

WALKABILITY IN ASIAN CITIES: A SYSTEMATIC LITERATURE REVIEW OF HIGH-DENSITY URBAN ENVIRONMENTS

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ABSTRACT

Urban walkability is a critical dimension of sustainable urban development, particularly in rapidly urbanising Asian cities characterised by high-density and high-intensity built environments. However, existing research remains fragmented and largely descriptive, limiting its analytical and conceptual contribution to understanding walkability across diverse urban contexts in different cities. This study presents a systematic literature review of walkability research in Asian cities, analysing 30 peer-reviewed articles across 11 countries. Guided by a PRISMA based approach, the review addresses how walkability is conceptualised and what dominant patterns, tensions, and gaps emerge in the literature. The synthesis focuses on high-density urban environments where pedestrian activity, accessibility, and spatial intensity operate as interdependent urban conditions rather than isolated categories. Findings shows that walkability is a multidimensional construct shaped by interactions between physical infrastructure, experiential perception, and governance mechanisms. These dimensions' function relationally, where pedestrian outcomes depend on alignment between urban form, user experience, and policy implementation. The review also identifies persistent tensions between formal walkability measures and lived pedestrian realities in high-footfall urban settings. Although many studies focus on commercially active areas, these are better understood as high-intensity urban environments rather than distinct analytical categories. The study develops a conceptual synthesis of walkability in Asian cities, advancing understanding from descriptive classification towards a relational analytical framework and contributing to urban accessibility and pedestrian-oriented planning research.

Keywords: Walkability, Asian Cities, Systematic Literature Review; Urban Accessibility; High-density Urban Environments.

1. INTRODUCTION

Walkability is now a growing priority in urban planning, offering a sustainable alternative to vehicle-dependent transportation systems (Aydin et al., 2022). Walking is widely recognised as a fundamental and sustainable mode of urban mobility, contributing to environmental performance, public health, and social equity (Audi et al., 2010; Bozovic et al., 2021). Walkability enhances urban accessibility by enabling individuals from diverse socioeconomic groups to navigate and access transportation systems and urban services more effectively (Pereira et al., 2023). However, walking behaviour is not solely determined by individual choice; it is shaped by the interaction between built environment characteristics, socio-cultural conditions, and planning frameworks (Herrmann-Luncke et al., 2021). As a result, walkability has evolved into a multidimensional construct that reflects how urban form, infrastructure, and governance collectively influence mobility patterns and everyday urban experience (Dovey & Pafka, 2020; Ramos et al., 2026).

Existing walkability research remains fragmented across disciplinary and geographical contexts, with many studies emphasizing isolated environmental attributes and case-specific findings rather than integrated analytical frameworks (Zhang et al., 2019; De Vos et al., 2023). In particular, the relationships between different dimensions of walkability are rarely examined, restricting the ability to explain how similar urban conditions produce varied pedestrian outcomes. Although previous work has established the importance of land use configuration and urban structure in shaping pedestrian movement (Hall & Tewdwr-Jones, 2019; Carmona, 2021), there is limited synthesis that connects these elements within a coherent conceptual framework.

This limitation is especially significant in Asian cities, where rapid urbanisation and motorisation have transformed historically walkable environments. To be considered "walkable", a place must offer more than just physical access or basic activities (Forsyth, 2015). While many cities retain compact urban form, mixed land use, and active street life, these characteristics now coexist with increasing congestion, infrastructural imbalance, and declining pedestrian priority (Gota et al., 2010; Leather et al., 2011). This creates a tension between inherited urban morphology and contemporary development pressures. Existing studies frequently emphasise improvements in pedestrian infrastructure; however, evidence suggests that infrastructure alone does not ensure walkability without corresponding environmental quality, accessibility, and governance support (Wibowo et al., 2015; Hahm et al., 2019; Vichiensan & Nakamura, 2021). This indicates that walkability outcomes are shaped by interacting conditions rather than isolated interventions.

A further issue within the literature is the implicit reliance on commercially active areas as the primary context for analysing walkability. Although these environments are characterised by high pedestrian intensity and diverse activities, their analytical role is under considered. Commercial areas are frequently treated as indicators of density, mixed land use, and urban vitality within walkability research rather than as independent analytical categories (Jacobs, 1961; Ewing & Cervero, 2010). This raises an important question as to whether observed walkability patterns are driven by commercial functions themselves or by broader spatial and socio-environmental conditions. The lack of critical engagement with this distinction contributes to ambiguity in how walkability is conceptualised across studies. Taken together, these issues reveal a clear research gap. There is a need for a systematic and analytically grounded synthesis that moves beyond descriptive reporting towards an integrated understanding of how different dimensions of walkability interact and vary across urban contexts in Asia. Accordingly, the aim of this study is to develop a comprehensive and conceptually grounded understanding of walkability in Asian cities through a systematic literature review.

The objectives of the study are to identify the key dimensions that define walkability, to examine patterns and variations across different urban contexts, and to analyse how these dimensions interact to shape pedestrian experiences and outcomes. To achieve these objectives, the study is guided by the following research questions:

RQ-1: What are the key dimensions that define walkability in Asian urban high-density contexts?
RQ-2: How do these dimensions interact to produce patterns, variations, and contradictions in walkability across Asian cities?

By addressing these questions, the study advances walkability research beyond descriptive accounts towards a more analytical and integrative understanding, contributing to both theoretical development and practical insights for urban planning and design.

2. METHODOLOGICAL APPROACH

This study adopts a systematic literature review (SLR) to provide a rigorous and transparent synthesis of research on walkability in Asian high-density urban contexts. The review is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure methodological consistency, replicability, and analytical robustness. The approach is designed to address the research questions by identifying key dimensions of walkability and examining their interactions across diverse high-density urban environments, moving beyond descriptive aggregation towards analytical synthesis.

2.1 PRISMA Framework and Search Strategy

The PRISMA framework is applied as both a reporting and analytical structure that supports systematic identification, screening, and selection of studies. A comprehensive literature search was conducted across three major academic databases: Web of Science, Scopus, and Science Direct. These databases were selected due to their extensive coverage of peer-reviewed literature and relevance to urban studies, transport research, and the social sciences (Chadegani et al., 2013; Birkle et al., 2020; Visser et al., 2021; Clarivate, n.d.; Elsevier, n.d.)

