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Review

Approaching Sustainable Bike-Sharing Development: A Systematic Review of the Influence of Built Environment Features on Bike-Sharing Ridership

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Abstract: Bike-sharing is known as a sustainable form of transportation. This travel mode is able to tackle the "last mile" transit issue and deliver financial, well-being, and low-carbon lifestyle advantages to users. To date, many studies have analysed the influence of various factors, including built environments, on bike-sharing ridership. However, no study has exclusively synthesised these findings regarding the association between built-environment attributes and bike-sharing ridership. Thus, in this study, a systematic literature review was conducted on 39 eligible studies. These studies were assessed with respect to (1) bike-sharing usage, (2) studies' geographical distribution, (3) data collection and analysis method, and (4) built environment factor type. Most studies were carried out in the US and Chinese cities. Variables associated with diversity, density, and distance to public transport stations and public transport infrastructure were frequently employed by the studies reviewed. It was found that BS stations with an average capacity of 24.63 docks and street network systems with an average length of 12.57 km of cycling lanes had a significant impact on the bike-sharing ridership. The findings of these studies were combined, and a series of recommendations were proposed based on them for bike-sharing service providers and researchers in academia. The findings of this evaluation can help practitioners and scholars understand the important built environment elements that influence bike-sharing ridership. Knowledge in this field will enable bike-sharing service providers to direct their resources sufficiently to enhance the more essential aspects of bike-sharing users' satisfaction.

Keywords: bike-sharing ridership; station flow; docked bike sharing; dockless bike sharing; diversity; built environment attributes

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1. Introduction

The bike-sharing (BS) service is a sustainable [1] and fast-growing transport mode [2], which allows people to rent bicycles for typically short-distance trips or first- and last-mile connections [3]. Various advantages of BS, including cost-effectiveness [4], convenience [5], traffic and emission reduction capability [6], flexibility [4], and positive health outcomes [4], have been acknowledged in previous works. The BS systems have been advanced gradually. Various generations of the BS systems and their specifications are shown in Figure 1.

Nowadays, the BS services can be classified into two main classes: docked and dockless. The docked BS service refers to a BS service that has a series of stations for parking bicycles, while the dockless BS service does not, and the bikes can be parked anywhere.

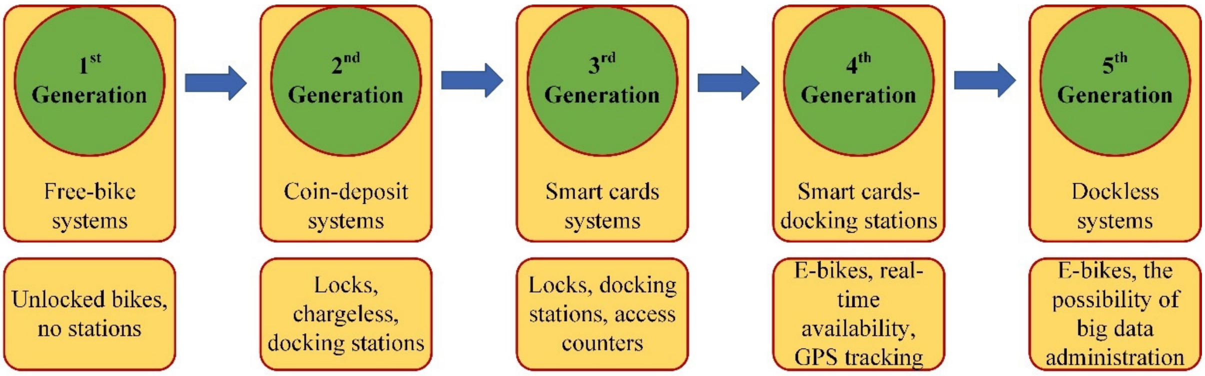

Figure 1. Different generations of BS systems and their specifications.

The effects of various factors on the BS ridership were assessed extensively. Some of these factors are sociodemographic [7], weather [8,9], temporal [7,10], and built environment [8,11]. While many studies have examined the effects of BE attributes on the BS systems, there is no review that has exclusively inspected these studies with regard to the BE characteristics.

The influence of the built environment (BE) on travel behaviour is one of the most studied topics in travel behaviour investigation. A simple search in the scientific databases shows that more than 350 studies have been conducted on this issue until the date of preparing this paper (August to October 2021). Thus far, several literature reviews have been conducted on this topic (e.g., [12–16]). In comparison with traditional travel modes, fewer literature reviews have been conducted on BS systems [5,17–23], possibly because of their recent wide application. These reviews did not evaluate the role of BE in BS ridership profoundly, and even some of them did not consider BE variables. Thus, this present study provides a deep and comprehensive study on the effects of BE variables on the BS ridership. Based on the outcomes of this study, some recommendations are offered for BS service providers and researchers in academia. The remainder of this paper is designed as follows. First, the method section provides useful information about the search approach, inclusion and exclusion criteria, assessment dimensions, and a summary of the characteristics of the selected publications. Second, the findings on the built environment and bike-sharing ridership are presented, and some discussions are provided on each. Third, some recommendations for both researchers in academia and bike-sharing service providers are provided. Finally, the paper is concluded with a summary of this paper.

2. Methods

Electronic databases were the fundamentals of the search strategy. These databases involved Google Scholar, Scopus, Web of Science, Transportation Research Board, and Medline (Figure 2). The search strings included “built environment” OR “physical environment” AND “bike-sharing” OR “cycling” OR “bike” OR “bicycle” AND “pattern” OR “adoption” OR “travel behaviour” OR “ridership” OR “usage” OR “use”. The initial inclusion rule of this inspection was the usage of built environment factors for examining BS travel behaviour. The exploration approach of this present review was wide; however, this study restricted the investigations to the English language only. Non-English papers could be translated into English, but there was concern that the translated papers might not convey their message, owing to translation problems. On the other hand, studies that lacked statistical properties were excluded. This was because the statistical approaches clearly show the relationships between independent variables and the dependent variable. Furthermore, these methods can show the magnitude of these relationships clearly. These all help this study better understand how the BE factors and BS ridership are linked. The conference proceedings, review papers, and reports were excluded from this analysis and only peer-reviews were included.

