

## Article

# Evaluating Public Library Services in Taiwan through User-Generated Content: Analyzing Google Maps Reviews

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**Abstract:** This study explores the public library service evaluation domain through user-generated content on Google Maps, highlighting digital feedback's significant yet underexplored potential in understanding public library patronage across Taiwan's six major cities. Utilizing a mixed-methods research design, this study integrates Google Maps review content analysis with social network analysis to delineate public perceptions and identify areas for service enhancement in public libraries. It innovatively leverages personal experiences extracted from over 60,000 Google Maps reviews to evaluate public library services in cities such as Taipei, New Taipei, Taoyuan, Taichung, Tainan, and Kaohsiung. The research taps into the National Library of Taiwan's National Library Statistics System to provide a robust analysis of library performance and user satisfaction, offering a novel perspective by emphasizing user-centric feedback from Google Maps as a primary data source. This approach provides quantitative data on library usage and geographic distribution and enriches our understanding of the qualitative experiences of library users. In analyzing the keywords from Google Maps reviews of public libraries, we categorize and interpret these under the three core LibQUAL+ dimensions—Affect of Service, Information Control, and Library as Place. The findings expose variances in perceived service quality among the cities, with Kaohsiung and Taichung receiving the highest accolades for service satisfaction. Simultaneously, the study identifies potential areas for improvement, particularly in cities with lower satisfaction ratings like Taipei. This personalized feedback illustrates the intimate relationship between public libraries and their communities, offering invaluable insights for policymakers and library management to enhance service delivery and user experience.

**Keywords:** user-generated content; public library evaluation; experiential feedback; service quality; Google Maps review



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## 1. Introduction

For public libraries to engage in effective strategic planning, it is imperative to thoroughly understand their current patronage and those segments of the population that remain underrepresented among their users. Notably, research indicates that disadvantaged groups, such as ethnic minorities, recent immigrants, and individuals with disabilities, exhibit lower rates of public library usage [1]. This discrepancy underscores libraries' need to understand these communities' perceptions, needs, and intentions toward public library services. Recognizing and addressing the barriers that deter these groups from utilizing library resources is essential for libraries to fulfill their mission of providing equitable access to information and fostering an inclusive community space for all members of society. In the digital age, public libraries are essential to community learning, cultural exchange, and information dissemination. While, traditionally, the evaluation of public library services has relied heavily on direct surveys, usage metrics, and qualitative feedback mechanisms,

the advent of user-generated content (UGC) on digital platforms offers a novel approach to assessing public sentiment and service quality. Prior research has highlighted that word of mouth is the primary channel through which individuals garner information regarding public libraries and their associated activities, with traditional media outlets such as television, radio, and even the Internet being less frequently utilized for this purpose [2]. However, a notable shift in this trend has been observed, as many library patrons now increasingly rely on Google Maps to access pertinent information about library services. This evolution in information-seeking behavior underscores the growing importance of digital platforms in influencing how public libraries are discovered and engaged with by their potential users, suggesting that libraries adapt their communication strategies to align with the digital habits of contemporary audiences. As a form of UGC, Google Maps reviews provide a rich, unfiltered source of public opinion and experience regarding library services. The utilization of these reviews for evaluating public library services represents a significant shift toward a more democratic, user-centric approach to service evaluation.

Public libraries serve diverse community needs, from providing access to educational resources and facilitating lifelong learning to offering community support services and promoting cultural engagement. In this context, understanding how users perceive library services and identifying areas for improvement become crucial for library administrators and policymakers. With their spontaneous, detailed, and varied user experiences, Google Maps reviews present an untapped resource for gaining insights into public satisfaction and expectations. This research aims to harness the potential of this UGC to evaluate the quality of public library services across Taiwan's six major cities, thereby contributing to the body of knowledge on public service evaluation in the era of digital feedback.

This study aims to evaluate public library services through user-generated content on Google Maps. The goal is to leverage the detailed feedback provided in online reviews to gain insights into user perceptions and identify areas for service enhancement. Additionally, the study compares these digital metrics with traditional evaluation methods to assess their credibility and utility. It ultimately provides actionable recommendations for library administrators and policymakers to improve service delivery and user experience. The study focuses on several dependent variables extracted from Google Maps reviews to evaluate public library services, including service quality, which is assessed through user ratings and the sentiment expressed in reviews. Service quality encompasses the effectiveness of library services, staff responsiveness, and the availability and accessibility of library resources. The positive or negative sentiment of reviews measures User Satisfaction. User satisfaction reflects the overall user experience, encompassing aspects such as the library environment, ease of use, and fulfilling user needs and expectations. Public engagement is indicated by the number of reviews and the interaction between users and the library on Google Maps, and it reflects the degree of community involvement and interest in library services. Facility and environmental quality are evaluated through user comments on the physical condition of the library, including cleanliness, space availability, and the overall ambiance. This variable assesses the physical attributes of the library that contribute to a conducive reading and learning environment. By analyzing these dependent variables, the research seeks to uncover the strengths and weaknesses of public library services as perceived by users. This approach not only highlights areas of excellence but also identifies potential areas for improvement, guiding future strategies for library service enhancement. Through a detailed examination of UGC, this study aims to offer actionable insights into optimizing public library services to effectively meet the community's evolving needs. Google Maps is a web platform that allows users to review businesses and services, including libraries. Given the impact of online reviews on the reputation of companies and institutions, it is crucial to understand how library users share and interpret their experiences on these platforms. Understanding these reviews can provide valuable insights into patrons' perceptions of public libraries and inform the development of effective strategies to address their feedback and manage their suggestions and complaints [3]. An initial investigation into the use of Google Maps for sharing feedback on library facilities and services by users

in Barcelona, Spain, highlighted a low engagement rate from library managers toward user reviews, particularly noting that reviews with lower ratings were more elaborately detailed. Positive feedback was primarily aimed at children's sections, collections, and the locations of libraries, though the facilities also received commendation. In contrast, aspects such as noise levels and inadequate seating for studying received negative comments. Mixed responses were observed regarding staff interaction, operational hours, and the availability of technology. The research recommended that Barcelona's public libraries should invest more in updating their online information and actively engage with user feedback, especially crafting a structured approach to address negative reviews. This study, however, was confined to the context of Google Maps and only one city, Barcelona [3].

