Abstract: Since the start of the new century, the focus of China’s socioeconomic development has gradually shifted from prioritizing efficiency to social equity, which is an important ingredient of sustainable development. The accessibility of public service facilities (PSFs) is vital for achieving social–spatial sustainability. As a basic tool for arranging PSFs, however, traditional urban plannings mainly focus on the spatial uniform distribution of facilities rather than the variance of the spatial distribution of populations they serve. So, by taking the dual perspective view, this paper quantitatively measures the balance of PSFs’ spatial distribution of and populations of Urumqi City at the sub-district level. Based on point of interest (POI) data, this paper calculates and analyzes Gini coefficients and location entropy of three basic PSF types: living service facilities (LSFs), primary schools and kindergartens (PSAKs), and medical facilities (MFs). The research finds that the Gini coefficients of LSFs, PSAKs, and MFs in Urumqi City are 0.42, 0.36, and 0.34, respectively. Moreover, there are three significant mismatch areas: an extremely high PSF index value in low-population sub-districts, an extremely low index value in remote suburbs, and an extremely low index value in the city center. These findings indicate an obvious imbalance between the spatial distribution of PSFs and the population in Urumqi, which may be a critical impediment to sustainable development. Based on these, this paper offers guidance for achieving sustainability in the allocation of spatial resources.

Keywords: public service facilities; sustainable development; Gini coefficient analysis method; locational entropy

1. Introduction
1.1. Background

The focus of modern urban planning has gradually shifted from physical space engineering to public policy [1]. Urban planning, as a public policy, is not simply connected to society, economy, culture, and environment but is an important tool for urban management and operation and for safeguarding the welfare of citizens’ interests [2,3]. The allocation of public service facilities is a crucial aspect of urban planning for urban sustainability [4]. Consequently, the accessibility of public services is a key indicator of the government’s efficiency and fairness in allocating PSFs [5]. Therefore, it is essential to ensure that the allocation is sufficient and balanced [5]. However, it is not easy to achieve such an ideal state in reality. First, at the stage of rapid urbanization, public service facilities and amenities cannot keep up with the urban construction pace [6], which makes it challenging to achieve the theoretical states of PSFs in terms of quantity, scale, and quality that match the needs of urban development [7]. Secondly, the differentiation of residential space deriving from the urban socioeconomic structure could result in an imbalance in the PSFs’ distribution. Third, relying on market mechanisms alone certainly cannot fulfill the demand for PSFs. So, it is crucial to accurately evaluate the status and imbalance between the supply and demand of such facilities for urban sustainable development.
1.2. Literature Review

Since the 1980s, China’s market-oriented reform and rapid economic growth have accelerated the process of social stratification [8]. The issue of social fairness and justice, concerning the rational distribution of resources in societies, has increasingly got the attention of governments across all levels and sectors [9]. In recent years, China’s socioeconomic development has been gradually adjusted from “prioritizing efficiency” to “focusing on social equity”, which means that maintaining social equity and improving management capacity has become one of the main tasks of governments at all levels [10]. The Communist Party of China’s (CPC) 18th National Congress established a social equity guarantee system based on fair rights, opportunities, and rules [11], leading China’s public policies toward greater fairness. As a result, the planning community’s investigation into social equity has evolved and emphasized that people are the agents of cities and that urban planning should be “planning for people” [12]. Since then, the combination of theory and practice has been increasing, including studies on the rationality of spatial layout and surveying methods of project implementation. The scope of this research has been expanding to various scopes, such as environment and culture, sports, transport, medical care, education, and others [13–16].