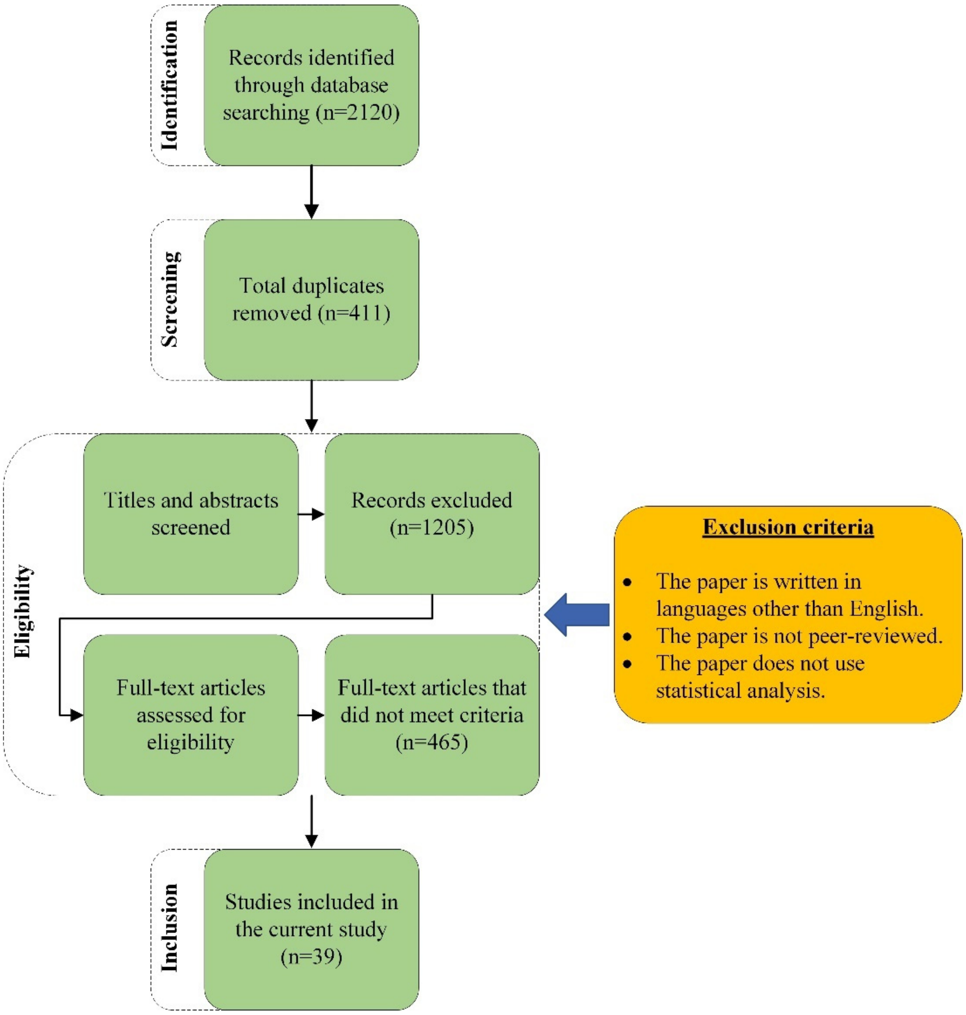

Figure 2. Flow diagram of literature exploration.

The ultimate collection of studies included 39 studies published between 2012 and 2021. A summary of these investigations is provided in Table 1. Many entries were omitted because of the duplications that arose while searching several databases. The abstract, title, and full text of the papers were looked at later to see if they met the inclusion criteria, which were the English language writing, the availability of statistical analysis in the paper, and the fact that they had been peer-reviewed. In addition, those papers that focused only on cycling and not bike-sharing were removed from the analysis. These studies were reviewed with respect to (1) bike-sharing usage, (2) geographical distribution, (3) data collection and analysis method, and (4) built environment factor type. It is critical to note that the purpose of this review was to determine how the built environment influences BS ridership.

Table 1. Summary of the studies reviewed.

Author	Country	Aim	Docked or Dockless?	Data Analysis Method
Bachand-Marleau, et al. [24]	Canada	To identify factors influencing BS usage frequency.	D	Binary Logistic Model
Rixey [25]	US	To examine the impacts on ridership levels of the demographic, BE, and BS network properties near BS stations in three operational systems.	D	MLR
Mateo-Babiano, et al. [26]	Canada	To investigate the impact of various factors on arrival and departure flows at the station level.	D	MLR
Tran, et al. [27]	France	To model BS demand at station level in the city of Lyon.	D	Robust Linear Regression
El-Assi, Salah Mahmoud and Nurul Habib [8]	Canada	To investigate the factors influencing Toronto's BS ridership.	D	Multivariable Regression Model
Liu, et al. [28]	US	To analyse influences of BS program on rail transportation ridership utilising Washington, D.C. data.	D	OLS
Bordagaray, et al. [29]	Spain	To examine the BS casuistry within a sharing system.	D	Binary Probit
Mateo-Babiano, Bean, Corcoran and Pojani [26]	Australia	To explore Brisbane's CityCycle system and study the role of environmental characteristics on usage.	D	Correlation and Regression
Noland, et al. [30]	US	To model trip generations for BS journeys, for weekday journeys, weekends, and by the user's character.	D	Bayesian Regression
Wang, et al. [31]	US	To determine correlates of BS activity.	D	Log-linear OLS, Negative Binomial Regression
Mattson and Godavarthy [32]	US	To study influences of weather, temporal, and spatial variables on BS employment.	D	One-Way Random Effects Model
Médard de Chardon, et al. [33]	US, UK, Luxembourg, Canada, Belgium, Austria	To determine the number of daily trips of case studies across the globe.	D	Robust Regression
Zhang, et al. [34]	China	To learn how BE factors influence the real use of BS.	D	Linear Regression
Zhao and Li [35]	China	To investigate the determinants of the BS-metro combination.	D	MLR
Ji, et al. [36]	China	To examine factors that affect BS-metro ridership from a spatial view.	D	Geographically Weighted Poisson Regression
Shen, et al. [37]	Singapore	To learn the usage of new DBS systems.	DL	Linear Regression or Spatial Autoregressive Model
Sun, et al. [38]	US	To learn determinants that promote or hinder BS trip generation and attraction at the station level.	D	Generalised Additive Mixed Model (GAMM)
Wang, et al. [39]	US	To determine how the accessibility of other transport methods nearby BS stations affects the traffic flow thereat.	D	Multi-Regression Model
Alcorn and Jiao [40]	US	To investigate the impact of various BEs on BS usage in nascent dock-based schemes.	D	Stepwise Multiple Variable Regression
Duran-Rodas, et al. [41]	Germany	To associate arrivals and departures of station-based BS systems with BE determinants.	D	Stepwise OLS, Generalised Linear Models (GLM) with A Lasso Selection Technique, and Gradient Boosting Machine (GBM)
Mooney, et al. [42]	US	To examine the equality of spatial access in a novel DBS system.	DL	Descriptive Analysis, Two-Tailed Wilcoxon Rank-Sum Tests
Nickkar, Banerjee, Chavis, Bhuyan and Barnes [10]	US	To investigate the temporal and spatial models of BS usage.	DL	ANOVA Tests, MNL
Bieliński, et al. [43]	Poland	To classify determinants that relate to BSS performance.	DL	OLS
Ni and Chen [44]	China	To investigate the impacts of the BE on transfer modes for metros: DBS and Taxis.	DL	Moran's I Test, Spatial Lag Model (SLM),

Table 1. *Cont.*

Author	Country	Aim	Docked or Dockless?	Data Analysis Method
Böcker and Anderson [45]	Norway	To explain the social and spatial inclusiveness of BS.	D	SEM
Böcker, Anderson, Uteng and Throndsen [7]	Norway	To evaluate the potential usage of BS for accessing, egressing, and interchanging between PT stops.	D	Negative Binomial Regression, MLR
Guo and He [46]	China	To analyse the impact of the BE on the integrated use of DBS and the metro.	DL	Negative Binomial Regression
Ma, et al. [47]	China	To assess travel models of two BS systems.	D and DL	OLS, GWR, Geographically and Temporally Weighted Regression
Mehadil Orvin and Rahman Fatmi [48]	Canada	To examine trip-level destination selection behaviour of users of the DBS.	DL	Random Parameter Latent Segmentation-Based Logit (RPLSL), Multinomial Logit (MNL)
Wu, et al. [49]	China	To examine how BE determinants influence the topological characteristics of BS networks.	DL	Moran's I, Spatial Regression Model (SLM);
Chen and Ye [11]	China	To recognise the nonlinear association between DBS usage and the BE.	DL	Gradient Boosted Regression Trees (GBRT), Partial Dependence (PD)
Gao, et al. [50]	China	To learn the modifiable areal unit issue in DBS use and investigate the interactive impacts of BE determinants.	DL	Shannon Entropy Index
Gao, et al. [51]	China	To investigate urban greenness spatially correlated with DBS usage on weekdays, weekends, and holidays.	DL	GWR
Guo and He [52]	China	To focus on the impacts of objective and perceived measures of the BE on DBS–metro combined usage for commuting journeys.	DL	Kappa Statistic, Path Analysis
Guo, et al. [53]	China	To introduce a people-metro-bike-route- urban space frame to explain the feeder-related BE from the view of the feeder process.	DL	Multilevel Negative Binomial Regression
Hu, et al. [54]	US	To investigate the spatiotemporal development of BS usage over the pandemic and compare it with other forms of transportation.	D	Generalised Additive Model (GAM), Longitudinal Analysis Using the Generalised Additive Mixed Model (GAMM)
Lee, et al. [55]	US	To determine whether immigrants in the U.S. are more inclined to depend on the three recently developing transport methods than US-born persons.	D	ZINB
Radzimski and Dzięcielski [56]	Poland	To examine the association between BS and PT in Poznan, Poland.	D and DL	Spatial Autoregressive Model, OLS
Wu, et al. [57]	China	To explore the global and local impacts of the BE on bike use, which describes the average bike trips on workdays and non-workdays.	D	GWR, Global Regression

Docked = D; Dockless = DL; Ordinary Least Squares = OLS; Structural Equation Modelling = SEM; Multinomial Logistic Model = MNL; Geographically Weighted Regression = GWR; Multivariate Linear Regression = MLR; Zero-Inflated Negative Binomial Regression = ZINB.