The search strategy combined four key concept groups: intervention-related terms (improvement, upgrade), design-related terms (design, elements), pedestrian-oriented terms (footpaths, sidewalks, walkability, pedestrian), and urban-context terms (urban, city, marketplace, bazaar, retail, commercial). These were combined using boolean operators (AND, OR) to ensure comprehensive and precise retrieval of relevant studies. This multi-string strategy enhanced sensitivity while maintaining conceptual relevance across diverse urban contexts. (Refer to Tables 1, 2 & 3)

Table 1: Eligibility and Exclusion Criteria (Web of Science-Wos)

Criteria	Inclusion	Exclusion
Timeline	2020-2024	<2019
Document type	Research article	Review article, Early access, proceedings paper, book chapter
Publication Stage	Final	Article In press
Language	English	Non-English
Country	Asian Countries	Other Countries

Table 2: Eligibility and Exclusion Criteria (Scopus)

Criteria	Inclusion	Exclusion
Timeline	2020-2024	<2019
Document type	Research article	Book, Book chapter, review, conference paper, note, editorial, short survey.
Publication Stage	Final	Article In press
Language	English	Non-English
Country	Asian Countries	Other Countries

Subject Areas	Environmental science, social science, engineering, Multidisciplinary, Arts & Humanity.	Other than Mentioned.
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Table 3: Eligibility and Exclusion Criteria (Science Direct)

Criteria	Inclusion	Exclusion
Timeline	2020-2024	<2019
Document type	Research article	Review articles, Encyclopaedia, Book chapters, Conference abstracts, Book reviews, Case reports , Conference info, Correspondence, Data articles, Discussion, Editorials, Examinations, Mini reviews , News, Practice guidelines, Short communications, Software publications, Other.
Publication title	Transportation Research Procedia, Cities, And Transportation Research Part D: Transport and Environment, Transportation Research Part A: Policy and Practice, Landscape and Urban Planning, Urban Forestry & Urban Greening, Land Use Policy, Sustainable Cities and Society, Case Studies on Transport Policy. Building and Environment, Transport Policy.	Heliyon, Transportation Research Interdisciplinary Perspectives, Procedia Computer Science, Journal of Dairy Science, Poultry Science, Frontiers of Architectural Research, Preventive Medicine Reports, animal, Journal of Transport Geography, ATSS Research, Social Science & Medicine, Cell, Ain Shams Engineering Journal, Environment International, Cell Reports.
Subject Area	Social Sciences, Environmental Science.	

2.2 Study Selection Process

The selection process followed PRISMA guided screening and eligibility procedures. Initially, duplicate records were removed, followed by title and abstract screening to exclude irrelevant studies. Full-text assessment was then conducted to ensure alignment with the research focus on walkability in urban Asian contexts.

Studies were included if they were peer-reviewed empirical articles published in English and focused on walkability, pedestrian environments, or urban form in Asian cities. Studies were excluded if they addressed non-urban contexts, transport-specific walking such as transit corridors, or topics not directly related to pedestrian environments. This ensured conceptual consistency and analytical relevance across the dataset (Refer to Figure 1).

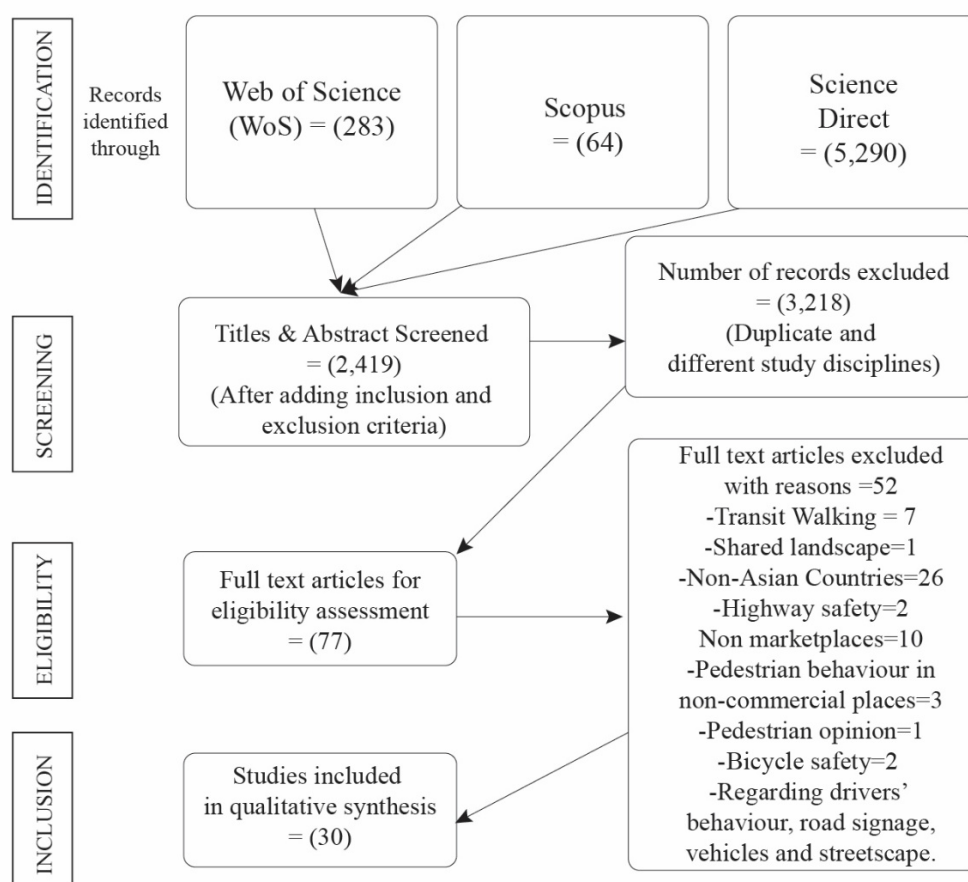


Figure 1: PRISMA Flow Diagram

2.3 Data Sources and Final Dataset

The use of Web of Science, Scopus, and Science Direct ensured a comprehensive and high-quality evidence base, given their rigorous indexing standards and interdisciplinary coverage. This combination enabled cross-contextual comparison across different methodological and regional perspectives, which is essential for studying Asian urban environments characterised by spatial and socio-economic diversity. The final dataset comprised 30 peer-reviewed studies across 11 Asian countries. Although limited in volume, the dataset reflects a targeted and quality controlled selection consistent with SLR standards, prioritising analytical depth, comparability, and relevance over quantity.

2.4 Data Extraction and Synthesis

Data extraction involved systematic identification of study objectives, methodologies, and key determinants of walkability. A thematic synthesis was then conducted to identify recurring patterns, contradictions, and higher-order conceptual dimensions across the literature. This process enables a shift from descriptive categorisation towards integrated analytical interpretation, supporting the development of a context-sensitive understanding of walkability as a multidimensional urban phenomenon in Asian cities.

2.5 Systematic Review Process

The evaluation was conducted in 2024. The review procedure consists of four phases: Identification, Screening, Eligibility, and Inclusion. In the initial phase of the inquiry, keywords such as 'improvement,' 'walkability,' 'marketplaces,' and 'pedestrian' were used. (Refer to Table 4).