Extending beyond this limitation, our research broadens the analytical horizon to encompass library services in six major cities, thereby addressing a noted gap in the academic literature where transactional online library data have been extensively studied, but the analysis of UGC like texts or photos on review platforms and social media remains underexplored. By combining Google Maps review content analysis with Social Network Analysis, our study seeks to deepen understanding of public library perceptions among users, aiming to devise strategic responses to user feedback and effectively manage both praise and criticism.

## 2. Literature Review

### 2.1. Public Library Service Evaluation

Evaluation of public library services must be based on a clear set of objectives. Identifying these objectives and formulating questions to address each is essential for a comprehensive evaluation. One effective approach is quantifying and statistically evaluating resource provision [4]. Public library services embody the principle of equitable access, ensuring that individuals from all walks of life, irrespective of race, religion, gender, nationality, language, or social status, are afforded the same opportunities to utilize library resources [5]. This foundational tenet underscores the role of public libraries as democratic institutions committed to fostering inclusivity and equal access to information, thereby supporting the community's diverse informational, educational, and recreational needs. Through this commitment, public libraries reinforce their pivotal role in promoting knowledge dissemination, cultural exchange, and social cohesion, serving as cornerstones of a fair and informed society. The evaluation of public library services has traditionally been grounded in quantitative metrics such as circulation numbers, visitation statistics, and program participation rates [6]. Qualitative approaches, including surveys and focus groups, have also been utilized to gather insights into user satisfaction and service quality [7]. Research has highlighted the significance of libraries in fostering social inclusion and community engagement, suggesting that service evaluation should extend beyond transactional metrics to encompass social and cultural impacts [8]. The advent of digital platforms has introduced UGC as a potential resource for evaluating public services. Previous studies have demonstrated the viability of analyzing online reviews to assess satisfaction with municipal services, suggesting that a similar approach could be applied to library services [9]. However, despite the recognized value of digital feedback, the application of UGC from platforms like Google Maps to evaluate public library services still needs to be explored. Existing research has yet to fully capture the nuances of library service quality expressed in spontaneous user reviews, which can offer real-time, diverse perspectives on user experiences [10].

### 2.2. User-Generated Content for Service Evaluation

When a computer network connects people or organizations, it forms a social network. The study of these computer-supported social networks has received significant attention, comparable to the research on human-computer interaction, online person-to-person interaction, and computer-supported communication within small groups [11]. Various online social networks (OSNs) have rapidly developed on the Internet. Previous studies have analyzed different aspects of these OSNs, primarily focusing on the formation and

evolution of the networks and the propagation of information within them [12]. Social networks enable users to connect with friends, discover new acquaintances, and share UGC, including videos, documents, blogs, and photos [13]. Fueled by technological advancements and swift user adoption, UGC has become the forefront of scholarly inquiry within communication studies. This burgeoning field of research sheds light on a phenomenon that, although nascent in comparison to the extensively studied domain of traditional mass media content crafted by professionals, has already exerted a transformative influence on the communication landscape. The exploration of UGC unpacks the nuances of contemporary digital interaction. It delineates its substantial role in reshaping how information is created, shared, and consumed, marking a pivotal shift in communication dynamics [14]. While the literature acknowledges the potential of UGC for service evaluation, specific insights into its application for public libraries are scarce. The variability in user engagement, the representativeness of online reviews, and the methodologies for analyzing qualitative feedback from digital platforms pose significant uncertainties [15,16]. Moreover, the relationship between digital feedback and traditional service evaluation metrics remains unclear, with limited studies examining how online reviews correlate with established library performance measures. A notable gap exists in understanding the specific aspects of library services that users are most inclined to comment on in their reviews and how these comments reflect broader user satisfaction and engagement trends. The literature has not adequately addressed the potential biases inherent in online reviews, including the overrepresentation of extreme sentiments and the demographic characteristics of users more likely to post reviews [17]. Furthermore, while studies have emphasized the importance of the physical library environment on user satisfaction [18], the extent to which this aspect is reflected in online reviews and its relative importance compared to other service aspects remains to be explored.

### 2.3. Google Maps Reviews

Google Maps, a web-based platform, facilitates user-generated reviews of businesses and services, libraries included, underscoring the substantial role online reviews play in shaping the corporate reputation of both companies and institutions. The influence of such reviews necessitates a comprehensive understanding of the mechanisms through which library patrons share and interpret feedback on digital platforms. This understanding is crucial for libraries to navigate the digital landscape effectively, ensuring their services are accurately represented and positively received in the public domain, thereby maintaining and enhancing their institutional reputation in the increasingly digitalized world of information exchange. In today's interconnected society, Google Maps has emerged as a ubiquitous presence, hosting many entities, including public libraries. It has become the go-to platform for users searching for and retrieving information about any location. This digital mapping service offers users the unique ability to post ratings and reviews of various entities, encompassing public libraries and detailing their facilities and services. This functionality not only aids potential visitors in making informed decisions but also provides libraries with invaluable feedback on public perception and areas for improvement, highlighting the platform's integral role in the information-seeking behavior of contemporary users [19]. In the service industry, the customer experience is a pivotal determinant of competitive advantage, with online reviews representing a significant conduit through which consumer feedback is conveyed. Primarily text-based, customers post such reviews on Yelp, TripAdvisor, and Google Maps. Notably, Google Maps features a "Local Guide", allowing users to author reviews and assign ratings to various places and businesses utilizing a one to five-star grading system. This rating scale, driven by consumer evaluations, informs potential customers about a company's quality. Google's ascendancy in the review platform market is underscored by data from the United States, indicating that Google Maps review has emerged as the platform with the most accelerated growth rate, thereby highlighting its significant impact on shaping consumer perceptions and choices in the service sector [20]. The existing literature establishes a foundation for