3. A Summary of Investigations on the BE and BS Ridership

3.1. Geographic Distribution of Studies

A total of (n = 13, 29.5%) of the studies were conducted in US cities. Similarly, (n = 13, 29.5%) of studies were carried out in Chinese cities. Canadian works accounted for 11.4% of all studies. A total of (n = 4, 10.2%) of the studies were conducted in Norway and Poland (two investigations in each country). A total of (n = 1, 2.5%) of investigations were carried out in each of the following countries: Australia, Austria, Belgium, France, Germany, Luxembourg, Singapore, Spain, and the UK. While most studies (n = 38, 97.4%) focused only on one case study, only one (n = 1, 2.5%) study had multiple case studies. Figure 3 shows the geographic dispersion of investigations evaluated. The geographic distribution of case studies can influence the outcomes of the studies. Hence, the analysis results across the world may not be analogous. This issue is principally attributable to the different urban structures and biking cultures that each country or even city has. It is worth mentioning that (n = 15, 36.6%) of studies were conducted on the dockless BS service, and (n = 25, 63.4%) were related to the docked BS service.

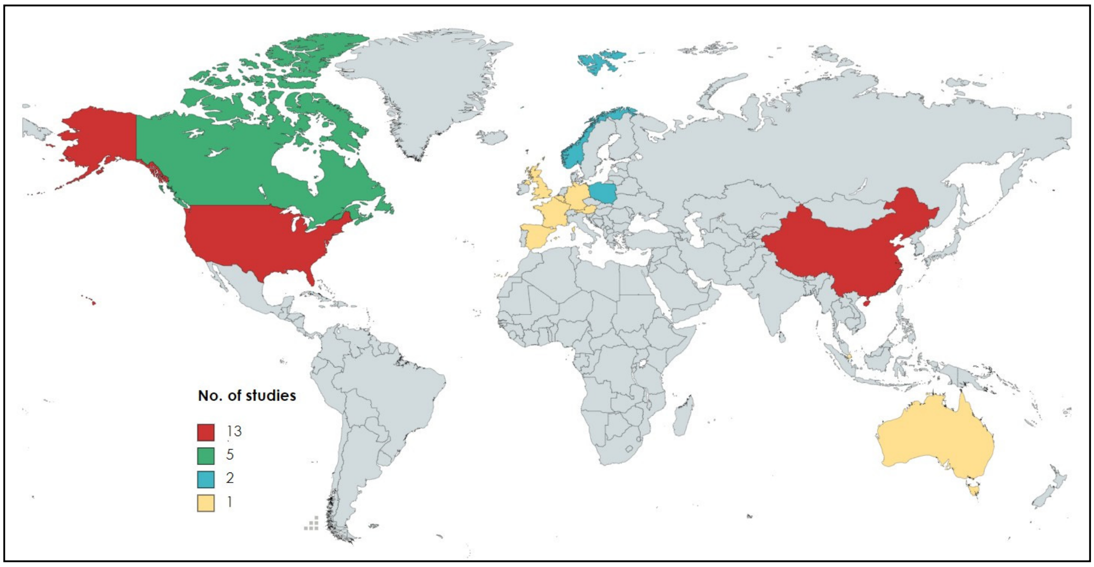

Figure 3. Geographic dispersion of investigations evaluated.

A journal co-citation network analysis was also conducted on the studies selected. The outcomes of this analysis are shown in Figure 4. This analysis helps distinguish the most prominently referred journals that may play vital roles in the domain's advancement. The capacity of the nodes shows the frequency, providing the number of cited references, which are published in similar journals. Evidently, the three most-cited journals in the domain of bike sharing ridership and its influential factors are the Journal of Transport Geography, Transportation Research Part A, and Transportation Research Record. These are transportation or infrastructure-focused discipline journals; hence, they are neither inter-disciplinary nor multi-disciplinary. These journals serve as the main rational turning points and connect other journals at different points, which shows how important they are to the field of BS.

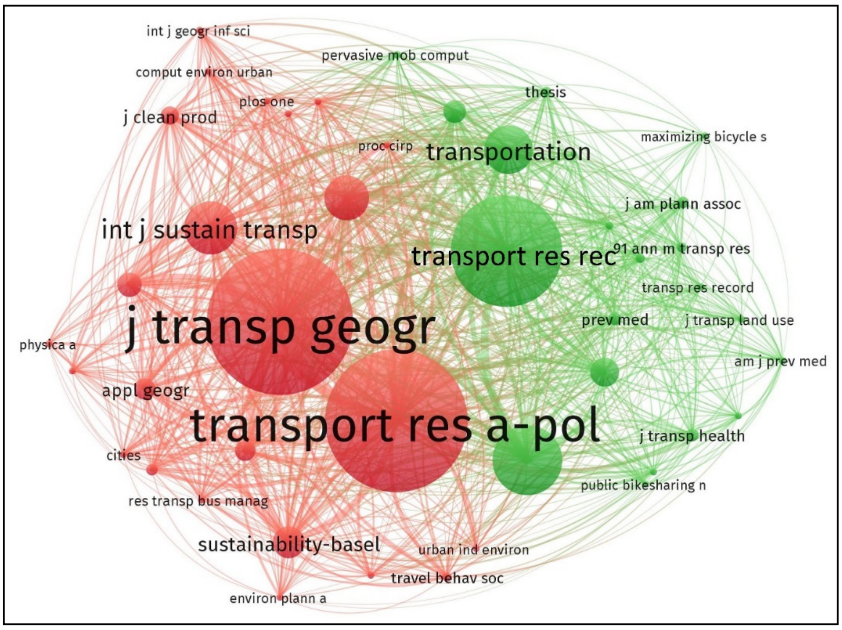

Figure 4. The visualisation of the journal co-citation network in Vosviewer.

3.2. Principal Research Topics and Aspects of the BE

The studies reviewed examined several issues of BS travel behaviour and incorporated several aspects of BE. The most investigated issues of BS travel behaviour were BS usage frequency, integrated usage of BS with public transport (PT), and BS flows. Thus, these issues were focused on by this present study. A list of principal aspects of BS travel behaviour that were studied using the BE variables is provided in Table 2. Travel is chiefly motivated by activities, but merely a few works regarding activity behaviour are available, probably because of a dearth of data as most studies collected data on BS travel behaviour, and activity behaviour is neglected. Most studies employed GPS data as well as data provided by the BS service providers. Utilising such a source of data may restrict researchers to examine the activity behaviours. The characteristics of activity behaviour can be included but not limited to the time spent for study, maintenance, work, and recreation activities.

Table 2. Principal BS issues covered by the studies reviewed.

BS Aspect	Number of Studies	%
BS usage frequency	14	35.9
BS integration with other travel modes	9	23.1
BS flows	5	12.8
Access to dockless BS	1	2.6
BS demand	1	2.6
BS interest	1	2.6
BS membership	1	2.6
BS station activity	1	2.6
BS travel behaviour	1	2.6
BS usage likelihood	1	2.6
BS users' profile	1	2.6
Destination choice behaviour of dockless BS	1	2.6
Topological properties of the BS network	1	2.6
Trip generation	1	2.6

The main aspects of BE analysed in the literature are presented in Table 3. The BE factors used by various studies can be classified as shown in Figure 5. Diversity seems to be the most examined BE aspect, followed by density. More than 70% of the evaluated studies adopted diversity and density as the dominant research theme. One probable reason for this is that mixed land use and activity concentration have typically been regarded as important predictors of travel behaviour. Thus, it makes sense that studies employ these two types of factors more frequently than others. Additional favoured aspects for research included distance to PT stations and PT infrastructure, cycling network, and BS station attributes. More than 40% of the investigations examine one of these three aspects. Alternatively, factors including walking infrastructure and urban greenness have gained comparatively little consideration.