Table 4: Search Strings for Systematic Literature Review

Databases	Keywords
Web of Science	TS= ((improvement OR upgradation) AND (design OR elements) AND (footpaths OR sidewalks OR walkability OR pedestrian) AND (Urban OR city OR marketplace OR bazaar OR retail OR commercial))
Scopus	(improvement OR upgradation) AND (design OR elements) AND (footpaths OR sidewalks OR walkability OR pedestrian) AND (Urban OR city OR marketplace OR bazaar OR retail OR commercial)
Science Direct	Query 1: (improvement OR upgradation) AND (design OR elements) AND (footpaths OR sidewalks OR walkability OR pedestrian) Query 2: (footpaths OR sidewalks OR walkability OR pedestrian) AND (Urban OR city OR marketplace) Query 3 : (footpaths OR sidewalks OR walkability OR pedestrian) AND (bazaar OR retail OR commercial)

From an initial retrieval of 3,218 articles across multiple databases, duplicates and irrelevant studies were removed, leaving 77 articles for full-text assessment. Following a detailed review, 52 articles were excluded due to topics outside the study’s focus, such as transit walking, non-Asian contexts, non-commercial areas, highway or bicycle safety, and vehicle-related issues. The remaining 30 articles met all inclusion criteria and were selected for qualitative analysis, forming the core evidence base for understanding and enhancing walkability in Asian commercial districts as shown in Figure 1 above.

2.6 Data Abstraction and Analysis

The selected articles were analysed using content analysis to identify patterns, relationships, and thematic structures related to walkability in Asian urban contexts. Following initial screening of titles and abstracts, full-text articles were systematically examined to extract key variables, methodological approaches, and principal findings. This process was explicitly guided by the study’s research questions, enabling the identification of higher-order dimensions of walkability and the examination of how different factors, including attributes and measurement approaches, interact across diverse urban settings.

Themes and sub-themes were developed iteratively through a structured coding process, allowing recurring concepts to be synthesised into broader analytical categories (Luo, 2019; Delve, 2022; Sirilakshmi et al., 2024). In line with established content analysis methodologies, this approach ensured a systematic and rule-based interpretation of the data while supporting conceptual refinement (Mayring, 2000). Rather than focusing on frequency counts alone, the analysis prioritised the identification of cross-study patterns, consistencies, and contradictions, reflecting the multidimensional and relational nature of walkability.

The use of content analysis also supports analytical generalisation by enabling synthesis across individual studies and facilitating comparative insights across different urban contexts (Downe-Wamboldt, 1992). Organising the data into coherent thematic structures enhances interpretability and provides a foundation for higher-order synthesis (Bengtsson, 2016). Although several studies examined commercially active environments, these were interpreted as high pedestrian intensity contexts rather than a distinct analytical category, ensuring consistency with the broader conceptual scope of the review. The distribution of thematic dimensions across the reviewed studies is summarised in Table 5, forms the basis for the subsequent analysis, where patterns, variations, and interactions are examined in relation to the research questions.

Table 5: Thematic classification of reviewed studies on walkability in Asian cities

Sl. No.	Author	Research Method	Country	Physical Environment	Experiential Factors	Governance and Measurement
1	Ahmed & Rahman (2020)	Ql	Bangladesh (Dhaka)	✓	✓	
2	Chen et al., (2020)	Qt	Taiwan (Taipei)	✓		✓
3	Lee & Choi (2020)	Qt	China (Beijing)	✓	✓	✓
4	Li & Yang (2020)	Qt	China (Guangzhou)	✓	✓	
5	Chen & Lin (2021)	Ql	Taiwan (Kaohsiung)	✓		✓
6	Gaglione et al., (2021)	Qt	China (Multiple cities)	✓		✓
7	Kwon & Park (2021)	Ql	South Korea (Busan)		✓	✓
8	Kumar & Singh (2021)	Ql	India (Delhi)	✓	✓	✓
9	Rahman & Hossain (2021)	Ql	Bangladesh (Sylhet)	✓	✓	
10	Song & Kim (2021)	Ql	South Korea (Gwangju)		✓	✓
11	Tan & Lim (2021)	Ql	Thailand (Bangkok) Japan (Nagoya)	✓	✓	
12	Wang & Liu (2021)	Qt	China (Nanjing)	✓		✓
13	Chang et al. (2022)	Qt	South Korea (Seoul)	✓	✓	✓
14	Meneses & Buluran (2022)	Qt + Ql	Philippines (Tarlaq City)	✓	✓	
15	Nguyen (2022)	Qt	Singapore	✓	✓	✓
16	Putra & Sari (2022)	Qt	Indonesia (Jakarta Sudirman-thamrin CBD)	✓		✓
17	Sato & Tanaka (2022)	Ql	Japan (Osaka)		✓	✓
18	Singh & Sharma (2022)	Qt	India (Mumbai)	✓	✓	✓
19	Wang & Liu (2022)	Qt	China (Shenzhen)	✓	✓	✓
20	Zhang et al., (2022)	Qt	China (Hangzhou)	✓	✓	✓
21	Kim & Choi (2023)	Ql	South Korea (Daegu)	✓	✓	✓
22	Li & Zhao (2023)	Qt	China (Shanghai)	✓	✓	✓
23	Nguyen & Tran (2023)	Qt	Vietnam (Ho Chi Minh City)	✓		✓
24	Tan & Wong (2023)	Qt	Malaysia (Penang)	✓	✓	✓
25	Wang & Chen (2023)	Qt	China (Wuhan)	✓		✓
26	Ahmed & Karim (2024)	Ql	Bangladesh (Khulna)		✓	✓
27	Park & Lee (2024)	Qt	South Korea (Incheon)	✓	✓	✓
28	Peckson et al. (2024)	Qt	Philippines (Metro Manila)	✓	✓	
29	Saito & Nakamura (2024)	Qt	Japan (Kyoto)	✓	✓	✓
30	Zhang & Li (2024)	Qt	China (Beijing & Chengdu)	✓	✓	✓

✓ indicates the presence of a thematic focus within the study. Physical environment includes infrastructure, pedestrian facilities, and spatial accessibility; Experiential factors include safety, comfort, cleanliness, visual quality, and universal mobility; Governance & measurement includes accessibility indices, Level of service (LOS), and walkability evaluation frameworks. Qt = quantitative; Ql = qualitative

2.7 Method of Synthesis

This study employed a narrative synthesis to integrate findings across heterogeneous studies on walkability in Asian high density urban contexts. As a text-based and interpretive approach, narrative synthesis enables the systematic identification of patterns, relationships, and inconsistencies across diverse forms of evidence (Popay et al., 2006; Leamy et al., 2011). Given the variation in study designs, geographical contexts, and methodological approaches, this method was particularly suitable for developing a coherent and comparable analytical understanding of walkability (Lisy & Porritt, 2016).