evaluating public library services using traditional metrics and introduces the potential of digital feedback for broader service evaluation. However, a significant gap exists in comprehensively understanding how UGC, specifically Google Maps reviews, can be systematically analyzed to assess public library service quality. The specific dimensions of library service quality most frequently addressed in user reviews, the alignment of digital feedback with traditional service evaluation metrics, and the methodological approaches for analyzing and interpreting UGC in the context of public libraries remain underexplored. This research aims to bridge this knowledge gap by developing a framework for leveraging Google Maps reviews to evaluate public library services, thereby contributing to a more nuanced understanding of user satisfaction and engagement with public libraries.

### 3. Research Methodology

#### 3.1. Dataset Description

This study employs a mixed-methods approach, integrating quantitative and qualitative analyses. The quantitative analysis examines the star ratings and review volumes of public libraries in Taiwan's six major cities. The qualitative analysis is limited to the content of the comments associated with the Google Maps reviews, providing insights into user experiences and perceptions. No additional interviews or surveys were conducted as part of this study. This approach combines the strengths of both methodologies to offer a nuanced perspective on public library service quality. The dataset for this study consists of over 60,000 Google Maps reviews of public libraries in Taiwan's six major cities: Taipei, New Taipei, Taoyuan, Taichung, Tainan, and Kaohsiung. The reviews span a three-year period from 2021 to 2023. Each review includes a star rating, review text, date of submission, and reviewer information. Focused on a comprehensive list of 354 public libraries, as delineated by the National Library Statistics System. A novel approach to data collection is employed by designing a specialized web crawler, which meticulously extracts pivotal elements from the reviews in conjunction with the Google Maps API service. This process involves the aggregation of numerical star ratings, the textual content of reviews, the dates of review submissions, and the reviewers' usernames. The dual utilization of automated web scraping technology, augmented by manual verification, guarantees the precision and integrity of the data collection process, thus laying a solid foundation for the ensuing analytical phases.

#### 3.2. Analytical Framework

Quantitatively, descriptive statistics are applied to examine the distribution of star ratings and review volumes for the libraries in question, with star ratings acting as a direct measure of user satisfaction and review counts as indicators of public engagement with the library services. Qualitatively, the research progresses through thematic content and sentiment analysis of the review texts. The process begins with identifying prevalent themes within user feedback and categorizing them into predefined areas such as service quality, facility conditions, and emergent themes. This thematic exploration is augmented by sentiment analysis, employing algorithms to assign a sentiment polarity—positive, negative, or neutral—to the review texts, thus deriving an aggregate sentiment score for each library. To accurately capture the sentiment of user feedback, review star ratings are operationalized as follows: ratings of 1 to 2 denote negative reviews, signifying user dissatisfaction; ratings of 4 to 5 are indicative of positive reviews, reflecting user satisfaction and favorable experiences; and a rating of 3 is considered a neutral review, representing a middling or mixed response to the library services. This analytical framework facilitates a nuanced understanding of library service quality from the perspective of library users. This study employs an analytical framework that utilizes the three core LibQUAL+ service quality dimensions—Affect of Service, Information Control, and Library as Place—to analyze the content of Google Maps reviews for public libraries [21–23]. Affect of Service will focus on evaluating users' feedback related to staff interactions and assessing comments on staff helpfulness, efficiency, and friendliness to gauge the emotional impact of service encounters. Information Control will analyze users' comments on their ability to access

and utilize library resources, such as the availability of books, databases, and ease of information retrieval, which are critical for user empowerment and satisfaction. Library as Place will examine user reviews that discuss the physical and virtual environment of the library, evaluating how aspects like ambiance, space layout, and overall comfort contribute to the library's role as a conducive space for learning and leisure. By synthesizing insights from user-generated content in Google Maps reviews, this framework aims to uncover how these dimensions influence overall user satisfaction and identify potential areas for service enhancement without deploying traditional survey methods, thus offering a real-time, narrative-based understanding of user experiences.

#### 4. Research Results

The findings of this study align with previous research on evaluating public library services using user-generated content. Studies have shown that many public libraries are establishing an online presence and offering online services and reviews, which provide valuable insights into user satisfaction and areas for improvement [1,3]. For example, Borrego and Comalat (2021) demonstrated the effectiveness of using Google Maps reviews to assess public library services in Spain, highlighting the importance of user feedback in service enhancement [3]. Similarly, Khan and Loan (2022) emphasized the potential of online reviews in understanding public perceptions of library services in India [19]. By situating our findings within this context, this study contributes to the growing knowledge on leveraging digital feedback for public service evaluation.