Table 3. Major BE aspects covered by the studies reviewed.

BE Aspect	Number of Studies	%
Diversity	29	76.3
Density	28	73.7
Distance to PT stations and PT infrastructure	25	65.8
Cycling network	21	55.2
BS station attributes	17	44.7
Design	10	26.3
Destination accessibility	8	21.0
Geographic factors	2	5.2
Walking infrastructure	1	2.6
Urban greenness	1	2.6

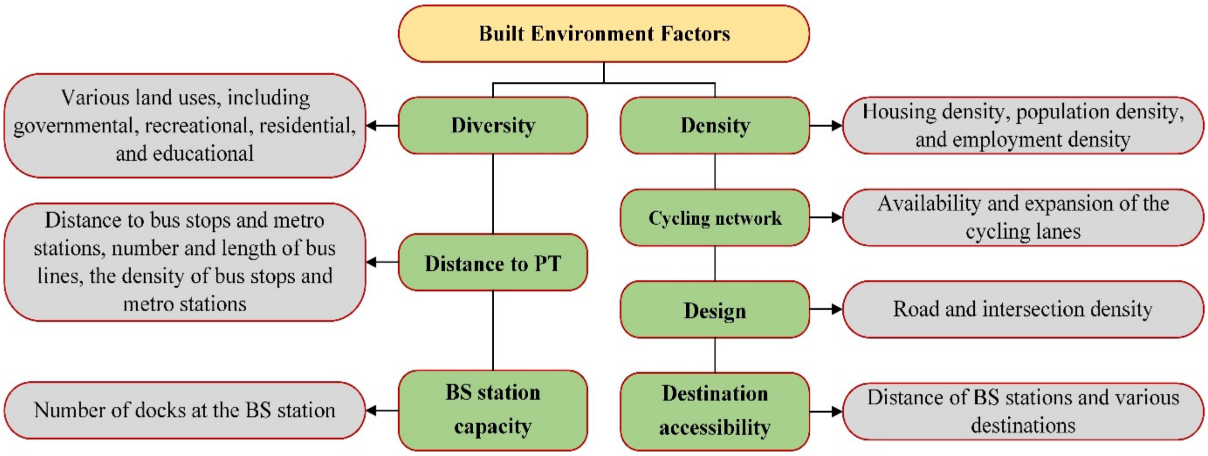

Figure 5. The classification of built environment factors identified by this study.

3.3. Major Employed Data Collection and Analysis Techniques

The studies reviewed mainly used two sources of data: primary data gathered through field investigations and secondary data gathered through several available datasets prepared by the BS service providers, transport sectors of public organisations, and so on. Only three studies (7.9%) employed online or face-to-face surveys [24,45,52]. These studies used this first-hand evidence to identify factors influencing the BS system's usage frequency, interest and membership, and BS integration with the metro. However, for the combined use of BS and metro services, the primary data were also combined with the secondary source of data [52]. The rest of the studies utilised secondary data (92.1%). These studies can be classified into two main groups: (1) BS station-based analysis and (2) trip-based analysis. The former aims to investigate the usage pattern of BS stations. The latter provides a deeper understanding of the aspects of single trips, including the pace and duration of travel and the trip-based journey. This information provides a better opportunity to examine the travel behaviour of BS users. The secondary sources of data were smart cards, GPS, weather monitoring records, and so on. The studies obtained the BE data from several sources, including different maps, metropolitan planning organisations, and public organisations (e.g., municipalities).

Traditional statistical techniques, including multivariate analysis and descriptive statistics, were frequently employed in data analysis. Regression models were among the most frequently used to analyse the BS problems. These regression models include multivariate linear regression (e.g., [25]), ordinary least squares regression (e.g., [56]), Bayesian regression (e.g., [30]), zero-Inflated Negative (e.g., [58]), and binomial regression negative (e.g., [7]). A limited number of studies adopted advanced statistical techniques, including structural equation modelling (e.g., [45]). Geographical Information Systems (GIS) instruments were also employed to analyse spatial and geographic data (e.g., [36,51,57,59]). Machine learning techniques were also rarely employed. For example, only Chen and Ye [11] used one of these techniques, namely Gradient Boosted Regression Trees (GBRT), to identify the nonlinear association between free-floating BS use and the BE. The researchers widely employed quantitative techniques, although the integration of qualitative methods into quantitative can be helpful because they can obtain the potential characteristics of the BE that are not effectively quantifiable.

4. Built Environment and Bike-Sharing Ridership

4.1. Associations between Diversity and Bike-Sharing Ridership

Each variable of variety has a unique effect on the use of BS, integration with other transport modes, and BS flow. Various factors, including government land usage, recreational land use, residential land use, and educational land use, were evaluated in the examined research.

Based on the findings of Chen and Ye [11], in China, governmental land uses affect BS usage minimally. The main reason for this could be that the management of these buildings does not provide any bicycle parking inside the buildings or allow bicycles to enter. Thus, people choose to use other commute modes to reach these types of destinations.

Recreational land uses include restaurants, shopping malls, parks, cinemas, and bodies of water. The availability of restaurants and shopping malls significantly increases the usage of BS, especially in the afternoons and evenings. In fact, the arrival rate of the BS stations increases if shopping malls and restaurants are available near them. A possible reason for this is that people may prefer to chill out after a hectic working day and spend time in restaurants or shopping malls [49]. Typically, areas that encompass many restaurants, shopping malls, and retail are congested, especially in the evenings. Thus, it makes sense that people use the BS service to reach these destinations to avoid traffic jams. While the availability of shopping malls was found to have a positive association with the general BS usage [34,49,56,57], a negative impact on the usage of BS at metro stations was found by Zhao and Li [35]. In other words, people preferred to adopt different travel modes, such as private cars. For shopping malls located in the suburbs, typically a lot of parking lots are provided for cars and motorcycles, which encourages people to use their vehicles rather than use the BS services.

Parks are another influential land-use factor on BS ridership. The findings from the studies reviewed in Germany [41], Australia [26], and China [34] suggested that the availability of parks near the BS station probably increases the usage of BS systems, especially at the weekends. As the trips from/to parks are often assumed recreational, their duration is longer and slower than trips to/from other land uses. For dockless BS systems, different outcomes were found. In Canada, Orvin and Fatmi [48] observed that parks were not attractive destinations to dockless BS users. One possible explanation for this can be that the route to the parks lacked bicycle-friendly infrastructures. In terms of BS integration with metro stations, it was found that the availability of parks was positively associated with the docked and undocked BS usage to metro stations, especially during the morning and evening peaks. It can be supported by this fact that the commuters may use the parks as a shortcut to reach their desired station and avoid traffic congestion. In addition, parks may provide a safer and more convenient space for BS users. In Germany [41] and Poland [56], positive associations with the BS usage were observed for both cinemas and bodies of water. These land uses are regarded as a place for entertainment wherein people spend their free time, particularly at the weekends. Thus, it makes sense that the proximity of these places to the BS stations increases the BS ridership.

Some studies have shown that BS stations near residential areas have a higher turnover in the mornings and weekdays than in the evenings and weekends (e.g., [26]). This higher turnover occurs because many people start their trip by BS in the mornings to reach their workplace in a commercial area. These trips can be called work commutes. However, the return trips (commercial to residential) in the evenings may not follow the usage pattern in the morning. Some people may prefer to not return home directly from their workplaces. Some others may choose other travel modes that require less physical effort. In addition, it was observed that many people employ the BS service for the first part of their trips to reach PT (e.g., metro) [46]. However, this observation may be more valid for those residential areas provided with dockless or docked BS by the operators.