Urban PSFs, mainly supplied by municipalities, provide various public products and services to citizens [17]. Most studies on PSFs have recently focused on spatial location and layout [18,19], spatial distribution and accessibility [20–22], and social differentiation and its formation mechanisms. Most academics take their studies from their disciplines, focusing on individual facilities rather than holistic studies covering multiple public service facilities. Among the studies above, amenities, medical facilities, and educational facilities are common objects of frequent attention, and their importance has risen to new heights. For example, Wu H et al. examined the living service facilities in Shanghai from the perspective of supply and demand balance, concluding that living service facilities play an essential role in guaranteeing basic services for residents [23]. Similarly, Li Z et al. studied medical public services, highlighting that medical service facilities have become an important aspect of public health services in Chinese cities [6]. Furthermore, the study by Si-Qi Z et al. on urban basic education facilities demonstrates that the ability to fulfill the demand for quantity and space directly influences residents’ living and urban transport [24]. Additionally, there are a few studies in which various types of urban public service facilities have been employed. Moreover, the majority of studies have been concentrated in developed eastern coastal regions, with minimal research conducted in remote regions.

As equity is an important concern in various subjects, the distribution equity of public services and facilities is one of the major goals in urban planning [25]. Equity in the distribution of PSFs refers to the ability of urban residents to have equal access to public resources. It is generally based on the number of facilities and their spatial matching [26]. Different disciplines have different approaches to assessing the distribution equity of PSFs [27]. Common methods of measuring distribution equity in reaches are mainly based on accessibility [28], a few take the lens of spatial matching of population and utility functions for equity assessment [29]. With interdisciplinary research progress supported by geographic information systems (GISs) and other related technologies, many scholars have adopted quantitative methods to study the accessibility of PSFs. These research subjects include parks and green spaces [30,31], transportation facilities [32], medical facilities [33], educational facilities [34], etc. Accessibility measuring methods include the distancing method, potential model method, two-step moving search method, time geography method, core density method, search density method, etc. At the same time, various factors have been integrated into assessing PSFs’ accessibility, such as regional structure, population diversity, and individual characteristics of the target, which largely broaden the width of studies [35,36]. However, most methods for evaluating the accessibility of PSFs are commonly referred to as “place-based” methods [37,38], which typically focus on the placement and interconnection of PSFs [39]. To respond to this insufficiency, some studies take the “people-oriented” perspectives to integrate population distribution and individual
activity patterns into the study of PSF distribution [40]. Meanwhile, the focus of relevant research has gradually shifted from spatial parity to the parity of people’s enjoyment of resources and to the matching degree of correlation between the PSFs’ distribution and populations [41].

In conclusion, the prevailing trend in equity research has undergone a significant shift, moving away from sociological studies and toward a diverse range of disciplines. Additionally, the focus has shifted from abstract concepts of equity to specific themes or goals. Equity measures of the spatial distribution of PSFs are mainly dominated by place-based, qualitative methods for single types of facilities.

So, in this paper, we aim to measure the equity of PSFs from a “people-oriented” perspective. Given the limitations of previous studies, this study assesses the spatial distribution of public service facilities in underdeveloped areas at the municipal sub-district level by examining three types of public service facilities simultaneously, adopting a “people-oriented” quantitative measurement method and addressing equity concerns. The findings will give advice when allocating PSFs for urban management and planning projects in similar regions. In order to better support the “people-oriented” paradigm, PSFs’ point of interest (POI) data have been selected as the basis for this study, as they can best reflect the places and activity patterns of the public [42,43]. The sub-districts are primary research units, and quantitative measuring methods, such as the Gini coefficient, location entropy, and spatial analysis methods, are employed. Overall, this study aims to address the following two questions:

1. What is the current status of equity performance in the spatial distribution of urban PSFs?
2. Based on the current status, how can we improve the allocation of PSFs for better spatial equity?

2. Materials and Methods

This paper applies Gini coefficients, commonly used in economics to measure income distribution, to evaluate the distribution of urban PSFs, and adopts the location entropy method, which analyzes the degree of industrial agglomeration, to compare the spatial distribution of resources with the spatial distribution of the population. In order to realize the matching calculation of the Gini coefficient and location entropy with population and space, the sub-district [44], the primary administrative unit in demographic analysis, was selected as the unit of delineation for this study. Based on the sub-district as the unit of calculation, spatial data (including sub-district boundaries, demographic data, and POI data for LSFs, PSKFs, and MFs), overlay calculations, and comparative analyses were conducted to evaluate equity at the spatial level quantitatively.