##### 4.1. Macro Analysis of Google Maps Reviews on Public Library Services

In this study, a macro-level analysis of Google Maps reviews was conducted to evaluate public library services across Taiwan's six major cities, leveraging data from the National Library's comprehensive statistical system. This system records the existence of 354 libraries across Taipei, New Taipei, Taoyuan, Taichung, Tainan, and Kaohsiung, including main libraries, independent libraries, branch libraries, and reading rooms. The collection of basic library information, such as location and contact details, provided a foundational dataset for analysis. Among those cataloged were seven main libraries, two independent libraries, 293 branch libraries, and 52 reading rooms, with notable establishments including Taipei City Library, New Taipei City Library, and Kaohsiung City Library, among others. Analyzing reader reviews on Google Maps, encompassing star ratings, author names, review texts, whether the reviewer was a local guide, and the timing of reviews revealed significant insights into user satisfaction and engagement with library services. Kaohsiung City's libraries emerged as the frontrunner in service quality, boasting the highest average star rating of 4.35 and receiving 10,507 reviews, indicative of high user satisfaction and active engagement. Taichung City followed closely with an average rating of 4.33 and 11,935 reviews, affirming positive public perception of library services. Notably, despite a slightly lower rating of 4.25, New Taipei City saw the highest number of reviews at 16,551, suggesting a high frequency of library use and enthusiastic participation by readers. The cities of Tainan and Taoyuan, with ratings of 4.34 and 4.30, respectively, and review counts of 13,925 and 9664, showed room for improvement in meeting user expectations. Although Taipei City had a lower average rating of 4.28 among the six cities, it demonstrated significant reader engagement with 13,220 reviews, indicating a sustained interest in library services despite areas of challenge. This study found that libraries across all six cities received an average rating above 4.0, underscoring a generally positive reception from users. The variation in service quality perceptions among the cities reflected diverse public expectations and experiences with library services, highlighting the nuanced view of library service quality across Taiwan's urban landscape. This comprehensive review of UGC on Google Maps provides invaluable insights into public satisfaction with library services, offering a critical perspective for library management and policy development to enhance the quality and accessibility of public library services. Table 1 illustrates the average star rating and the total number of reviews for public libraries in Taiwan's six

major cities, highlighting the variations in public satisfaction and engagement across different municipalities. Extreme opinions can skew average ratings. To address this, in this study, a distribution analysis of the review ratings was conducted to show the spread of scores. This analysis revealed whether the average rating of 4.1 results from a balanced distribution or is influenced by extreme scores. Understanding this distribution provides a more comprehensive view of user satisfaction and highlights potential areas for targeted improvements. Table 1 includes extensive data, such as the population of six cities. This allows the study to gauge the enthusiasm of local residents in responding to public libraries. For instance, the response rate for public libraries in Tainan City is notably high at 0.75. Additionally, the proportion of five-star and single-star evaluations across different programs is relatively balanced, indicating that the residents of Taiwan highly appreciate the services provided by public libraries.

**Table 1.** Reviews of public libraries.

| City            | Star | % Star | Reviews | Avg Rating | Reviews | Population | R/P   |
|-----------------|------|--------|---------|------------|---------|------------|-------|
| Taipei City     | 5    | 58%    | 7685    | 4.28       | 13,220  | 2,510,000  | 0.53% |
|                 | 4    | 26%    | 3421    |            |         |            |       |
|                 | 3    | 8%     | 1025    |            |         |            |       |
|                 | 2    | 3%     | 338     |            |         |            |       |
|                 | 1    | 6%     | 751     |            |         |            |       |
| New Taipei City | 5    | 61%    | 10,121  | 4.25       | 16,551  | 4,040,000  | 0.41% |
|                 | 4    | 21%    | 3484    |            |         |            |       |
|                 | 3    | 7%     | 1174    |            |         |            |       |
|                 | 2    | 3%     | 479     |            |         |            |       |
|                 | 1    | 8%     | 1293    |            |         |            |       |
| Taoyuan City    | 5    | 62%    | 5997    | 4.30       | 9664    | 2,320,000  | 0.42% |
|                 | 4    | 22%    | 2121    |            |         |            |       |
|                 | 3    | 7%     | 669     |            |         |            |       |
|                 | 2    | 3%     | 249     |            |         |            |       |
|                 | 1    | 6%     | 628     |            |         |            |       |
| Taichung City   | 5    | 66%    | 7818    | 4.33       | 11,935  | 2,840,000  | 0.42% |
|                 | 4    | 19%    | 2278    |            |         |            |       |
|                 | 3    | 6%     | 680     |            |         |            |       |
|                 | 2    | 2%     | 270     |            |         |            |       |
|                 | 1    | 7%     | 889     |            |         |            |       |
| Tainan City     | 5    | 60%    | 8388    | 4.34       | 13,925  | 1,850,000  | 0.75% |
|                 | 4    | 25%    | 3514    |            |         |            |       |
|                 | 3    | 8%     | 1069    |            |         |            |       |
|                 | 2    | 2%     | 282     |            |         |            |       |
|                 | 1    | 5%     | 672     |            |         |            |       |
| Kaohsiung City  | 5    | 66%    | 6898    | 4.35       | 10,507  | 2,730,000  | 0.38% |
|                 | 4    | 20%    | 2067    |            |         |            |       |
|                 | 3    | 6%     | 604     |            |         |            |       |
|                 | 2    | 2%     | 244     |            |         |            |       |
|                 | 1    | 7%     | 694     |            |         |            |       |

R/P = Reviews/Population.