Educational land uses include schools and universities. For schools, studies in China [46] and Poland [56] could not identify an association between the availability of this place and BS turnover. However, a study in the US identified a negative relationship between the number of schools in the area under study and pickups [38]. One possible reason could be that school students typically have a high level of dependency on their parents. Parents may believe that the roads are unsafe for their children, so they drive them to school. Concerning universities, different findings are reported in various parts of the world. In Canada, El-Assi, Mahmoud, and Habib [8] observed that the availability of universities around the BS stations increased the BS trip activities. Alternatively, Radzimski and Dzięcielski [56] did not find a significant relationship between the availability of universities and BS trip numbers in Poland. In addition, a study in China by Wu, Chung, Liu, and Kim [49] reported that universities' presence near BS stations had no significant effect on the importance of BS stations in the BS network. The location of university campuses may impact the importance of a BS station in the BS system. Some universities may be located a long distance from the city centres. Thus, students may prefer to spend their free time on campus, and it is sensible that they do not use the BS system frequently. Additionally, the BS system around these campuses is probably not connected properly with other BS stations across the urban areas. Thus, students may prefer to use other travel modes, such as PT or even personal vehicles, to reach their desired destinations in the inner parts of the city.

Some studies used the Shannon entropy index to assess land use homogeneity [60]. The Shannon Diversity Index varies between zero and one. The Zero value shows the minimum diversity; in other words, all buildings have the same function. Alternatively, the value of one indicates the maximum diversity of buildings. Studies in Singapore [37] and Norway [7,45] found that the Shannon index has a positive relationship with the usage of DBS and integrated usage of BS and PT. The average of these three Shannon index values was 0.60, which can be a reference for future studies.

4.2. Associations between Density and Bike-Sharing Travel Behaviour

The BS studies assessed housing density, employment density, and population density as core density variables. In terms of housing density, no impact of BS on Metrorail ridership was reported in a US study [28]; in addition, no significant association between population density and BS usage was found [40]. Instead, various studies in the US [32], Norway [7,45], Poland [56], and China [11,52,57] found that population density had a significant positive impact on BS usage. In a Polish study by Radzimski and Dzięcielski [56], it was reported that population density became significant simply for long trips, where its impact was negative, in the sense that less populated areas produced longer trips. Alternatively, a few studies in China [44,46] and the US [58] found no significant association between population density and BS usage. The impact of population density on BS usage was inconsistent across the case studies. This discrepancy was probably due to the nonlinear influence of density on travel behaviour [61,62]. The population density may have an upper limit that deals with BS problems properly. This threshold changes amongst various urban settings.

Concerning employment density, several studies in Canada [48], China [11,55], Norway [7], and the US showed that this variable had a positive association with the destination choice behaviour of the dockless BS users, BS demand, BS integration with PT, and BS usage among immigrants, respectively. In China, Guo and He [52] reported a negative association between employment density and BS integration with the metro during the morning peak. The zones with high employment density may accommodate a few houses; thus, they may produce fewer demands for access-integrated uses (the majority of previously mentioned uses occurring from a house to a metro station) in the morning peaks. Instead, Alcorn and Jiao [40] in the US reported no significant relationship between employment density and BS usage and BS integration with metro. This variation can be supported by the fact that the population density differs among urban settings in the US and China. In addition, there are differences in cycling habits between these countries.

4.3. Associations between Distance to PT Stations and PT Infrastructure and Bike-Sharing Travel Behaviour

This variable refers to the availability and distance between the BS stations and PT stations. In the US and China, Liu, Erdoğan, and Ma [28] and Ni and Chen [44] showed that the number of bus stops within a 400 and 500 m distance of metro stations influences integrated usage of BS and metro. The same results were achieved by Guo and He [46] in China. However, these findings contradicted those of Fishman et al. [63] and Martin and Shaheen [64] in the US, UK, and Australia that found that the abundance of bus stops in proximity to metro stations caused bike-metro trips to be substituted with bus-metro trips. It is necessary to consider two vital issues regarding the bus services to interpret this contradiction: (1) the waiting and travel time of buses and (2) their crowdedness. These two factors may be different by district, city, or country. If bus services have great waiting and travel times and buses are remarkably crowded, commuters may prefer to choose cycling to metro stations to avoid them.

A couple of studies in China showed that the number of metro stations in a metro catchment area [44,46] and the distance from home/workplace to the nearest metro station [53] negatively impacted the integrated usage of dockless BS and metro. This negative association can be explained by the fact that a high concentration of metro stations in a specific area can decrease the travel distance to a station from home or workplace. Thus, commuters may walk to reach the metro station. Pan et al. [65] and Zhao and Li [35] reported that the biking distance in Shanghai and Beijing varied between 0.8 km and 1.5 km and between 1 km and 3 km, respectively. Therefore, travel distances lower or higher than these ranges may encourage people to use walking or private vehicles, respectively.

In China, most studies showed that the other factors of PT, including the number of bus lines, length of bus lines, the density of bus stations, and density of metro stations, negatively correlated with the integrated usage of BS and metro [35,36,44]. The findings of these studies suggest that there is an obvious substitution impact between buses and cycling.

In terms of BS usage rate, various factors, including the number of bus and metro stations, distance to nearest bus and metro stations, the density of bus and metro stations, and the number of bus routes in the catchment area, were assessed. In Singapore and China, Shen, Zhang, and Zhao [37] and Chen and Ye [11] found a positive relationship between density and the number of bus stops and BS ridership, while Ma, Ji, Yuan, Van Oort, Jin, and Hoogendoorn [59] in China reported a negative relationship. Chen and Ye [11] showed that the effects of bus station density on the free-floating BS system are nonlinear, so that when the number of bus stops was more than seven per square kilometre, the cycling trips rose rapidly. However, this trend was saturated at 11 stops per square kilometre.

4.4. Associations between Cycling Network and Major Bike-Sharing Themes

The cycling network refers to the availability and expansion of the cycling lanes. Expectedly, both docked and dockless BS ridership was linked to the number and length of cycling lanes [26,33,34,37,40,57]. These studies used various buffers of a bike station to test the association of length and density of cycling lanes with BS ridership (Table 4). For Chinese cities, the buffer was 1000 m, while for European and North American cities, this buffer ranged from 250 to 300 m.

Table 4. Distance from stations associated with the higher BS usage.

Study (Year)	Country	City	Buffer of BS Station (m)
Faghih-Imani, et al. [66]	Canada	Montreal	250
Mateo-Babiano, Bean, Corcoran, and Pojani [26]	Australia	Brisbane	250
Médard de Chardon, Caruso, and Thomas [33]	US, UK, Luxembourg, Canada, Belgium, Austria	Boston, Chicago, London, Luxembourg city, Vienna, Minneapolis, Montreal, Namur, New York City, San Francisco Washington	300
Wu, Kim, and Chung [57]	China	Suzhou	1000
Zhang, Thomas, Brussel, and van Maarseveen [34]	China	Zhongshan	1000

In China, Zhao and Li [35] noticed that the length of exclusive cycling lanes had no significant association with the integrated usage of BS and metro systems. Guo and He [46], in China, also reported the same finding for morning trips. However, this study found a significant impact of this factor on the unified usage of BS and metro systems in the evenings. The same insignificant impact was found in Poland [56]. Alternatively, the positive effect of bikeways' length on the integrated usage of BS and metro services was found in China [52,53]. This disagreement can be supported by the fact that these dedicated cycling lanes are occupied by cars and motorcycles in some areas. In addition, shared bicycles may be used in areas with insufficient cycling infrastructure. Thus, cyclists cannot rely on these lanes and assume they are an important element of cycling. Furthermore, the average length of bike lanes in the studies that found an insignificant effect of this factor on the integrated usage was 4.98 km, while the average for studies that found a significant impact was 12.57 km. This difference in average length shows that a higher bike lane length increases the likelihood of the BS and metro combination.

4.5. Associations between Capacity of BS Station and Bike-Sharing Ridership

BS usage studies in the US and China demonstrated a positive association between the number of docks in a station and BS usage [34,54,57]. Instead, a study by Wang, Sun, Zeng, and Wang [39] in China showed a negative association between the capacity of BS stations and BS ridership. Table 5 indicates the average number of docks of the BS stations in the studies mentioned above. The study that had the lowest capacity reported the negative impact of this factor on BS usage. It implies that the greater capacity of the BS station increases the chance of BS usage. In fact, selecting a station with a greater capacity can raise the likelihood of obtaining a parking spot or bike, especially at weekends, holidays, and during the morning-peak and evening-peak of weekdays. There are also three other studies, and the average capacity of them all is 24.63. This can be used as a guide for the development of future BS stations.

