Sayed Noor

Critical review of the manuscript for important intellectual content: Narariya Dita Handani, Mohammad Sayed Noor

Concept and design: Mohammad Sayed Noor

Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue.

Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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