#### 4.2. Individual Analysis of Google Maps Reviews on Branch Libraries

The study's analysis of Google Maps reviews presents a nuanced understanding of user perceptions regarding branch library services in various cities. High-performing libraries, such as Kaohsiung City's Neimen Muzha branch and Tainan City's Jiangjun District Library, achieved perfect 5.00-star ratings. However, they garnered fewer reviews, suggesting that libraries with fewer than ten reviews might be subject to biased opinions due to the small sample size. Other libraries receiving high ratings include New Taipei City's Shimen branch and Taishan Parent-Child Reading Room, rated at 4.77 stars, indicating high satisfaction with their services and environment. Tainan City's Siao-Long Children's Library stood out with a 4.76-star rating, emphasizing its child-friendly environment and services. Libraries in Tainan's Liuying District and Longqi District also received high praise, each with a 4.74-star rating, reflecting positive user feedback. The analysis identified four main factors contributing to positive evaluations: "Comfortable Environment", "Suitable for Reading", "Rich Book Collections", and "Child-Friendly". These keywords underscore the importance of a clean and comfortable environment, friendly staff service, and a quiet space conducive to reading and learning. Specifically, libraries that cater to children and families with appropriate reading materials, activities, and a safe environment were crucial for obtaining positive feedback. Conversely, libraries with lower ratings, such as Tainan City's Madou District Library (2.75 stars) and Xinxing District Library (3.37 stars), pointed to issues such as insufficient seating and staff attitude problems, highlighting areas for improvement. The analysis of negative review keywords revealed concerns related to "Insufficient Space", "Facility Issues", "Staff Attitude", and "Environmental Problems", indicating potential dissatisfaction with physical infrastructure, maintenance, and the quality of service. This detailed analysis emphasizes the critical role of addressing issues highlighted in negative reviews, such as expanding reading spaces, improving facility maintenance, enhancing staff training, and improving the library environment. By addressing these concerns, libraries can increase user satisfaction and achieve higher ratings. However, it is crucial to approach these review data with neutrality and objectivity. Star ratings and the number of reviews offer insights into user feedback on library services, facilities, collections, environment, and staff attitudes. Negative ratings may reflect unmet expectations or identify specific challenges in operation or service. Recognizing each review as an opportunity for feedback, library managers can identify and address potential issues, thereby enhancing service quality and user satisfaction. Libraries are encouraged to use these reviews as a catalyst for improvement and innovation, aiming to better serve their communities by engaging with readers and collecting more specific feedback for targeted improvements. Additionally, the absence of reviews for certain libraries, such as Taipei City's Daan branch, now closed, and the relocation of Taoyuan City's Longtan branch highlights the need for continuous engagement and updating library services to meet community needs and expectations.

#### 4.3. Keyword Analysis in Library Reviews on Google Maps

The keyword analysis of Google Maps reviews for public libraries across Taiwan's six major cities offers significant insights into the valued aspects of library services from the perspective of library users. This analysis identified consistent themes across the reviews, underscoring the importance of a conducive, quiet, and comfortable environment for reading and learning. In Taipei City, the predominant keywords were "environment", "space", "quiet", "comfortable", and "convenient". These terms reflect the city's libraries' emphasis on providing a comfortable reading setting complemented by convenient locations, making them ideal spaces for extended reading and study sessions. Similarly, New Taipei City libraries were associated with keywords such as "environment", "quiet", "reading", and "comfortable", indicating users' appreciation for clean, tranquil reading spaces and the availability of a diverse range of services and resources. Taoyuan City's libraries were characterized by "environment", "space", "clean", and "reading". These keywords highlight the libraries' reputation for clean and tidy reading environments, enriched with ample

reading resources, which foster comfortable reading and learning experiences accompanied by commendable service attitudes. In Taichung City, the libraries stood out for emphasizing “reading” with keywords like “environment”, “reading”, “comfortable”, “space”, and “reading”, offering spaces conducive to reading, spacious environments, and encouraging public reading engagement through attentive service. Tainan City libraries were marked by “environment”, “reading”, “comfortable”, “quiet”, and “space”, emphasizing quiet and cozy reading areas that cater to learners and readers of all ages with well-equipped facilities. Lastly, Kaohsiung City libraries, with the keywords “environment”, “space”, “quiet”, “reading”, and “many”, were favored for their spacious reading areas and tranquil environments, providing a wealth of books and resources to satisfy diverse reader needs. The keyword analysis underscores each city’s library system’s efforts to create welcoming spaces for reading and learning, highlighting a shared commitment to providing comfortable, quiet reading environments and a rich array of library resources. By fostering such environments, these libraries significantly enhance the cultural level and quality of life in their respective cities, demonstrating libraries’ critical role in promoting reading and lifelong learning within the community. While keywords such as “reading” and “book” are expected in the context of library reviews, the keyword analysis also uncovered less obvious themes and user concerns. These insights provide a deeper understanding of user experiences and expectations, highlighting specific areas libraries can focus on to enhance user satisfaction. The findings are emphasized to demonstrate the broader value of the keyword analysis. The number of reviews alone may not provide sufficient context for understanding user engagement. Therefore, the study contextualized the review numbers with the population size of each city. This approach allows for a more accurate interpretation of review engagement, indicating how actively residents in each city participate in reviewing their local libraries on Google Maps.

#### 4.4. Social Network Analysis of Keywords in Library Reviews on Google Maps

Utilizing social network analysis (SNA) focusing on K-core analysis, this study identified the core structures within networks of library user reviews across Taiwan’s six major cities. This analytical approach was instrumental in revealing the most tightly interconnected groups of nodes, considered the network’s “core”, which, in many applications, represents the central focus or the most cohesive subset within a network. By iteratively removing nodes with connectivity (or edge count) lower than a specified threshold  $K$  until all remaining nodes have connectivity of at least  $k$ , the K-core analysis delineates the largest subgraph composed of nodes interconnected by at least  $k$  edges. K-core decomposition plays a pivotal role in network analysis, aimed at identifying the largest subgraph within a network wherein each node is interconnected with at least  $K$  neighbors. This process is predominantly facilitated through a pruning algorithm, which iteratively eliminates nodes with degrees less than  $K$ , a method introduced initially by Seidman in 1983 [24]. Due to its straightforward approach and wide-ranging applicability, the K-core decomposition algorithm has rapidly gained prominence as a fundamental tool for unveiling the structural intricacies of networks. Its utility spans many disciplines, from biology and network science to computer science, ecology, economics, and the social sciences, underscoring its capacity to elucidate the densest parts of networks. Such analytical prowess enables the extraction of critical insights across diverse scientific fields, highlighting the algorithm’s significant contribution to our understanding of complex networked systems [25]. This methodology, applied to the keywords provided (with  $K$  set at six), has unveiled core concerns and characteristics prevalent in user comments about libraries across these cities. The keywords reflect direct feelings toward library environments and services and highlight the perceived roles of libraries in the public’s mind and their expectations of such institutions.