2.1. Research Methodology

2.1.1. The Gini Coefficient Method

The Gini coefficient is a frequently employed tool for assessing and examining income inequality within a country or region [45]. The Gini coefficient is widely used in fairness studies because it is simple, straightforward, and can be compared over time (vertical comparison of the same city) and across different cities (horizontal comparison) [41]. As the connotations of social equity based on income distribution and social equity based on the distribution of public resources are similar, scholars typically adopt this approach to study the distribution of resources for urban PSFs [46,47]. Therefore, the Gini coefficient is used in this study to reflect how much the resources for MFs, LSFs, and PSKFs match the population. At the same time, the interval of the Gini coefficient is used to judge the equity of the spatial layout of the above three types of PSFs.

The Gini coefficient is calculated as follows:

\[
G = 1 - \sum_{k=1}^{n} \left( p_k - p_{k-1} \right) (R_k + R_{k-1})
\]
where $G$ is the Gini coefficient, a measure of the distribution of the social equity performance of the original PSFs, which is assigned values between 0 and 1. The closer the Gini coefficient is to 0, the better the fairness of the layout of the relevant PSFs; the closer the Gini coefficient is to 1, the more it responds to the apparent imbalance in the layout of the relevant PSFs [48,49]. $P_k$ represents the cumulative ratio of the population, $k$ ranges from 1 to $n$, $P_0$ is 0, and $P_n$ is 1. On the other hand, $R_k$ symbolizes the cumulative ratio of the points of interest related to a PSF.

In the above formula, the calculation is based on the sub-district as the basic unit of division, the cumulative superposition of the number of people in the sub-district, and the sum of the points of interest of PSFs in each corresponding sub-district. There is a commonly held belief that the distribution is uniform when the $G$ value is less than 0.2. The distribution is considered relatively uniform when the $G$ value falls between 0.2 and 0.3. The distribution is barely uniform if the $G$ value is between 0.3 and 0.4. When the $G$ value is between 0.4 and 0.5, it constitutes a warning that the distribution may not be balanced. The distribution is significantly unbalanced if the $G$ value is between 0.5 and 0.6. Finally, when the $G$ value exceeds 0.6, it indicates a highly unbalanced distribution [50,51].

2.1.2. Location Entropy

The Gini coefficient can be used to express the social equity performance of the layout of PSFs regarding resource distribution. However, it does not evaluate the specific spatial matching degree between the layout of PSFs and the population distribution. The locational entropy method can identify specific spatial matching patterns between facility layouts and populations, and it can also be used as a measure of equity for PSFs [25,52], ameliorating some of the methodological shortcomings of “people-based” research. Therefore, this paper also analyzes the spatial pattern of the social equity performance of PSFs using the method of locational entropy.

The location entropy method, which originates from economics, calculates the relative concentration of an industrial sector in a small region compared to a larger region. A higher value indicates a higher relative concentration [53]. In this study, we apply this method by treating each industrial sector in the original table as a PSF and calculating the spatial distribution of resources for these facilities. The locational entropy of each spatial unit is calculated as the ratio of the number of PSFs per capita of the population in that spatial unit to the resources of PSFs per capita of the population in the entire study area. It is important to note that a high value indicates a significant concentration of PSFs, while a low value indicates their scarce distribution. This spatially unbalanced arrangement can directly impact equity, making it crucial to ensure that public services are evenly accessible to all community members.

$$LQ_j = \frac{S_j}{P_j}$$

$LQ_j$ denotes the entropy of the cell location in $j$-space. At the same time, $S_j$ represents the number of PSF POI points in space unit $j$. $P_j$ denotes the number of people in spatial unit $j$. $S$ represents the number of POI points of PSFs within the study area, and $P$ represents the total population within the study area. By classifying spatial units according to their locational entropy, it is possible to efficiently exclude spatial units with extremely high or low levels of equity performance.