The synthesis was explicitly guided by the study's research questions, shifting the focus from descriptive aggregation towards analytical integration. Rather than reiterating individual attributes or study-specific findings, the process involved consolidating coded themes into higher-order conceptual dimensions. This approach enabled the identification of recurring patterns, cross-contextual variations, and underlying contradictions within the literature, particularly in relation to the disconnect between formal planning measures and lived pedestrian experiences.

Furthermore, the synthesis critically reinterpreted commonly used study contexts. While a number of studies focused on commercially active environments, these were not treated as a distinct analytical category. Instead, they were understood as manifestations of high-intensity urban conditions, allowing the analysis to move beyond context-specific descriptions towards a more generalisable and conceptually grounded understanding of walkability across Asian cities.

3. RESULTS AND ANALYTICAL SYNTHESIS

The synthesis of the selected studies demonstrates that walkability in Asian urban contexts cannot be adequately understood through isolated attributes or measurement indicators alone. Rather than functioning as a singular physical condition, walkability emerges as a multidimensional construct shaped by the interaction of spatial, perceptual, and governance-related factors. This directly addresses Research question 1 by shifting the analysis beyond fragmented descriptions towards an integrated understanding of the dimensions that influence pedestrian environments across Asian cities.

3.1 Thematic Classification of Reviewed Studies

Most reviewed studies primarily adopt attribute-based perspectives, with strong emphasis placed on pedestrian infrastructure, safety, environmental quality, and comfort. Studies from China consistently associate walkability with infrastructure provision, visual quality, and environmental conditions, particularly within dense urban environments where pedestrian continuity remains uneven (Lee & Choi, 2020; Gaglione et al., 2021; Wang & Liu, 2022; Zhang et al., 2022; Li & Zhao, 2023; Wang & Chen, 2023; Zhang & Li, 2024). Similarly, South Korean studies frequently position safety, security, and urban aesthetics as central determinants of pedestrian behaviour and environmental perception (Kwon & Park, 2021; Song & Kim, 2021; Chang et al., 2022; Kim & Choi, 2023; Park & Lee, 2024).

In contrast, studies from Bangladesh foreground infrastructural deficiencies, safety concerns, and maintenance-related issues, reflecting the pressures of rapid urbanisation and uneven pedestrian provision (Ahmed & Rahman, 2020; Rahman & Hossain, 2021; Ahmed & Karim, 2024). Indian studies similarly emphasise pedestrian facilities, safety, and environmental comfort as critical determinants of walkability quality (Kumar & Singh, 2021; Singh & Sharma, 2022; Sharma & Patel, 2023). In Malaysia, greater emphasis is placed on infrastructure quality and maintenance within commercially active urban environments (Tan & Wong, 2023), while studies from Japan associate walkability more closely with environmental order, comfort, and spatial quality (Tan & Lim, 2021; Sato & Tanaka, 2022; Saito & Nakamura, 2024). Research from Indonesia and Taiwan highlights the combined importance of

infrastructure provision and aesthetic quality in shaping pedestrian environments (Chen et al., 2020; Chen & Lin, 2021; Putra & Sari, 2022). Similarly, Studies from the Philippines emphasising pedestrian facilities, environmental comfort, and physical infrastructure, urban vitality, and spatial and visual characteristics of street environments as key contributors to pedestrian perception (Meneses & Buluran, 2022; Peckson et al., 2024)

Alongside these experiential and attribute-oriented approaches, another subset of studies adopts measurement-based frameworks that evaluate walkability through indicators such as accessibility, proximity, connectivity, and Level of Service (LOS). In China, quantitative assessments focus primarily on accessibility and pedestrian capacity within urban networks (Zhang et al., 2022; Wang & Chen, 2023), while South Korean studies integrate spatial performance metrics with pedestrian flow efficiency (Kim & Choi, 2023; Park & Lee, 2024). Indian studies combine accessibility indicators with LOS evaluations to assess pedestrian functionality and movement conditions (Kumar & Singh, 2021; Sharma & Patel, 2023). Similarly, Taiwan-based studies utilise spatial connectivity and accessibility measures to evaluate pedestrian performance (Chen et al., 2020; Chen & Lin, 2021), whereas Vietnam and Singapore demonstrate stronger engagement with accessibility-based frameworks and mobility equity assessment (Nguyen, 2022; Nguyen & Tran, 2023). Study from the Philippines also incorporate proximity analysis and walkability indices to evaluate urban pedestrian environments (Meneses & Buluran, 2022).

However, these categories should not be interpreted as analytically separate domains. Instead, the coexistence of attribute-based and measurement-based approaches reveals a structural divide within the literature itself. Studies centred on experiential dimensions often prioritise lived pedestrian realities and environmental perception, whereas measurement-oriented studies focus on quantifiable spatial performance and planning efficiency. As a result, walkability research across Asian cities remains fragmented between qualitative experience and quantitative evaluation, with limited integration between how pedestrian environments are measured and how they are actually experienced.

3.2 Higher-Order Dimensions of Walkability

The analytical process began with an initial coding of the literature, which identified two broad categories: walkability attributes and walkability measures. Walkability attributes primarily referred to the physical and spatial characteristics of the built environment, while walkability measures captured evaluative and indicator-based approaches used to assess pedestrian environments. Although this classification provided an initial organisational structure for the review, further analysis revealed significant conceptual overlap between the two categories. In many studies, physical attributes were simultaneously linked with experiential interpretations and evaluative assessments, indicating that walkability cannot be meaningfully separated into static attributes and independent measurement constructs.

This overlap suggested that the identified categories were not analytically distinct but instead reflected interconnected dimensions of a more complex urban system. Consequently, the coding framework was refined through iterative comparison and thematic synthesis, leading to the development of a three-dimensional analytical structure comprising physical environment dimensions, experiential-perceptual dimensions, and evaluative-governance dimensions. The revised framework enables walkability to be interpreted as a relational and multidimensional phenomenon, where environmental form, human experience, and policy or assessment mechanisms operate in an integrated manner rather than as isolated analytical categories.