Table 5. Capacity of the BS stations and its effect of BS usage.

Study (Year)	Country	City	Effect	Docks in the BS Stations (Mean)
Hu, Xiong, Liu, and Zhang [54]	US	Chicago	+	18.857
Wang, Sun, Zeng, and Wang [39]	US	Seattle	−	17.751
Zhang, Thomas, Brussel, and van Maarseveen [34]	China	Zhongshan	+	26.59
Wu, Kim, and Chung [57]	China	Suzhou	+	28.459

4.6. Associations between Design and Bike-Sharing Ridership

Studies in the US [54] and China [11,50] showed that road and intersection density positively impacted the usage of BS. Areas with high road density have road systems that enable pedestrians to access many bikes quickly within a short walking range. In addition, cyclists can link to their destinations comfortably in various directions within a short biking range. Additionally, the presence of street lights along these roads has a positive influence on BS ridership [38].

Regarding the effects of design factors on the integrated usage of BS and PT systems, no study reported a significant association between the length of roads (main and branch) and BS-PT usage. However, a study conducted in China by Guo, Yang, Lu, and Zhao [53] discovered that main roads have a negative impact on joint usage during the evening peak. Additionally, the negative impact of the intersections' presence, especially along the main roads, was reported by Ni and Chen [44] and Guo and He [46] in China. The length of the road had no discernible effect on BS-PT usage. Various studies, however, have found that cyclists prefer to use branch roads with fewer intersections, particularly signalised intersections (e.g., [44,46,67]). It is obvious that cyclists assume that streets with little vehicular traffic are safer than those with high motor traffic flows. In addition, intersections along the main roads mean that cyclists should stop, which increases the travel time. In the branch streets, even with more crossings, it is easier for cyclists to pass the intersections (due to lighter traffic than main streets) without slowing down.

4.7. Associations between Destination Accessibility and Major Bike-Sharing Ridership

Unsurprisingly, studies found significant and negative associations between the distance of BS stations and various destinations, including rivers, CBDs, parks, campuses, bay lines, and BS ridership and station activities in China [39]. Furthermore, in the United States and Canada, Lee, Smart, and Golub [58] and Bachand-Marleau, Lee, and El-Geneidy [24] found that the distance between home and downtown/work had a negative effect on BS ridership and station activities. The leisure destinations increase the need for weekend trips, while the working ones raise the demand for weekday trips. Thus, different bicycle supply approaches should be employed to deal with these issues. To mitigate the deterrent effect of distance on BS ridership, it is crucial to place BS stations near leisure and work-related locations.

5. Recommendations with Respect to the BE Factors

Based on the findings synthesised above, some suggestions are made for both BS service providers and academic research in the future. These suggestions are meant to improve the overall efficiency of BS systems.

5.1. Recommendations for Bike-Sharing Service Providers

- BS service providers need to determine popular destinations, including workplaces, recreational, governmental, and educational, and locate enough bike racks in these locations. This can be achieved through close collaboration with the management of these places and encouraging them to allow cyclists to park their bicycles inside the premises.
- In suburbs and low-density areas, the availability of many car parks in shopping malls and other recreational places encourages people to drive their own cars. The BS service providers can encourage the management of these buildings to reduce the number of car parks and use these spaces for bike parking instead.
- For destinations in the suburbs, the BS service providers should ensure that the cycling network properly connects these places with the inner parts of cities. There should also be enough bikes at the metro stations or near the bus stops on the way to the suburbs.
- Regarding the cycling infrastructure in the central parts of cities and densely populated areas, the BS service providers should have close collaboration with municipalities regarding constructing the bike lanes and ensure that these lanes cannot be occupied by cars and motorcycles. The BS service providers should also ensure any misuse of these lanes is subject to appropriate consequences and penalties.
- It has been proven that in China, population density has a nonlinear effect on BS ridership and the integrated usage of this mode and metro service. Thus, the BS service providers in China need to identify these thresholds and select their supply balancing strategy based on them.
- Many urban areas, especially low-density areas, lack proper public bus services that are often crowded and have long wait and travel times. The BS service providers can find these areas and provide docked or dockless services in these areas.
- Cyclists prefer to ride on the branch streets due to their lower vehicular traffic and number of intersections. Thus, the BS service providers can offer more docked and dockless services along these routes and provide a network between these types of streets across an urban area.
- In urban areas where the distance between BS stations and destinations is long, BS service providers can offer users e-bikes that require less physical effort. It should also be made sure that the PT system and the cycling network work well together, so people can use the BS service as part of their trips.
- Based on the synthesised findings, in China and in the US, if the average capacity of BS stations is about 24.63 across a city, the probability of BS usage and integrated usage of BS-PT can be increased. However, the urban structure, cycling network connectivity, and other factors should be considered, along with the capacity of BS stations.

5.2. Recommendations for Academic Research on Bike-Sharing Travel Behaviours

- Most studies reviewed employed traditional statistical methods to analyse data. Future studies could use more advanced machine learning techniques, such as Bayesian networks and artificial neural networks, to achieve more accurate results in the future.
- Most studies on the BS were conducted in the US, China, and Canada. Research on BS ridership in other parts of the world, such as countries in South America and Southeast Asia, can help obtain a deeper understanding of the influential factors of BE.
- While most studies have focused principally on BS travel behaviour, activity behaviour regarding the involvement and time allocated for everyday activities has been overlooked. As a result, future studies will be able to obtain a complete picture of travel behaviour by looking at the choices people make every day.
- Most studies neglected the Shannon index to measure land diversity, which is a reliable index. This index can be used in the future, especially in Europe, North America, and China, to measure the diversity of the land in a systematic way.
- The existing studies tested the relationship between the length and density of the cycling network within various distances from the BS stations. In China, this assessment was based on only a 1000 m buffer of the BS station. In European and North American cities, this buffer is 250 or 300 m. However, future studies in these areas can run these tests with different buffers of BS to simulate different BEs that are relevant to BS use.
- Some factors, including walking infrastructure and urban greenness in China and North America, have gained comparatively little consideration. Thus, studies can likely focus on these factors.
- The combination of qualitative and quantitative methodologies might be advantageous as it enables the identification of potentially nonquantifiable properties of the BE.

6. Conclusions

This systematic literature review inspected 39 journal articles to identify the role of BE factors in BS ridership and the integrated usage of bike-sharing with PT services, especially the metro. These studies were assessed with respect to (1) bike-sharing usage, (2) geographical distribution, (3) data collection and analysis method, and (4) built environment factor type. Most studies were conducted in Chinese and US cities. Diversity, density, and distance to PT stations and PT infrastructure were the most frequently used BE factors in the studies reviewed. Bike-sharing ridership was shown to be influenced by BS stations with an average capacity of 24.63 docks and street network systems with an average length of 12.57 km of cycling lanes. A percentage of 36.6% of studies were conducted on the dockless BS service, and 63.4% were related to the docked BS service. Most studies used traditional statistical methods such as regression models. Based on the findings synthesised from various studies, the present review provides both bike-sharing service providers and researchers with some recommendations. The outcomes of this review can provide practitioners and researchers with sound information on the key BE factors contributing to BS ridership. This review can be used as a guideline for determining new strategies to enhance the performance of BS services around the world. The Shannon index is a capable measure of land use diversity and can help researchers assess land diversity systematically. However, a very limited number of studies employ this method. Thus, it would be helpful if this index were employed for future studies.