2.2. Scope of Research

Urumqi, commonly known as “Wushi” and formerly known as “Dihua”, is the largest city and capital city of Xinjiang Uygur Autonomous Region, with an administrative area of 13,788 square kilometers, comprising seven districts and one county under its jurisdiction. Urumqi is an important central city in northwest China and an international trade and commercial center for central and west Asia. According to the seventh census in 2020, the household population of Urumqi was 4,054,300. In recent years, the urban population...
has continued to grow, and the city has expanded [54]. This change has resulted in more prominent population growth in new urban areas, such as the Urumqi Economic and Technological Development Zone (Tutunhe District), the Urumqi High-tech Zone, and the Hemaquan New District. However, these areas need to improve their PSFs compared to the old urban areas, raising societal concerns. This study will analyze the layout of PSFs in the administrative area of Urumqi City. The study area includes ninety-nine sub-district units within seven districts in one county of Urumqi City (Figure 1). The analysis assesses the coupling degree of the population and the distribution of PSFs to evaluate equity performance.

![Image](https://xinjiang.tianditu.gov.cn)

Figure 1. (a,b) Scope of this study; (c) Urumqi sub-district boundaries and zones.

2.3. Data Processing

The China Standard Map is from the website of the Ministry of Natural Resources of the People’s Republic of China “https://www.mnr.gov.cn”, and the map of the administrative boundaries of Xinjiang Province is from the Xinjiang Department of Natural Resources “https://xinjiang.tianditu.gov.cn”. The vector data, such as administrative divisions, administrative boundaries, sub-district margins, POI data points of PSFs, and geographic coordinates of Urumqi City related to this study, were obtained from (https://poi86.com). The POI has been applied as the primary data support for facility layout equity research due to its rich data sample, precise spatial definition, and real-time accessibility [55], which mainly includes commercial facilities, LSFs, MFs, educational facilities, and more. The population data at each sub-district level were derived from China’s seventh population census statistics for 2020 (https://tjj.xinjiang.gov.cn). In this study, the living service facility points, medical facility points, and educational facility points, which are most closely related to residents’ daily lives, were used as the research objects. Since the geographic coordinates of the POI data do not match the projected coordinates of the sub-district units, the projected coordinates of the sub-district units were first converted to geographic coordinates to ensure that the POI data points are in the same coordinate system as the data points of the sub-district units.

Furthermore, the population data for each sub-district unit and the point data for living service, medical, and educational facilities were extracted from GIS attribute tables based on data alignment. The Gini coefficient and locational entropy were computed separately and transformed back into a spatial data frame for visualization and further analysis (Figure 2).
3. Results

Based on the Gini coefficients, the overall spatial distribution of LSFs, PSKFs, and MFs in Urumqi is uneven: LSFs are concentrated in the city center within the Third Ring Road, while PSKFs are dispersed, and there is a lack of PSKFs in some suburban areas. For MFs, there needs to be more facilities in the city center and suburban areas. The results of the combined analyses based on location entropy and population also show an apparent mismatch between facilities and population, suggesting a clear equity problem in the spatial distribution of the three types of facilities at the sub-district level and, therefore, the need for targeted strategies to improve spatial equity.

3.1. POI-Based Social Equity Performance Evaluation of Public Service Facility Layout

3.1.1. Evaluation Results of LSFs

The Gini coefficient of LSFs in Urumqi is 0.42, which falls within the alert value range. The spatial distribution of LSFs varies significantly regarding the overall spatial layout (Figure 3a). LSFs are concentrated within the Third Ring Road area, with an overall radial decrease outward [56]. However, a localized belt-shaped aggregation area appears in the northeastern area outside the Third Ring Road.