To address this fragmentation, the findings were synthesised into three interrelated higher-order dimensions: physical environment, experiential-perceptual factors, and evaluative-governance systems. This analytical restructuring enabled the literature to be interpreted relationally rather than through isolated categories (Refer to Figure 2)

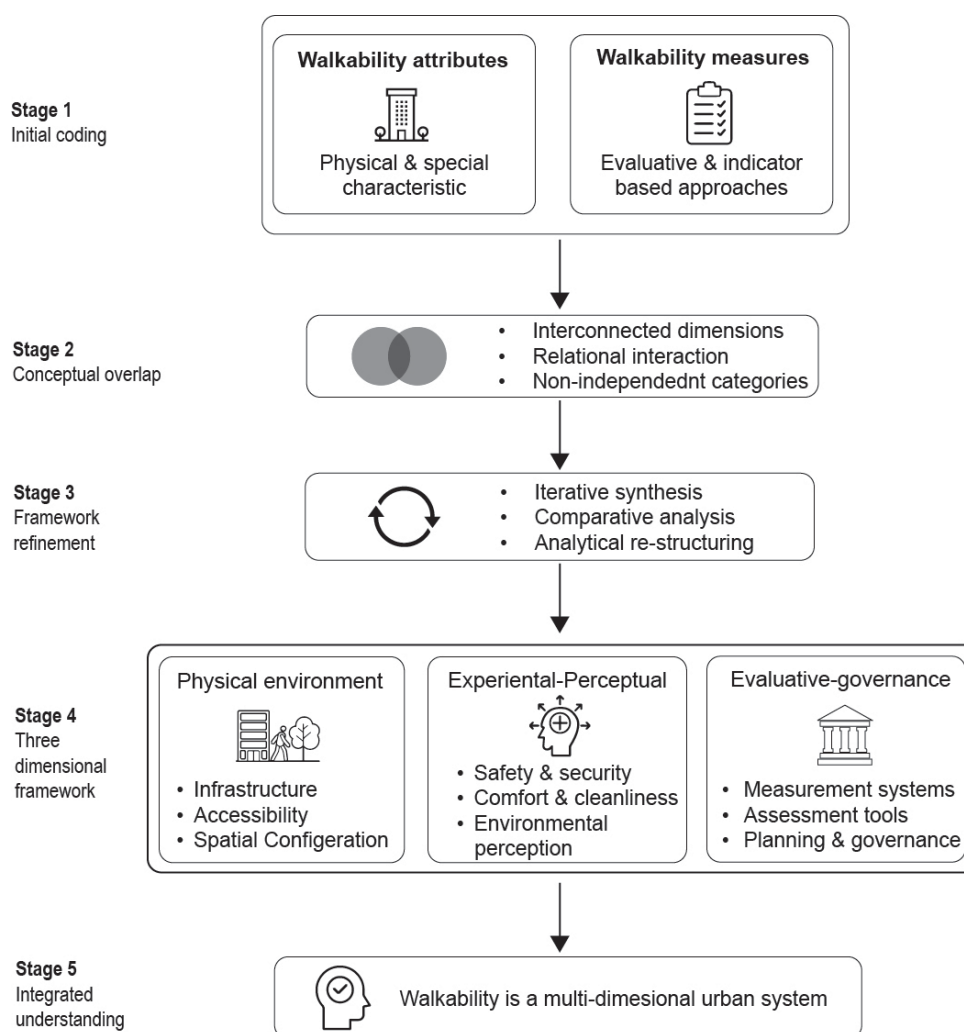


Figure 2: Evolution of the analytical framework from initial coding categories to an integrated three-dimensional understanding of walkability.

The physical environment dimension encompasses pedestrian infrastructure, spatial configuration, accessibility, and environmental conditions. Across studies from China, India, and Malaysia, these factors consistently emerge as foundational conditions shaping pedestrian movement and accessibility (Kumar & Singh, 2021; Sharma & Patel, 2023; Tan & Wong, 2023; Wang & Chen, 2023; Zhang & Li, 2024, Meneses & Buluran, 2022). Nevertheless, multiple studies also demonstrate that infrastructure provision alone does not necessarily translate into effective walkability outcomes. In high-density environments, infrastructural improvements are often undermined by congestion, discontinuity, poor maintenance, or conflicting land use pressures, indicating that physical provision alone cannot fully explain pedestrian experience.

The experiential-perceptual dimension reflects how pedestrians interpret and respond to urban environments through factors such as safety, security, cleanliness, visual quality, and comfort. South Korean studies demonstrate a strong relationship between perceived environmental quality and pedestrian behaviour (Kwon & Park, 2021; Chang et al., 2022; Kim & Choi, 2023), while studies from Bangladesh and the Philippines reveal that concerns related to safety and environmental maintenance frequently outweigh the influence of physical infrastructure (Ahmed & Rahman, 2020; Rahman & Hossain, 2021, Meneses & Buluran, 2022; Peckson et al., 2024). These findings suggest that walkability

is not solely determined by material conditions, but also by social perception and environmental interpretation.

The evaluative-governance dimension includes formal measurement systems and planning mechanisms such as accessibility indices, proximity analysis, LOS, and walkability assessment frameworks. Studies from China, South Korea, India, Taiwan, Vietnam, Singapore, and the Philippines increasingly demonstrate the use of quantitative and indicator-based approaches for assessing walkability, although the extent and methodological emphasis vary across contexts (Chen et al., 2020; Zhang et al., 2022; Nguyen, 2022; Nguyen & Tran, 2023; Wang & Chen, 2023; Park & Lee, 2024; Meneses & Buluran, 2022; Peckson et al., 2024). However, these frameworks frequently prioritise measurable efficiency and network performance over experiential quality. Consequently, a disconnect emerges between formal evaluation systems and the realities of lived pedestrian experience, revealing limitations in current planning-oriented approaches to walkability assessment.

3.3 Patterns and Regional Variations

Several recurring patterns emerge across the reviewed literature. The most consistent pattern is the prioritisation of physical infrastructure as the primary determinant of walkability. Nevertheless, the findings repeatedly demonstrate that physical provision alone is insufficient without supportive perceptual and environmental conditions. Safety, comfort, maintenance, and environmental quality frequently mediate whether pedestrian infrastructure is perceived as usable or attractive.

Regional variations further illustrate the contextual nature of walkability across Asian cities. Studies from China and South Korea tend to adopt more integrated approaches that combine qualitative and quantitative dimensions of analysis, reflecting stronger institutional engagement with both pedestrian experience and spatial performance (Zhang & Li, 2024; Park & Lee, 2024). In contrast, research from Bangladesh and India more frequently foregrounds infrastructural deficiencies, safety concerns, and uneven pedestrian provision associated with rapid urbanisation pressures (Ahmed & Rahman, 2020; Kumar & Singh, 2021). Meanwhile, studies from Taiwan, Singapore, and Vietnam demonstrate greater reliance on measurement-based frameworks focused on accessibility, spatial connectivity, and mobility performance (Chen et al., 2020; Nguyen, 2022; Nguyen & Tran, 2023).

These regional differences indicate that walkability outcomes are shaped not only by urban form, but also by governance capacity, planning priorities, and socio-economic conditions that vary across Asian contexts.

3.4 Emerging Contradictions

In addressing Research question 2, the synthesis reveals several interrelated contradictions that shape walkability outcomes across Asian cities. These contradictions expose persistent tensions between how walkability is planned, measured, and experienced in practice.

A primary contradiction exists between quantitative walkability assessments and lived pedestrian experience. While formal indicators often suggest acceptable levels of accessibility or service provision (Wang & Chen, 2023; Park & Lee, 2024), empirical findings repeatedly report dissatisfaction related to safety, maintenance, environmental comfort, and usability (Ahmed & Rahman, 2020; Kumar & Singh, 2021; Meneses & Buluran, 2022; Ahmed & Karim, 2024). This demonstrates that quantitative metrics alone are insufficient for capturing the experiential and behavioural realities of pedestrian environments.