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References

1. Ma, F.; Shi, W.; Yuen, K.F.; Sun, Q.; Guo, Y. Multi-stakeholders' assessment of bike sharing service quality based on DEMATEL–VIKOR method. *Int. J. Logist. Res. Appl.* **2019**, *22*, 449–472. [CrossRef]
2. Chen, Z.; Li, X. Unobserved heterogeneity in transportation equity analysis: Evidence from a bike-sharing system in southern Tampa. *J. Transp. Geogr.* **2021**, *91*, 102956. [CrossRef]
3. Xu, Y.; Chen, D.; Zhang, X.; Tu, W.; Chen, Y.; Shen, Y.; Ratti, C. Unravel the landscape and pulses of cycling activities from a dockless bike-sharing system. *Comput. Environ. Urban Syst.* **2019**, *75*, 184–203. [CrossRef]
4. Cheng, L.; Mi, Z.; Coffman, D.M.; Meng, J.; Liu, D.; Chang, D. The Role of Bike Sharing in Promoting Transport Resilience. *Netw. Spat. Econ.* **2021**. [CrossRef]
5. Fishman, E. Bikeshare: A Review of Recent Literature. *Transp. Rev.* **2015**, *36*, 92–113. [CrossRef]
6. Shaheen, S.A.; Guzman, S.; Zhang, H. Bikesharing in Europe, the Americas, and Asia. *Transp. Res. Rec. J. Transp. Res. Board* **2010**, *2143*, 159–167. [CrossRef]
7. Böcker, L.; Anderson, E.; Uteng, T.P.; Throndsen, T. Bike sharing use in conjunction to public transport: Exploring spatiotemporal, age and gender dimensions in Oslo, Norway. *Transp. Res. Part A Policy Pract.* **2020**, *138*, 389–401. [CrossRef]
8. El-Assi, W.; Salah Mahmoud, M.; Nurul Habib, K. Effects of built environment and weather on bike sharing demand: A station level analysis of commercial bike sharing in Toronto. *Transportation* **2017**, *44*, 589–613. [CrossRef]
9. Kim, K. Investigation on the effects of weather and calendar events on bike-sharing according to the trip patterns of bike rentals of stations. *J. Transp. Geogr.* **2018**, *66*, 309–320. [CrossRef]
10. Nickkar, A.; Banerjee, S.; Chavis, C.; Bhuyan, I.A.; Barnes, P. A spatial-temporal gender and land use analysis of bikeshare ridership: The case study of Baltimore City. *City Cult. Soc.* **2019**, *18*, 100291. [CrossRef]
11. Chen, E.; Ye, Z. Identifying the nonlinear relationship between free-floating bike sharing usage and built environment. *J. Clean. Prod.* **2021**, *280*, 124281. [CrossRef]
12. Arellana, J.; Saltarín, M.; Larrañaga, A.M.; Alvarez, V.; Henao, C.A. Urban walkability considering pedestrians' perceptions of the built environment: A 10-year review and a case study in a medium-sized city in Latin America. *Transp. Rev.* **2020**, *40*, 183–203. [CrossRef]
13. Yang, Y.; Wu, X.; Zhou, P.; Gou, Z.; Lu, Y. Towards a cycling-friendly city: An updated review of the associations between built environment and cycling behaviors (2007–2017). *J. Transp. Health* **2019**, *14*, 100613. [CrossRef]
14. Sharmin, S.; Kamruzzaman, M. Association between the built environment and children's independent mobility: A meta-analytic review. *J. Transp. Geogr.* **2017**, *61*, 104–117. [CrossRef]
15. Wang, D.; Zhou, M. The built environment and travel behavior in urban China: A literature review. *Transp. Res. Part D Transp. Environ.* **2017**, *52*, 574–585. [CrossRef]
16. van Wee, B.; Cao, J. Residential self-selection in the relationship between the built environment and travel behavior: A literature review and research agenda. *Adv. Transp. Policy Plan.* **2020**, *9*, 75–94.
17. Eren, E.; Uz, V.E. A review on bike-sharing: The factors affecting bike-sharing demand. *Sustain. Cities Soc.* **2020**, *54*, 101882. [CrossRef]
18. Ricci, M. Bike sharing: A review of evidence on impacts and processes of implementation and operation. *Res. Transp. Bus. Manag.* **2015**, *15*, 28–38. [CrossRef]
19. Si, H.; Shi, J.-g.; Wu, G.; Chen, J.; Zhao, X. Mapping the bike sharing research published from 2010 to 2018: A scientometric review. *J. Clean. Prod.* **2019**, *213*, 415–427. [CrossRef]
20. Galatoulas, N.-F.; Genikomsakis, K.N.; Ioakimidis, C.S. Spatio-temporal trends of e-bike sharing system deployment: A review in europe, north America and asia. *Sustainability* **2020**, *12*, 4611. [CrossRef]
21. Albuquerque, V.; Sales Dias, M.; Bacao, F. Machine learning approaches to bike-sharing systems: A systematic literature review. *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 62. [CrossRef]
22. Vallez, C.M.; Castro, M.; Contreras, D. Challenges and Opportunities in Dock-Based Bike-Sharing Rebalancing: A Systematic Review. *Sustainability* **2021**, *13*, 1829. [CrossRef]
23. Cao, J.; Prior, J.; Moutou, C. The governance of dockless bike-sharing schemes: A systemic review of peer-reviewed academic journal papers between 2016 and 2019. *Clean. Eng. Technol.* **2021**, *4*, 100140. [CrossRef]
24. Bachand-Marleau, J.; Lee, B.H.Y.; El-Geneidy, A.M. Better Understanding of Factors Influencing Likelihood of Using Shared Bicycle Systems and Frequency of Use. *Transp. Res. Rec. J. Transp. Res. Board* **2012**, *2314*, 66–71. [CrossRef]
25. Rixey, R.A. Station-Level Forecasting of Bikesharing Ridership. *Transp. Res. Rec. J. Transp. Res. Board* **2013**, *2387*, 46–55. [CrossRef]
26. Mateo-Babiano, I.; Bean, R.; Corcoran, J.; Pojani, D. How does our natural and built environment affect the use of bicycle sharing? *Transp. Res. Part A Policy Pract.* **2016**, *94*, 295–307. [CrossRef]
27. Tran, T.D.; Ovtracht, N.; d'Arcier, B.F. Modeling Bike Sharing System using Built Environment Factors. *Procedia CIRP* **2015**, *30*, 293–298. [CrossRef]