The location entropy results indicate that most high-value sub-districts are situated on the outskirts of the central city or in the central area directly adjacent to the Third Outer Ring Road. Examples of such areas include the southern part of Shayibak District, Tutunhe District, the new urban area (Areas 1, 2, and 3 in the figure), and the northern part of Shaybak District (Area 4 in the figure). Areas outside the central city have very low values. The vast majority of the very low values are situated in the outermost regions of the city. However, it is worth noting that in addition to the existence of large areas of very low value in areas outside the Third Ring within the central city, there are also areas of very low value inside the Third Ring where living services are more concentrated, such as Changshengdong sub-district (Area 5 in the figure), Cangfanggou sub-district (Area 6 in the figure), and Kashidong Road sub-district (Area 12 in the figure), which are immediately adjacent to the Third Ring Road, and Yinchuan Road sub-district (Area 10 in the figure), Hangzhou Road sub-district (Area 11 in the figure), Racecourse sub-district (Area 8 in the
and Shengliang Road sub-district (Area 9 in the figure), which are inside the Third Ring.

![Figure 3. (a) Density of LSF sites and population distribution; (b) entropy of LSF locations.](image)

Further analysis in combination with population and facility distribution reveals that the location entropy results exhibit distinct patterns (Figure 3b). Areas with high values typically have a moderate number of facility points in their vicinity but a low population; conversely, areas with very low values in remote suburbs lack a high population yet have a scant number of facilities or none at all; and areas with very low values in the city center are predominantly found in old sub-districts, characterized by a high population but a scarcity of facilities.

3.1.2. Evaluation Results of PSKFs

The Gini coefficient of PSKFs in Urumqi City is 0.36, which needs to be more balanced. Findings from related studies in the same region also support the conclusions of this study [57,58].

Although the PSKF points are relatively concentrated in the central city, it can also be seen that there are only one or two PSKFs in each sub-district on the edge and periphery of the central city. In contrast, some of the city’s remote suburban zones appear to be missing PSKFs. The location entropy results indicate that high-value areas are concentrated in the western part of Shumogou District (Area 1 in the figure) and southwestern and southeastern parts of Tutunhe District (Areas 2 and 3 in the figure). Low values are distributed in both the central urban area and the remote suburban areas. Specifically, the low values in the central urban area are mainly located on the edge of the central district of Shayibak District’s Xishan Farms (Area 4 in the figure) and Changsheng South and Changsheng West sub-districts (Areas 5 and 6 in the figure), Urumqi County’s Wangjiagou sub-district (Area 7 in the figure), the Corps’ 12th Division Tutunhe Farm (Area 8 in the figure), and Wuyi Farm (Area 9 in the figure) in Tutunhe District. In the far suburbs, except for Shumogou District, where there are no extremely low values, there are large areas of extremely low values in all other regions (Figure 4a).
Combined with population distribution and facility distribution, the entropy results of PSKF zones have the following characteristics: the very-high-value sub-districts are mainly concentrated in low-population areas outside the Third Ring Road within the central district, while very-low-value sub-districts are scattered; the facilities are unevenly distributed spatially, with a higher concentration of facilities within the Third Ring Road and decreasing radioactively outwards. Therefore, the location entropy results are mainly related to the sub-district population; the number of very-low-value sub-districts is higher in the city's central area (Figure 4b).

3.1.3. Results of Evaluating MFs

Based on the sub-district population, the Gini coefficient of major medical service facilities (including general hospitals, 3A hospitals, specialty hospitals, and sub-district health clinics) in Urumqi was calculated, and the results showed that the Gini coefficient of MFs was 0.34, which was in the range of barely equal. This conclusion is more consistent with previous related studies [58,59]. For example, in analyzing the equity of medical resource allocation in Xinjiang, Song Yajun et al. argued that, based on a Gini coefficient calculation of 0.32, the spatial equity of MFs in Urumqi City has yet to be improved. YAO Xuan et al. showed that although the Gini coefficient related to the social equity of medical and health facilities in the seven districts of Urumqi City showed a decreasing trend during 2011–2015, there is still a gap between their levels and a high level of equity.