A second contradiction emerges in relation to high-intensity urban environments, particularly those characterised by strong commercial activity. Although dense mixed-use environments are commonly associated with improved walkability through enhanced accessibility and increased pedestrian activity, evidence from studies across Asian cities suggests that these environments may also introduce constraints related to pedestrian comfort, perceived safety, and environmental quality, largely

attributable to intensified human activity and increased pressure on urban space (Lee & Choi, 2020; Wang & Liu, 2022; Kumar & Singh, 2021; Meneses & Buluran, 2022).

Rather than inherently producing walkable environments, commercial intensity appears to amplify both enabling and constraining conditions depending on planning quality, management capacity, and spatial organisation.

A further contradiction emerges between policy intentions and implementation outcomes, as walkability guidelines and planning standards are widely referenced across Asian urban contexts, yet their effectiveness remains uneven in practice. Evidence suggests that the translation of these frameworks into tangible pedestrian outcomes is often constrained by governance capacity, institutional coordination, and local adaptation, resulting in inconsistent implementation across rapidly urbanising settings (Ahmed & Rahman, 2020; Rahman & Hossain, 2021; Kumar & Singh, 2021; Singh & Sharma, 2022; Zhang et al., 2022; Wang & Chen, 2023).

Collectively, these contradictions reinforce the argument that walkability should not be understood as a linear outcome of infrastructure provision or regulatory compliance alone. Instead, it is produced through dynamic interactions between spatial conditions, environmental perception, and governance systems.

3.5 Transition Towards a Conceptual Framework

The synthesis demonstrates that walkability in Asian cities is fundamentally relational and multidimensional, shaped through the interaction of physical infrastructure, experiential perception, and governance mechanisms. These dimensions operate interdependently, producing context-specific pedestrian outcomes that cannot be adequately explained through isolated indicators or single-domain analysis.

This analytical synthesis therefore provides the foundation for the development of a conceptual framework that formalises the relationships between these dimensions. By integrating physical, perceptual, and governance-related factors into a unified structure, the framework advances walkability research beyond descriptive categorisation towards a more coherent and theory-informed understanding of pedestrian environments across Asian urban contexts.

4. CONCEPTUAL FRAMEWORK

4.1 Conceptual Development

The analytical synthesis demonstrates that walkability in Asian cities is not produced through isolated infrastructural elements or singular planning measures. Rather, it emerges through the interaction between spatial conditions, pedestrian experience, and institutional regulation. Existing studies frequently examine these components independently, resulting in fragmented interpretations that limit a comprehensive understanding of how walkability operates across diverse urban environments.

The review further indicates that current walkability research remains divided between two dominant orientations. The first prioritises physical and environmental attributes such as infrastructure, accessibility, and safety, while the second relies on quantitative measurement systems including accessibility indices and Level of Service assessments. Although both approaches contribute valuable insights, they rarely explain how these dimensions interact in practice. As a result, a recurring gap exists between formally evaluated walkability conditions and actual pedestrian experience.

This issue is particularly evident within Asian urban contexts, where rapid urbanisation, high-density development, and uneven governance structures generate complex pedestrian conditions that

cannot be adequately captured through isolated indicators alone. The findings suggest that walkability outcomes are shaped not only by physical provision, but also by perceptual interpretation and the effectiveness of governance systems in translating planning objectives into lived urban realities.

To address these limitations, this study develops an integrated conceptual framework that organises walkability into three interrelated dimensions; the physical environment; the experiential perceptual dimension; and the governance measurement system. The framework advances the study beyond descriptive categorisation by explaining how these dimensions interact to shape pedestrian outcomes across Asian cities.

4.2 Framework structure

The proposed framework consists of three interconnected dimensions that collectively influence walkability outcomes. The physical environment dimension represents the spatial and material conditions that support pedestrian movement. This includes pedestrian infrastructure, spatial connectivity, accessibility, environmental comfort, and maintenance conditions. These elements establish the structural foundation for walkability by determining the continuity, usability, and physical quality of pedestrian environments.

The experiential perceptual dimension reflects how pedestrians interpret and respond to urban environments. Factors such as perceived safety, comfort, visual quality, and cleanliness influence pedestrian behaviour and shape the willingness to walk. The findings indicate that subjective perception frequently mediates the effectiveness of physical infrastructure, suggesting that well-designed environments may still fail to encourage walking if users perceive them as unsafe or uncomfortable.

The governance measurement system represents the institutional and evaluative mechanisms through which walkability is regulated, assessed, and implemented. This includes planning frameworks, accessibility assessments, Level of Service evaluations, and policy-oriented measurement tools. While these mechanisms guide urban development and infrastructure provision, the review identifies recurring inconsistencies between measured performance and actual pedestrian experience. Together, these dimensions form an integrated structure in which walkability is understood as a relational urban condition rather than a fixed physical attribute.

4.3 Functional Relationship

The framework is grounded in the premise that walkability emerges through interaction between systems rather than through independent variables operating in isolation. The relationship between the physical environment and experiential perception demonstrates that pedestrian behaviour is influenced not only by the presence of infrastructure, but also by how urban conditions are interpreted by users. Similar spatial conditions may therefore generate different walkability outcomes depending on environmental quality, perceived safety, and socio-cultural context.

Governance systems influence the physical environment through planning standards, implementation practices, and regulatory control. However, the findings indicate that policy intentions do not always translate into effective pedestrian environments, particularly in rapidly urbanising contexts characterised by uneven governance capacity and spatial pressures. A reciprocal relationship also exists between governance systems and experiential perception. Measurement frameworks frequently prioritise efficiency and accessibility while underrepresenting qualitative pedestrian experience. This contributes to the recurring mismatch identified in the review between formal walkability assessments and lived urban realities. These interactions explain why walkability outcomes vary significantly across Asian cities despite similarities in infrastructure provision or planning objectives.

4.4 Conceptual Model of Walkability

Based on these relationships, walkability is conceptualised as an emergent urban condition generated through the interaction of physical, perceptual, and governance systems:

$$W=f(P, E, G)$$

Where

- (W) represents walkability outcomes
- (P) represents the physical environment
- (E) represents experiential perceptual factors
- (G) represents governance and measurement systems

This formulation reinforces that walkability should not be understood as a singular urban attribute, but as a dynamic condition shaped by multiple interdependent influences.

4.5 Conceptual Framework Diagram

The diagram presents a three-layer interaction model illustrating the relationships between the physical environment; experiential perceptual dimension; and governance measurement system. These dimensions interact dynamically to shape broader walkability outcomes within Asian urban contexts.