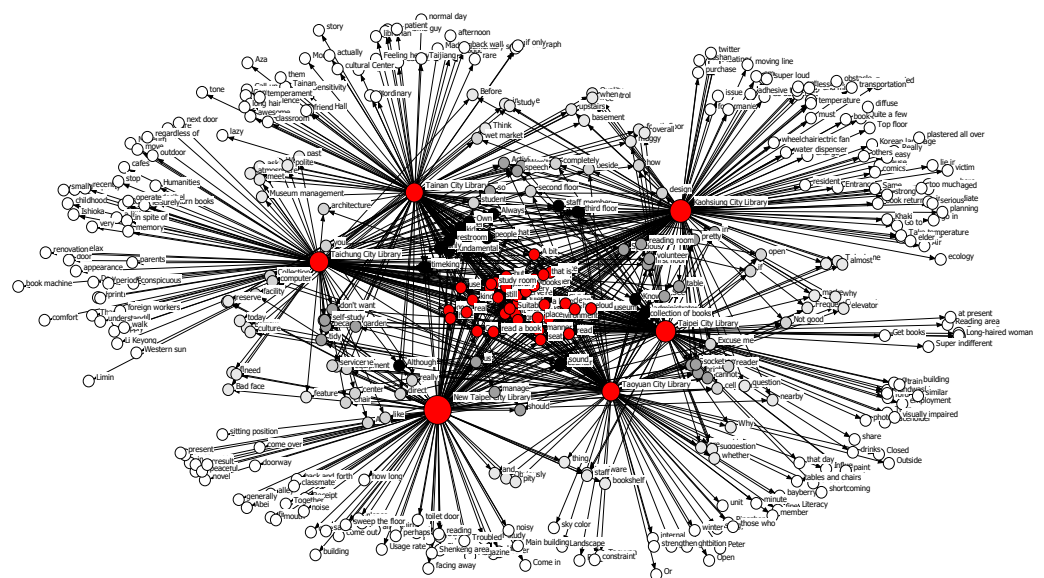
The network analysis depicts six public libraries at the core, each serving as a nexus connecting various keyword nodes. The structure is organized according to the K-core method, categorizing the nodes into six distinct classes that radiate from the center to the periphery based on their importance. This visual representation highlights the central role

of these libraries within the network, indicating their pivotal position in bridging diverse service aspects as reflected by the connected keywords. The concentric arrangement from the core to the outer layers effectively demonstrates the hierarchical significance of service attributes, with the most critical elements positioned closest to the library nodes at the center. This arrangement not only elucidates the structural importance of specific services within the library ecosystem but also visually encapsulates the layered complexity of library service offerings, reflecting both the breadth and depth of user needs and preferences catered to by these institutions. Such an analytical depiction underscores the multifaceted nature of library services, offering insights into the interconnections and relative importance of various service components within the public library network.

#### 4.5. Degree Analysis of Library Reviews

Out-degree centrality, within the social network analysis framework, quantifies the extent of active participation or engagement by a specific node within a network. This measure primarily reflects the number of outward connections or relationships that a node initiates toward other nodes in the network, indicating the node's propensity to disseminate information, influence, or resources across the network. In-degree centrality, a fundamental concept in social network analysis, measures the extent to which a particular node receives direct connections from other nodes. This metric indicates the node's attractiveness or prominence within the network, reflecting the degree to which it is sought out or considered necessary by other members [26]. In this social network analysis of keywords from Google Maps reviews focused on library services, the data intriguingly reveal the predominance of Taiwan's six major city libraries in Out-degree, signifying their significant presence. Conversely, the In-degree measure, indicative of the frequency at which users mention various service-related keywords, highlights crucial aspects of library services valued by the public. The most frequently cited attributes—"environment", "space", "reading", "air conditioning", "quiet", and "seating"—underscore the public's prioritization of physical comfort, conducive reading environments, and the availability of resources within library settings. This nuanced analysis illuminates the essential components of library services that contribute to user satisfaction and engagement, suggesting that attributes about the physical layout and atmosphere of libraries, alongside the provision of necessary facilities, play a pivotal role in the public's perception and utilization of library services. Such insights provide valuable guidance for library administrators and policymakers aiming to enhance library services, underscoring the importance of focusing on tangible and intangible aspects that improve user experience and foster a positive library environment. To enhance the descriptive sections of the paper, illustrations and visual representations of the social network analysis are included. These visual aids help readers better understand the network structures and relationships identified in the analysis, providing a clearer and more engaging presentation of the findings. In discussing out-degree and in-degree centrality, examples of graph structures are provided to illustrate these concepts. These examples help to concretize the discussion, showing how nodes (libraries) and edges (connections between keywords) form the network. This visualization aids in understanding the significance of these metrics within the context of the social network analysis. Figure 1 represents a social network analysis (SNA) of keywords extracted from Google Maps reviews of public libraries. This SNA diagram illustrates the relationships and interactions between keywords extracted from Google Maps reviews of public libraries in Taiwan. The nodes in the diagram represent individual keywords or concepts derived from the reviews. At the same time, the edges signify the connections between these keywords, indicating their co-occurrence within the same reviews. The size of each node reflects its degree centrality, which denotes the number of connections a node has; larger nodes signify higher frequency and more connections with other keywords. Different colors may be used to distinguish various categories or themes of keywords, such as library services, facilities, user experiences, etc. Closely connected nodes form clusters, representing groups of keywords frequently appearing in the reviews, revealing specific areas of interest or concern among library

users. The largest nodes in the diagram represent the most frequently mentioned keywords, likely indicating key aspects of library services that users care about most. The connections between different clusters highlight overlapping areas of concern, suggesting that multiple aspects of library services are interrelated from the users' perspective. By analyzing this social network analysis diagram, one can identify library users' primary themes and concerns, understand the interrelationships between different aspects of library services, and pinpoint key areas for improvement based on user feedback. The diagram prominently features six large nodes representing the six public libraries studied in Taiwan, with their larger size indicating a high degree of connectivity. At the center of the diagram are the shared service items and focal points common to these six libraries: noise, reading, reading rooms, sustainability, and environmental hygiene. The outer areas of the diagram depict service items specific to individual public libraries, which are not commonly shared or identical across all libraries and may include unique services characteristic of each library. The numerous shared items in the network and many peripheral nodes demonstrate that Taiwan's public libraries have common issues and service items while developing their unique features. The degree and constraint for public libraries' social network analysis are shown in Table 2.