In the central urban area, MFs are mainly concentrated in the intersection of Shayibak District, New City District, Shumogou District, and Tianshan District within the Third Ring Road. The number of facilities decreases as we move outward from this area: MFs in Tutunhe District are primarily located in the southwestern corner of the city along Bajiyi Road. In contrast, urban fringe sub-districts do not exhibit a concentrated pattern of medical facility distribution. The locational entropy analysis indicates high concentrations of MFs in specific zones, such as the Urumqi Economic and Technological Development Zone within the Third Ring Road (Area 1 in the figure), the western part of Shumogou District (Area 3 in the figure), and the southwestern part of Tutunhe District (Area 2 in the

![Figure 4. (a) Density of PSKFs and population distribution; (b) entropy of PSKF sites.](image-url)
It is evident that some administrative districts do not have an adequate distribution of high-value zones; the very-low-value zones are distributed in both the city center area and the remote suburbs, which is the same as the results of the first two items, and at the same time, the Corps farms of Tunutne District in the central city (Area 4 in the figure), the Xishan Farms of the Twelfth Division of the Corps and Changshengnan sub-district in Shaybak District (Areas 7 and 8 in the figure), the Hongyan sub-district in the southern part of Tianshan District (Area 6 in the figure), and Gumudi Town and Tiechanggou Town in the southern part of Midong District (Areas 9 and 10 in the figure) are typical, very-low-value zones in the central city. Overall, very low values of locational entropy for MFs are distributed in every district (Figure 5a). The location entropy results reveal the following characteristics when combining population distribution and facility distribution: very-high-value sub-districts have a small population and few facility points; facility points in high-value sub-districts are scattered; and the regionally concentrated facility distribution contrasts with the high-value results of the location entropy, as presented in Figure 5b.

Figure 5. (a) Point density of MFs and population distribution; (b) entropy of medical facility point locations.

3.2. Summary

The calculations show that the Gini coefficient values for the three types of facilities are within the reasonable range of 0.3 to 0.4, indicating the obvious spatial mismatch of PSFs in Urumqi City. The results of the locational entropy calculation also show that most sub-districts are in the low-value range, which shows a particular polarization. Analyzing from the perspective of specific space, the exceptionally high and extremely low values generated in the results of location entropy also reflect some problems in terms of fairness. Comprehensive MFs, PSKFs, and LSFs of the location entropy results within the study area (Figure 6) were used to analyze the sub-districts with a high frequency of outliers. According to the characteristics of the outliers, the overall results can be summarized in three categories: the very-high-value category of low-population sub-districts located in marginal urban areas, the low-value category of urban centers in densely populated areas, and the low-value category of remote urban suburbs in remote areas or new urban areas.
with insufficient or missing facilities (Table 1, Figure 7). These three categories of outliers reflect the spatial mismatch between population and facilities and the lack of facilities in some areas. In the following discussion, we will examine the specific factors contributing to these outliers and suggest customized strategies to improve the spatial equity of PSFs.

![Figure 6. Coupling analysis of sub-district population and location entropy value of PSFs.](image)

<table>
<thead>
<tr>
<th>Sub-District Type</th>
<th>Sub-District Characteristics</th>
<th>Typical Sub-District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely high value for low population</td>
<td>It is located in an urban fringe area with a low population, resulting in extremely high values of locational entropy.</td>
<td>Changshenggran sub-district, Xishan Farm sub-district, Wuyi Farm sub-district, Anninggs sub-district.</td>
</tr>
<tr>
<td>Low value in the central area</td>
<td>Inadequate installation in densely populated sub-districts.</td>
<td>Tianzhen Road sub-district, Fengyuan sub-district, Yan’erwo sub-district.</td>
</tr>
<tr>
<td>Low value in remote suburbs</td>
<td>Inadequate or missing facilities in remote areas of the city or new towns.</td>
<td>Ulupo sub-district, Bayanghe River Township, Xigou Township, Toli Township, Awergou sub-district.</td>
</tr>
</tbody>
</table>