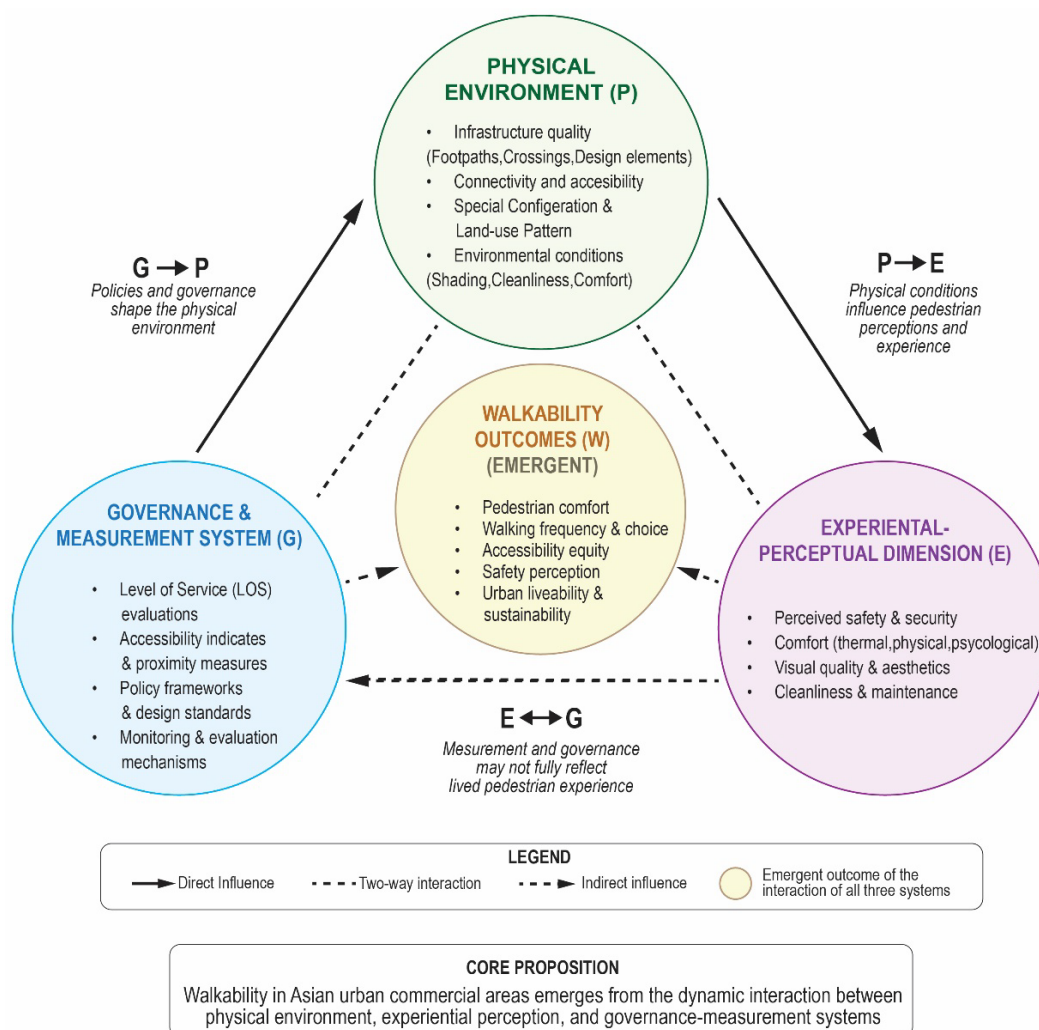


Figure 3. Conceptual framework of walkability in Asian urban contexts

4.6 Explanation of The Framework

Figure 3 illustrates the relational structure of walkability developed through the analytical synthesis of the reviewed studies. Rather than presenting walkability as a linear outcome of infrastructure provision, the framework demonstrates how pedestrian environments are produced through continuous interaction between spatial conditions, human experience, and governance systems.

The physical environment forms the foundational layer of the framework by representing the tangible conditions that support or constrain pedestrian movement. The experiential perceptual dimension reflects the interpretive layer through which pedestrians evaluate safety, comfort, and environmental quality. The governance measurement system functions as the regulatory and evaluative layer responsible for shaping urban form and defining planning priorities.

The directional relationships represented in the framework indicate that these dimensions are mutually influential. Physical conditions shape pedestrian perception, governance systems influence spatial development, and experiential realities may expose limitations within formal measurement frameworks. This interactional structure explains why similar planning interventions may produce different pedestrian outcomes across urban contexts.

At the centre of the framework, walkability outcomes emerge from the interaction of all three dimensions. These outcomes include pedestrian comfort, walking frequency, accessibility equity, safety perception, and broader aspects of urban liveability. Their central positioning emphasises that walkability is not directly generated by any single factor, but is instead an emergent condition shaped by interdependent urban systems.

4.7 Framework Contribution

The conceptual framework contributes to walkability research in three significant ways. First, it moves beyond fragmented attribute-based classifications by integrating physical, perceptual, and governance dimensions into a unified analytical structure. Second, it explains the recurring contradictions identified throughout the review, particularly the gap between measured walkability and lived pedestrian experience. Third, it positions walkability as a context-sensitive and relational urban condition, providing a stronger theoretical basis for comparative urban analysis within Asian cities.

By advancing walkability from a descriptive planning concept towards an interaction based analytical framework, this study contributes a more comprehensive foundation for future urban research, policy development, and pedestrian-oriented planning strategies.

5. DISCUSSION

The findings indicate that walkability in Asian cities is shaped through the interaction between physical conditions, pedestrian experience, and governance systems. Rather than functioning as isolated variables, these dimensions collectively influence how urban environments are used, perceived, and evaluated. This discussion interprets the broader implications of these relationships and explains why walkability outcomes vary across different Asian urban contexts.

5.1 Beyond Infrastructure

The findings show that walkability cannot be explained by physical infrastructure alone. Although many studies emphasise pedestrian facilities, accessibility, and connectivity, these elements do not automatically generate positive walking experiences. In several contexts, environments with adequate infrastructure continue to perform poorly in terms of safety, comfort, or usability.

This suggests that walkability is not solely a design outcome, but also a perceptual and behavioural condition shaped by how pedestrians experience urban space. Improvements in infrastructure therefore have limited impact when environmental quality and user perception remain weak.

5.2 Measured vs Lived Experience

A major issue identified in the review is the mismatch between measured walkability and lived pedestrian experience. Evaluation tools such as accessibility indices and Level of Service provide structured methods for assessing urban environments; however, these approaches primarily capture measurable spatial conditions while overlooking experiential dimensions. In many Asian cities, factors such as crowding, informal activities, environmental stress, maintenance quality, and perceived safety strongly influence walking behaviour. Aldrin, A. (1999) explained that Perceptions of safety and fear of crime significantly influence how residents use and move through public and semi-public urban spaces. These conditions are often difficult to quantify and therefore remain underrepresented in formal assessments. As a result, areas that perform well according to technical indicators may still be perceived negatively by users. This finding highlights the need for more integrated assessment approaches that combine quantitative evaluation with qualitative and experiential perspectives.