28. Liu, C.; Erdoğan, S.; Ma, T. Bicycle Sharing and Transit: 1 Does Capital Bikeshare Affect Metrorail Ridership in Washington, DC? In Proceedings of the Transportation Research Board 94th Annual Meeting, Washington, DC, USA, 11–15 January 2015; pp. 15–5660.
29. Bordagaray, M.; dell'Olio, L.; Fonzone, A.; Ibeas, Á. Capturing the conditions that introduce systematic variation in bike-sharing travel behavior using data mining techniques. *Transp. Res. Part C Emerg. Technol.* **2016**, *71*, 231–248. [CrossRef]
30. Noland, R.B.; Smart, M.J.; Guo, Z. Bikeshare trip generation in New York City. *Transp. Res. Part A Policy Pract.* **2016**, *94*, 164–181. [CrossRef]
31. Wang, X.; Lindsey, G.; Schoner, J.E.; Harrison, A. Modeling Bike Share Station Activity: Effects of Nearby Businesses and Jobs on Trips to and from Stations. *J. Urban Plan. Dev.* **2016**, *142*. [CrossRef]
32. Mattson, J.; Godavarthy, R. Bike share in Fargo, North Dakota: Keys to success and factors affecting ridership. *Sustain. Cities Soc.* **2017**, *34*, 174–182. [CrossRef]
33. Médard de Chardon, C.; Caruso, G.; Thomas, I. Bicycle sharing system 'success' determinants. *Transp. Res. Part A Policy Pract.* **2017**, *100*, 202–214. [CrossRef]
34. Zhang, Y.; Thomas, T.; Brussel, M.; van Maarseveen, M. Exploring the impact of built environment factors on the use of public bikes at bike stations: Case study in Zhongshan, China. *J. Transp. Geogr.* **2017**, *58*, 59–70. [CrossRef]
35. Zhao, P.; Li, S. Bicycle-metro integration in a growing city: The determinants of cycling as a transfer mode in metro station areas in Beijing. *Transp. Res. Part A Policy Pract.* **2017**, *99*, 46–60. [CrossRef]
36. Ji, Y.; Ma, X.; Yang, M.; Jin, Y.; Gao, L. Exploring Spatially Varying Influences on Metro-Bikeshare Transfer: A Geographically Weighted Poisson Regression Approach. *Sustainability* **2018**, *10*, 1526. [CrossRef]
37. Shen, Y.; Zhang, X.; Zhao, J. Understanding the usage of dockless bike sharing in Singapore. *Int. J. Sustain. Transp.* **2018**, *12*, 686–700. [CrossRef]
38. Sun, F.; Chen, P.; Jiao, J. Promoting public bike-sharing: A lesson from the unsuccessful Pronto system. *Transp. Res. Part D Transp. Environ.* **2018**, *63*, 533–547. [CrossRef]
39. Wang, Z.; Sun, Y.; Zeng, Y.; Wang, B. Substitution effect or complementation effect for bicycle travel choice preference and other transportation availability: Evidence from US large-scale shared bicycle travel behaviour data. *J. Clean. Prod.* **2018**, *194*, 406–415. [CrossRef]
40. Alcorn, L.G.; Jiao, J. Bike-Sharing Station Usage and the Surrounding Built Environments in Major Texas Cities. *J. Plan. Educ. Res.* **2019**. [CrossRef]
41. Duran-Rodas, D.; Chaniotakis, E.; Antoniou, C. Built Environment Factors Affecting Bike Sharing Ridership: Data-Driven Approach for Multiple Cities. *Transp. Res. Rec. J. Transp. Res. Board* **2019**, *2673*, 55–68. [CrossRef]
42. Mooney, S.J.; Hosford, K.; Howe, B.; Yan, A.; Winters, M.; Bassok, A.; Hirsch, J.A. Freedom from the Station: Spatial Equity in Access to Dockless Bike Share. *J. Transp. Geogr.* **2019**, *74*, 91–96. [CrossRef] [PubMed]
43. Bieliński, T.; Kwapisz, A.; Ważna, A. Bike-Sharing Systems in Poland. *Sustainability* **2019**, *11*, 2458. [CrossRef]
44. Ni, Y.; Chen, J. Exploring the Effects of the Built Environment on Two Transfer Modes for Metros: Dockless Bike Sharing and Taxis. *Sustainability* **2020**, *12*, 2034. [CrossRef]
45. Böcker, L.; Anderson, E. Interest-adoption discrepancies, mechanisms of mediation and socio-spatial inclusiveness in bike-sharing: The case of nine urban regions in Norway. *Transp. Res. Part A Policy Pract.* **2020**, *140*, 266–277. [CrossRef]
46. Guo, Y.; He, S.Y. Built environment effects on the integration of dockless bike-sharing and the metro. *Transp. Res. Part D Transp. Environ.* **2020**, *83*, 102335. [CrossRef]
47. Ma, C.; Zhou, J.; Yang, D.; Fan, Y. Research on the relationship between the individual characteristics of electric bike riders and illegal speeding behavior: A questionnaire-based study. *Sustainability* **2020**, *12*, 799. [CrossRef]
48. Mehadil Orvin, M.; Rahman Fatmi, M. Modeling Destination Choice Behavior of the Dockless Bike Sharing Service Users. *Transp. Res. Rec. J. Transp. Res. Board* **2020**, *2674*, 875–887. [CrossRef]
49. Wu, C.; Chung, H.; Liu, Z.; Kim, I. Examining the effects of the built environment on topological properties of the bike-sharing network in Suzhou, China. *Int. J. Sustain. Transp.* **2020**, *15*, 338–350. [CrossRef]
50. Gao, F.; Li, S.; Tan, Z.; Wu, Z.; Zhang, X.; Huang, G.; Huang, Z. Understanding the modifiable areal unit problem in dockless bike sharing usage and exploring the interactive effects of built environment factors. *Int. J. Geogr. Inf. Sci.* **2021**, *35*, 1905–1925. [CrossRef]
51. Gao, F.; Li, S.; Tan, Z.; Zhang, X.; Lai, Z.; Tan, Z. How Is Urban Greenness Spatially Associated with Dockless Bike Sharing Usage on Weekdays, Weekends, and Holidays? *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 238. [CrossRef]
52. Guo, Y.; He, S.Y. The role of objective and perceived built environments in affecting dockless bike-sharing as a feeder mode choice of metro commuting. *Transp. Res. Part A Policy Pract.* **2021**, *149*, 377–396. [CrossRef]
53. Guo, Y.; Yang, L.; Lu, Y.; Zhao, R. Dockless bike-sharing as a feeder mode of metro commute? The role of the feeder-related built environment: Analytical framework and empirical evidence. *Sustain. Cities Soc.* **2020**, *65*, 102594. [CrossRef]
54. Hu, S.; Xiong, C.; Liu, Z.; Zhang, L. Examining spatiotemporal changing patterns of bike-sharing usage during COVID-19 pandemic. *J. Transp. Geogr.* **2021**, *91*, 102997. [CrossRef] [PubMed]
55. Lee, M.; Hwang, S.; Park, Y.; Choi, B. Factors affecting bike-sharing system demand by inferred trip purpose: Integration of clustering of travel patterns and geospatial data analysis. *Int. J. Sustain. Transp.* **2021**, 1–14. [CrossRef]

56. Radzimski, A.; Dzięcielski, M. Exploring the relationship between bike-sharing and public transport in Poznań, Poland. *Transp. Res. Part A Policy Pract.* **2021**, *145*, 189–202. [CrossRef]
57. Wu, C.; Kim, I.; Chung, H. The effects of built environment spatial variation on bike-sharing usage: A case study of Suzhou, China. *Cities* **2021**, *110*, 103063. [CrossRef]
58. Lee, S.; Smart, M.J.; Golub, A. Difference in travel behavior between immigrants in the U.S. and us born residents: The immigrant effect for car-sharing, ride-sharing, and bike-sharing services. *Transp. Res. Interdiscip. Perspect.* **2021**, *9*, 100296. [CrossRef]
59. Ma, X.; Ji, Y.; Yuan, Y.; Van Oort, N.; Jin, Y.; Hoogendoorn, S. A comparison in travel patterns and determinants of user demand between docked and dockless bike-sharing systems using multi-sourced data. *Transp. Res. Part A Policy Pract.* **2020**, *139*, 148–173. [CrossRef]
60. Shannon, C.E. A mathematical theory of communication. *Bell Syst. Tech. J.* **1948**, *27*, 379–423. [CrossRef]
61. Choi, K. The influence of the built environment on household vehicle travel by the urban typology in Calgary, Canada. *Cities* **2018**, *75*, 101–110. [CrossRef]
62. Tao, T.; Wang, J.; Cao, X. Exploring the non-linear associations between spatial attributes and walking distance to transit. *J. Transp. Geogr.* **2020**, *82*, 102560. [CrossRef]
63. Fishman, E.; Washington, S.; Haworth, N. Bikeshare's impact on active travel: Evidence from the United States, Great Britain, and Australia. *J. Transp. Health* **2015**, *2*, 135–142. [CrossRef]
64. Martin, E.W.; Shaheen, S.A. Evaluating public transit modal shift dynamics in response to bikesharing: A tale of two U.S. cities. *J. Transp. Geogr.* **2014**, *41*, 315–324. [CrossRef]
65. Pan, H.; Shen, Q.; Xue, S. Intermodal transfer between bicycles and rail transit in Shanghai, China. *Transp. Res. Rec.* **2010**, *2144*, 181–188. [CrossRef]
66. Faghih-Imani, A.; Eluru, N.; El-Geneidy, A.M.; Rabbat, M.; Haq, U. How land-use and urban form impact bicycle flows: Evidence from the bicycle-sharing system (BIXI) in Montreal. *J. Transp. Geogr.* **2014**, *41*, 306–314. [CrossRef]
67. Lin, J.-J.; Zhao, P.; Takada, K.; Li, S.; Yai, T.; Chen, C.-H. Built environment and public bike usage for metro access: A comparison of neighborhoods in Beijing, Taipei, and Tokyo. *Transp. Res. Part D Transp. Environ.* **2018**, *63*, 209–221. [CrossRef]