![Table 1. This table illustrates the types and characteristics of equity in the spatial layout of PSFs in Urumqi City.](image)

![Figure 7. (a) Very-high-value sub-districts at the city’s edge; (b) very-low-value sub-districts in urban centers and remote suburbs.](image)
4. Discussion

Based on the typical characteristics of the three categories summarized above, the sub-districts that generate very high values were characterized by a small population, such as Changshengnan sub-district, Wuyi Farm sub-district, Xishan Farm sub-district, and Anningqu Township. Changshengnan sub-district is situated on the city’s outskirts, within the warehouse district, and has a small population. Despite limited public services, the per capita benefits are substantial. Anningqu is a town that has mainly developed in the agricultural industry. Most of the area is dedicated to agricultural and industrial purposes, with minimal residential land and low building density. With a small population, the statistical data reflect a high per capita indicator. Two situations give rise to very low values: one is where very low values are found in central urban areas. These sub-districts generally have large populations, and although the number of facilities is intermediate, the per capita enjoyment is low. For instance, the Fengyuan sub-district in Shayibak District is in the city’s historic downtown area, characterized by a dense population and a high demand for public service amenities. Since most of the sub-districts are high-density commercial and residential land on the ground floor, there are more significant restrictions on construction, and there needs to be more space for public facilities to be set up, resulting in insufficient per capita enjoyment and low entropy of the district. At the same time, Yan’erwu is a sub-district of natural scenic beauty situated within a large zoning district, with a relatively concentrated population and a relatively limited number of private establishments in the immediate area. They calculate results based on the sub-district as a unit, which results in a low outcome.

The second factor is the significantly low value seen in the distant suburbs of the city, which are far removed from the urban center and have sparse populations. These areas often need more PSFs, decreasing the district’s entropy score. For instance, Ulaipo Street in Tianshan District, Toli Township in Urumqi County, Xigou Township, and Aivir sub-district in Dabancheng District are good examples.

After analyzing and summarizing the evaluation results, it is evident that there are two primary categories of equity performance issues in the spatial arrangement of PSFs. The first category pertains to inequity resulting from insufficient PSFs. These findings are better supported by the relevant studies by Yuan M. et al. [60,61]. There needs to be more PSFs in the sub-district, particularly in remote suburban areas that blend urban and rural features, as well as in industrial zones in cities. These areas often end up being overlooked when distributing public resources, becoming “dead zones.” The construction and development degree of the city’s remote suburbs are at a low level; if the urban development strategy and direction do not involve the area, they will make it marginalized, leading to the basic PSF demand not being met and the development of urban industrial warehouses due to the nature of the unique nature of the land. The lack of space for the configuration of service facilities leads them to passively choose to “move outwards.”

The second category is due to the high degree of population distribution. The second category is characterized by the mismatch between facilities and the population due to the population’s highly concentrated and dispersed distribution. Our findings echo those of Chen Y. et al. [25], who, by measuring the spatial equity in the layout of urban public sports facilities, found that the mismatch between facilities and the population is closely related to the concentration of facilities and population. There are fewer PSFs in sub-districts with more concentrated populations and more PSFs in sub-districts with smaller populations. This kind of scenario is increasingly common during rapid urbanization. As urbanization accelerates, a significant influx of people migrate to the city, resulting in a shift in the spatial structure of social classes. Traditional urban areas often attract low-income residents, leading to higher population density. However, this can result in the deterioration of the original urban environment and a reduction in the energy efficiency of service facilities, resulting in a shortage of public services in these sub-districts. As a result, some high-income individuals choose to leave these areas and settle in suburban areas, leading to gentrification. On the other hand, some high-income people leave the old
city and choose to live in the suburbs. The settlement of high-income people promotes the development of the “gentrification” of the environment, and the number of facilities and the energy efficiency of services are relatively high. As a result, there is an imbalance of “high population, low facilities, low population, high allocation”.