**Figure 1.** Social network of public libraries.

**Table 2.** Degree for public libraries SNA.

| Node                    | Out Degree | In Degree | Constraint |
|-------------------------|------------|-----------|------------|
| Kaohsiung City Library  | 9854       | 0         | 0.025      |
| Taichung City Library   | 6080       | 0         | 0.023      |
| New Taipei City Library | 5700       | 0         | 0.024      |
| Tainan City Library     | 4662       | 0         | 0.024      |
| Taoyuan City Library    | 4400       | 0         | 0.026      |
| Kaohsiung City Library  | 4298       | 0         | 0.023      |
| Library                 | 0          | 1725      | 0.184      |
| Environment             | 0          | 1444      | 0.183      |
| Space                   | 0          | 1245      | 0.180      |
| Read                    | 0          | 1035      | 0.181      |
| Air conditioner         | 0          | 941       | 0.240      |
| Quiet                   | 0          | 897       | 0.211      |
| Read a book             | 0          | 868       | 0.202      |
| Child                   | 0          | 824       | 0.215      |
| Seat                    | 0          | 823       | 0.221      |

Table 2. *Cont.*

| Node        | Out Degree | In Degree | Constraint |
|-------------|------------|-----------|------------|
| Study room  | 0          | 685       | 0.249      |
| Convenient  | 0          | 663       | 0.208      |
| Comfortable | 0          | 662       | 0.190      |
| Librarian   | 0          | 638       | 0.269      |
| Manner      | 0          | 574       | 0.223      |
| Clean       | 0          | 470       | 0.252      |
| Loud        | 0          | 469       | 0.229      |
| Great       | 0          | 385       | 0.184      |
| Books       | 0          | 344       | 0.192      |

#### 4.6. Structure Holes of Keywords in Library Reviews

In the context of social network analysis, the concept of structural holes refers to the gaps within a social network that separate non-redundant sources of information. When examining library services through this lens, keywords such as “environment”, “study room”, “child”, and “air conditioner” exhibiting lower constraint values suggests that these areas represent unique niches within the network of library services that are less densely connected to other nodes, thereby occupying structural holes. This distinct positioning implies that these services act as critical junctures that bridge otherwise disconnected segments of the library’s service network, facilitating novel interactions and diverse information flow. For instance, the specific focus on conducive “environment”, dedicated “study room” facilities, child-friendly services, and “air conditioner” presence highlights differentiated service areas that cater to unique user needs, potentially attracting distinct user groups or satisfying varied user expectations that are not as densely covered by other library services. Such services possessing structural hole characteristics can play a pivotal role in enhancing the library’s overall value proposition by offering unique benefits, fostering diversity in service utilization, and improving user satisfaction by filling critical gaps in the library’s service ecosystem. From a strategic standpoint, identifying and capitalizing on these structural holes within the library services network can provide opportunities for innovation, differentiation, and strengthened engagement with the library’s user base.

#### 4.7. LibQUAL+ Model Analysis in Library Reviews

In analyzing the keywords from Google Maps reviews of public libraries, we can categorize and interpret these based on the three core dimensions of the LibQUAL+ model—Library as Place, Affect of Service, and Information Control. Our comprehensive study analyzing user-generated keyword data within library services delineated the terms into three principal service dimensions, reflecting targeted user concerns and priorities in modern library utilization; see Table 3. The dimension of “Library as Place” accounted for a total of 11,528 mentions, with keywords like “library”, “environment”, “space”, and “place” highlighting users’ emphasis on the physical setting and amenities provided by library facilities. This focus suggests that the tangible aspects of library environments are crucial in creating inviting and functional spaces for users. For “Affect of Service”, which garnered 7806 mentions, the keywords such as “read”, “service”, and “staff” were prominent, indicating a significant user emphasis on the quality of interaction and service provided by library personnel. This dimension underscores the importance of positive staff–user interactions and efficient service delivery in shaping overall user satisfaction and perception of library services. The “Information Control” dimension, with 4021 mentions, featured keywords like “laptop”, “collection of books”, and “rich”, which highlight the users’ priorities concerning the accessibility and usability of information resources. This dimension emphasizes the need for libraries to effectively manage the availability and operational aspects of their resources to meet user demands for ease of access and rich collection environments.