5.3 Asian Urban Contexts

The review demonstrates that walkability outcomes are closely linked to the broader urban conditions of Asian cities. Rapid urbanisation, high-density development, mixed land use, and uneven governance structures create pedestrian environments that differ significantly from many Western planning contexts. In some cities, walkability is constrained by inadequate infrastructure and maintenance deficiencies, while in others the primary challenges relate to congestion, overcrowding, and environmental pressure. These variations indicate that walkability cannot be addressed through standardised models alone. The findings therefore reinforce the importance of context-sensitive planning approaches that respond to local spatial, social, and governance conditions.

5.4 Commercial Intensity

Although commercially active areas formed an important context within the reviewed studies, the findings suggest that commercial activity functions more as an intensifying condition than as a distinct analytical category. Commercial environments often encourage pedestrian movement through density and activity concentration; however, they also amplify congestion, environmental stress, and safety concerns. This dual effect demonstrates that commercial intensity does not inherently produce walkability, but instead strengthens both enabling and constraining urban conditions simultaneously. This interpretation helps reposition commercial districts as contextual urban environments rather than as the central focus of walkability analysis.

5.5 Planning Implications

The findings suggest that improving walkability requires a more integrated planning approach that extends beyond infrastructure provision. Safety, comfort, environmental quality, and pedestrian perception should be treated as central components of walkability rather than secondary considerations. In addition, governance and evaluation systems should better reflect lived urban experience. Overreliance on quantitative indicators may overlook important socio-spatial conditions that significantly influence pedestrian behaviour. Finally, planning interventions should remain adaptable to local urban realities. Differences in governance capacity, development patterns, and socio-economic conditions indicate that walkability strategies must be tailored to specific contexts rather than universally applied.

5.6 Future Directions

This study contributes by framing walkability as an emergent condition produced through interaction between physical, experiential, and governance dimensions. By explaining the contradictions between measured and perceived walkability, the study advances understanding beyond descriptive classification towards a more relational interpretation of pedestrian environments. Future research should further integrate qualitative and quantitative assessment methods to develop more comprehensive walkability evaluation frameworks. Empirical application of the proposed conceptual model within different Asian urban contexts would also strengthen its practical and theoretical relevance.

6. CONCLUSION

6.1 Key insights

This study examined how walkability is conceptualised and assessed within Asian urban contexts through a systematic literature review of 30 studies across 11 countries. The findings demonstrate that walkability cannot be understood as a singular physical attribute or a purely technical planning outcome. Instead, it emerges as a multidimensional urban condition shaped through the interaction of physical infrastructure, experiential perception, and governance mechanisms.

The review further shows that pedestrian facilities, accessibility, and spatial configuration remain important foundations for walkability; however, these elements alone are insufficient to produce positive pedestrian outcomes. Across the reviewed studies, the effectiveness of walkable environments was consistently influenced by how urban conditions were experienced in practice, particularly in relation to safety, comfort, cleanliness, and environmental quality. The recurring mismatch between measured performance and lived experience therefore highlights the limitations of evaluating walkability solely through quantitative indicators or infrastructural provision.

At the same time, the findings reveal that commercially intensive urban environments function less as a distinct analytical category and more as high-activity urban conditions that amplify existing walkability dynamics. While such areas often support pedestrian movement through density and accessibility, they also intensify congestion, environmental stress, and safety challenges. This reinforces the argument that walkability outcomes are relational and context dependent rather than universally determined by urban form alone.

6.2 Theoretical Contribution

This study contributes to walkability research by moving beyond descriptive classifications of attributes and measurement indicators towards an integrated analytical understanding of walkability in Asian cities. Through the synthesis of diverse studies and contexts, the research demonstrates that walkability is best understood as an emergent outcome produced through the interaction between spatial, perceptual, and governance systems. The proposed conceptual framework advances existing literature in three important ways. First, it addresses the fragmentation between attribute-based and measurement-based approaches by integrating physical, experiential, and evaluative dimensions within a single relational structure. Second, it explains the contradictions identified across the literature, particularly the persistent gap between formal walkability assessments and lived pedestrian experiences. Third, it provides a context-sensitive framework capable of explaining why similar planning interventions generate different outcomes across Asian urban environments. By shifting the discussion from isolated indicators towards interaction-based relationships, the study advances walkability research beyond report-style synthesis towards a more theory-informed and explanatory perspective.

6.3 Practical Implications

The findings suggest that improving walkability in Asian cities requires a shift from isolated infrastructural interventions towards integrated and context-sensitive planning strategies. Although pedestrian infrastructure remains essential, its effectiveness depends heavily on complementary experiential and governance conditions. In particular, the review indicates that planning approaches should move beyond prioritising accessibility and Level of Service indicators alone. While these tools remain useful for evaluating spatial performance, they should be complemented by qualitative and participatory approaches capable of capturing pedestrian perception, environmental comfort, safety, and usability.

The study also highlights the importance of inclusive and universal mobility strategies that ensure pedestrian environments remain accessible to diverse user groups, including older adults and persons with disabilities. Similarly, environmental quality, including cleanliness, greenery, visual coherence, and maintenance, plays a significant role in shaping pedestrian willingness and satisfaction. More broadly, governance systems must strengthen the relationship between planning standards and implementation capacity. For instance, (Aini et al., 2019) stated that, public open spaces for people with disabilities, focusing on how the built environment supports inclusive and barrier-free movement. Without effective institutional coordination, local adaptation, and context-responsive policy application, even well-designed walkability strategies may fail to produce meaningful urban outcomes.

6.4 Limitation

Several limitations should be acknowledged. First, the review is based on a selected body of peer-reviewed English-language studies, which may not fully capture the diversity of urban conditions and local research across all Asian cities. Second, variations in methodological approaches, assessment criteria, and contextual focus among the reviewed studies limit direct comparability across cases.

In addition, the study relies on secondary data and published findings, restricting the ability to examine real-time behavioural dynamics, informal urban practices, and rapidly evolving urban conditions that may influence pedestrian experience.

6.5 Future Research

Future research should focus on developing integrated walkability assessment models that combine quantitative spatial indicators with experiential and behavioural dimensions. Empirical application of the proposed conceptual framework within specific urban contexts would further strengthen its analytical and practical relevance. Additional research is also needed to examine how emerging urban challenges, including climate adaptation, digital mobility systems, informal urbanism, and rapid urban transformation, influence walkability across Asian cities. Such studies would support the development of more adaptive, context-sensitive, and human-centred approaches to pedestrian planning and urban liveability.

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