Based on the findings, the following recommendations are proposed. (1) Emphasis should be placed on improving the allocation of facilities in areas with gaps and raising the overall standard. With the guarantee that every person has access to adequate PSFs, it is crucial to measure the population coverage of these facilities while achieving complete spatial coverage. In addition, the urban planning and management process should pay special attention to marginalized and underdeveloped areas, increasing the number of facilities in proportion to the population. (2) It is crucial to prioritize the flexible and lightweight installation of service facilities. If there are insufficient facilities due to limited land space or challenges in sub-district redevelopment and construction, steps should be taken to introduce lightweight PSFs. By strategically implementing mixed-use land and installing community-level service facilities, the strain on existing facilities in densely populated areas can be alleviated, ultimately enhancing the city’s grid-based management. (3) Finally, by developing public transportation, we can improve fairness in the distribution of existing facilities. When there is an imbalance in the allocation of PSFs, we can achieve balance by adding to the deficient areas while guiding population mobility. Restricted by the mode of commuting and the cost of commuting time, part of the population chooses to concentrate in the city’s central area. Therefore, the development of public transportation can effectively guide the outflow of people from high-density areas and increase the opportunities for people to flow to low-density areas with better environments and abundant facilities, thus balancing the “excess” resources of PSFs in certain areas.

5. Conclusions

Accurately identifying an optimal distribution of public service resources is a crucial preliminary step in optimizing resource allocation, improving utilization efficiency, and achieving sustainable urban development. In recent years, the spatial equity of PSFs has been of great concern [62]. However, there are only a small number of publications in the literature on the fairness of the layout of PSFs. This article provides a combination of spatial and non-spatial perspectives from a human point of view complementary to current mainstream land-based analysis methods. The equity of PSFs was measured using a combination of Gini coefficients and locational entropy at the aggregate level and spatial unit metrics, respectively. This study concludes that the layout of PSFs in Urumqi needs to be fairer. At the same time, it summarizes three types of typical sub-districts in the spatial unit that affect fairness. Then, it puts forward suggestions to improve the situation by compensating for missing facilities, setting up small PSFs, and diverting and digesting excess facilities. Compared with other related studies, this study has certain advantages in selecting research perspectives. Most relevant studies on equity in PSFs have been conducted from a place-based perspective [37,38,63], neglecting the importance of facility use. This study attempts to objectively reflect people’s needs and demand points from their perspective using the Gini coefficient method, the location entropy method, and facility POI data. In addition, some studies have used population fishing net data as the base data to judge the point of demand in the study of equity in the layout of PSFs. This study uses more accurate sub-district level census data as a basis, reflecting a more precise scale of demand. When examining the equity of PSFs, most studies assess equity at the level of specific urban areas, individual streets, or individual facilities [64,65], and the findings are somewhat one-sided. This study uses a broader range of urban administrative areas as the study area and, at the same time, uses the three types of PSFs that are most closely related to the daily activities of the residents as the study object for fairness evaluation, which improves the one-sidedness of the related studies to a certain extent.

The PSF fairness evaluation method can be used in the social equity performance evaluation system of public facilities, which not only provides methodological support
for accurately measuring the supply-demand relationship between urban public facility resources and population but also provides a reference for the specific application of social equity theory in spatial research to strengthen urban planning and management from the perspective of social equity, which is an important ingredient of sustainable development.

The assessment of equity performance in this paper could be improved in several ways. The focus of this paper is to develop and refine an equitable performance evaluation methodology for private institutions from a “people-based” perspective. However, the evaluation system still needs to consider relevant evaluation indicators, such as private institutions’ service capacity, which limits the results. Therefore, in future research based on establishing a more comprehensive equity assessment system, adopting more accurate and diversified real-time data to support equity assessment research to achieve the accuracy of equity identification and the relevance of optimization strategies is essential.

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