**Table 3.** Counts of reviews' keywords by the three dimensions.

| Dimensions          | Total Counts |
|---------------------|--------------|
| Library as Place    | 11,528       |
| Affect of Service   | 7806         |
| Information Control | 4021         |

1. **Library as a Place:** The physical characteristics of library environments, as highlighted in user reviews, underscore the importance of creating tranquil, immaculate, and well-furnished spaces. Keywords such as “clean”, “comfortable”, and “space” illuminate the significant impact of the library’s physical conditions on user experiences, stressing that a sanitary, inviting, and spacious environment is indispensable for cultivating an ideal atmosphere for reading and learning. These attributes are pivotal in attracting and retaining visitors, transforming the library into a welcoming space suitable for prolonged study and relaxation. Furthermore, user reviews specifically mentioning “air conditioning”, “seating”, and “study rooms” reflect precise expectations for the comfort of study environments. These expectations encompass the need for effective temperature control and ample personal space, which are critical for establishing conducive conditions that elevate the overall library experience.
2. **Affect of Service:** The way users perceive their interactions with library staff significantly influences their overall service experience. Keywords such as “attitude”, “very”, and “really” reveal strong user sentiments toward the quality of service received, providing insight into the emotional impact of staff interactions. These terms offer direct feedback on the performance of library personnel, which is crucial for driving improvements in service delivery. Additionally, keywords like “borrowing”, “service”, and “staff” underline the essential elements of library service quality, including the simplicity of the book borrowing process and the staff’s demeanor and efficiency. Positive evaluations of staff attitudes and kindness significantly enhance the library’s image, underscoring the value of empathetic and efficient service in fostering user satisfaction and shaping perceptions of the library.
3. **Information Control:** This dimension assesses the effectiveness and convenience with which users can access and utilize the library’s information resources. Keywords such as “borrow books”, “book machine”, “operation”, and “collection of books” shed light on user experiences concerning the ease of performing information searches and utilizing library resources. The emphasis on the accessibility of essential resources and the modernity and efficiency of equipment highlights the imperative for libraries to enhance their information service offerings. Additionally, terms like “quiet”, “loud”, and “children” address internal management and normative concerns, underlining the necessity of maintaining a quiet environment as fundamental for library operations, where effective noise control poses a significant operational challenge. Moreover, “convenient” and “location” suggest that the geographical accessibility of the library plays a crucial role for users, with strategically located libraries experiencing higher foot traffic and increased utilization. This dimension underscores the significance of both the physical and operational aspects of library services that support and facilitate user access to and engagement with information resources.

Through this keyword analysis, we understand users’ specific needs and perceptions regarding public libraries. This not only aids library managers in improving aspects related to service affect, information control, and the role as a place but also better meets the expectations and needs of community members. The results from the LibQUAL+ Model Analysis indicate that users’ expectations for libraries span multiple dimensions, from basic physical environments to high-quality services and unique cultural activities. This necessitates that libraries focus on enhancing facilities and service quality in their daily operations and long-term planning and pay attention to unique development and cultural promotion to serve the public better and meet diverse societal needs. Additionally, through

the outcomes of the social network analysis, library managers can more accurately identify and optimize those key nodes and connections critical to improving user satisfaction and attraction. Online reviews are a critical source of information for consumers, significantly influencing their decisions. Reviews rated as more helpful tend to exert a stronger influence. A previous study found that linguistic subjectivity and objectivity positively affect review helpfulness. However, combining subjective and objective sentences in the same review can reduce its perceived helpfulness due to the increased complexity and the effort required for processing [12]. In the context of public library services, the advantages of using internet reviews include access to real-time, diverse perspectives and detailed user experiences that traditional survey methods may not capture. However, there are also disadvantages, such as the potential bias introduced by extreme opinions and the challenge of interpreting mixed subjective and objective feedback. These factors must be considered to ensure a balanced and comprehensive evaluation of library services, leveraging the strengths of online reviews while mitigating their limitations.

## 5. Conclusions

In the current digital era, individuals increasingly rely on online platforms to gather information about various entities, guided by the shared experiences of others. Google Maps stands out as a prominent platform that allows users to rate and review a wide range of services, including public libraries. It is imperative for libraries to proactively engage with user reviews on Google Maps and similar platforms, as this feedback is instrumental in identifying areas for service and facility enhancement. By undertaking such measures, libraries can significantly improve user satisfaction and sustain a positive reputation among their patrons, underscoring the importance of responsive and adaptive library management in the digital age [27]. This study's comprehensive analysis of Google Maps reviews through social network analysis and keyword evaluation has provided profound insights into the perceptions and expectations of library users across Taiwan's six major cities. The findings underscore a universal appreciation for library environments that are conducive to reading and learning, characterized by cleanliness, comfort, spaciousness, and quietness, alongside a demand for high-quality services, efficient management, and unique cultural offerings. By highlighting the core concerns and characteristics valued by library patrons, such as the importance of physical facilities, the caliber of service and staff interaction, and the library's role as a cultural and educational hub, this research delineates the multifaceted expectations users have of their libraries. These insights not only contribute to the academic discourse on library science and user experience design but also provide actionable intelligence for library administrators and policymakers aiming to enhance the quality of library services. The study emphasizes the critical role of libraries in fostering educational growth, cultural enrichment, and community engagement, suggesting that continuous efforts to improve library environments, diversify services, and embrace the unique cultural identity of each library can significantly elevate user satisfaction and societal value.

While offering valuable insights into library user perceptions through Google Maps reviews, this study has limitations. Firstly, the reliance on UGC limits the analysis to those willing to leave reviews, potentially skewing results toward more vocal users and omitting the silent majority's preferences. Additionally, the interpretation of keywords and sentiments from reviews is subject to the nuances of language and individual expression, which might introduce a degree of subjectivity into the analysis. Furthermore, the geographical scope limited to Taiwan's six major cities might not capture the diversity of library services and user experiences in smaller municipalities or rural areas, potentially limiting the generalizability of the findings.

Future research could address these limitations by incorporating a broader dataset that includes user feedback from a wider range of platforms and geographical locations, enhancing the diversity and representativeness of the data. Qualitative interviews or surveys could complement the analysis, providing deeper insights into user experiences and motivations behind the reviews. Additionally, longitudinal studies could track changes

in user perceptions over time, offering a dynamic view of how libraries evolve to meet user needs. Finally, comparative studies between digital and physical user interactions with libraries could shed light on the changing landscape of library services in the digital age, providing a comprehensive understanding of library user behavior and expectations.

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