

Exploring Urban Liveability: The Key Performance Indicators for Walkability

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ARTICLE INFO

Article history:

Received 18 December 2024

Revised 07 April 2025

Accepted 27 June 2025

Online first

Published 31 July 2025

Keywords:

Urban Planning

Urban Liveability

City Street

Walkability

Key Performance Indicator

DOI:

10.24191/bej.v22iSI.5641

ABSTRACT

Walking refers to the act of moving on foot, and it offers individuals an intimate sense of the urban environment. It reduces harmful emissions and promotes a healthier lifestyle. This underscores the importance of designing a pedestrian-friendly physical environment, incorporating elements such as land use, sidewalk quality as well as street connectivity to encourage and increase walking rates. Walkability is also used as a performance measure, assessing the ability of city streets to promote and encourage walking behaviour in communities. This study proposes a comprehensive framework integrating Indicators, Key Performance, and Key Components to enhance urban walkability. The framework identifies elements influencing the pedestrian experience including safety and security, scenery, comfort, convenience, continuity and visibility, convivial, good health, and climate. This study took a qualitative and quantitative approach using the structured literature review and empirical observations. This methodology identified significant gaps to walkability, including inadequate accessibility, uneven sidewalks, and a lack of shaded walkways, particularly for those with disabilities. Comparative research looking at major cities such as Copenhagen, Seoul, Bangkok, and Singapore for ways to design city streets was carried out. The findings highlight to redesign the city street through expanding green space, and enhancing pedestrian safety. There is need of combining global best practices with local demands to increase walkability in Kuala Lumpur. It highlights the vital role of walkability in enhancing urban quality of life, creating inclusive, dynamic communities, and addressing global sustainability challenges.

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<https://doi.org/10.24191/bej.v22iSI.5641>

INTRODUCTION

Walking is a fundamental yet often undervalued aspect of urban life. Beyond its practical function, walking offers individuals a unique opportunity to engage deeply with their surroundings, uncovering subtle nuances and fostering a richer experience of the environment. It also facilitates social interactions by bringing individuals together in shared public spaces. A spontaneous encounter can cultivate a sense of community and belonging, contributing to improved overall well-being. In addition to its social benefits, walking serves as a powerful form of exercise, promoting physical health, enhancing mental clarity, and alleviating stress. However, Owen et al. (2007) stated that the impact on satisfaction can vary depending on individual preferences and environmental conditions. Accordingly, people's opinions of walkability are influenced by factors such as aesthetics, traffic safety, crime, noise, access to green spaces, pedestrian infrastructure, and land use.

Walkability refers to the quality of a pedestrian-friendly environment with key characteristics, such as street design, infrastructure quality, and safety. Haykal & Abdullah (2018) emphasised its significance as a fundamental way to interact with the city, enabling a better knowledge of social dynamics and environmental complexity. Meanwhile, Dobesova & Krivka (2012) described the dimensions of walking, which include utilitarian, social, and health factors that are all closely related to the fabric of urban life. These perspectives underscore the need for comprehensive urban planning approaches that prioritise liveability, accessibility, and user-centred design.

Effective policy implementation is crucial for enhancing walkability. Haykal & Abdullah (2018) highlighted that planning strategies appear at both the macro and micro levels, with more initiatives and finer urban design specifics. Nevertheless, this study aims to provide valuable insights and recommendations for pedestrian-friendly neighbourhoods' that improve community health, sustainability, and well-being.

LITERATURE REVIEW

Özcan & Özyavuz (2022) define walkability as a performance indicator for assessing walking ability in urban spaces. It emphasises the evaluation of urban streets to encourage community walking and its relationship with the built environment. Lee et al. (2021) agreed that walkability is related to pedestrian performance and is influenced by factors in both the walking and street environments. Their research highlights the importance of walkability in analysing urban processes, particularly regarding spatial and social inequalities. Alfonzo (2005), identifies various characteristics that influence the individual experience of the urban environment and presents a hierarchical structure that considers physical attributes, personal factors, and urban planning elements that affect accessibility, safety, comfort, and enjoyment. Lynch (1984) developed performance indicators for cities, including pedestrian streets, with elements such as vitality, sensory, access, and control detailed. These studies collectively emphasise the multifaceted nature of walkability and its importance in creating an inclusive and user-friendly urban environment.

Identical results have been identified in numerous studies on the matter of walkability (Gehl, 2010; Handy et al., 2005). The result has identified major built environment characteristics that impact walking behaviour, including street connectivity, density, and land use mix. Walkability refers to the acceptance and public perception of a new way of life in a sustainable urban environment, which comprises walkway continuity, accessibility of facilities to people of all abilities, footpath regularity, connection to frequent transit services, crossing convenience and safety, visual interest, and perceived or real security. According to Fallahranjbar et al. (2019), the foundation of urban and urban quality is provided by urban design, urban

streets, and components that encourage physical activity in users. Hence, this study summarises major key performance indicators of walkability from several studies and blueprints.

Safety and Security

Walkability is strongly linked to the safety and security of a pedestrian-friendly environment. Painter (1996) highlighted the risk associated with poorly lighted or uneven locations, whereas Alfonzo (2005) determined the importance of traffic-free and low-crime environments for enhancing walkability. Effective urban design must prioritise sustainable, cost-effective, and user-friendly patterns to ensure pedestrian safety. Afsar (2014) further underscores highlighted the significance of visibility in safety, citing street lights, closed-circuit television (CCTV), and conspicuous signs. In Malaysia, smart traffic management prioritises security equipment such as closed-circuit television CCTV and emergency buttons to enhance pedestrian security. Similarly, Southworth (2005) underlined the importance of crosswalk timing, well maintained sidewalk and effective traffic control measures in ensuring pedestrian safety.

Improving safety and security in urban pedestrian environments requires a multifaceted approach that integrates physical design elements, increased visibility, and comprehensive safety measures. Cities can foster walkable environments that encourage physical activity but instil a strong sense of safety among pedestrians by prioritising these considerations in urban street planning and design.

Scenery

Walkability in cities is shaped by a range of factors influence pedestrian behaviour and experience. Mansouri (2014) established the importance of efficient road design by providing direct and convenient paths from origin to destination, simultaneously increasing walkability. Similarly, Özbil et al. (2015) emphasised the role of a diverse and visually engaging urban setting in encouraging pedestrian exploration and fostering cognitive interaction with the urban landscape. Both researches underscore that visual characteristics like landscaping, trees, and architectural details improve the pedestrian experience by making city streets more visually appealing.

Southworth (2005) highlights that the aesthetic qualities of the urban environment such as appealing vistas, appropriate lighting, and a well-designed façade foster social interactions and motivate people to walk for transit and leisure purpose. Integrating of landscape features into urban design improves the city's visual attractiveness and promotes a healthier, more active lifestyle and better communal well-being (Özbil et al., 2015; Mansouri, 2014; Southworth, 2005).

Comfort

Comfort in an urban environment is influenced by various dynamic characteristics that evolve over time and context (Gehl, 2010) for example the provision of covered pathways and seats on the city street may considerably improve pedestrian comfort. Alfonzo (2005) identified factors such sidewalk width, cleanliness, and greenery can all impact a pedestrian's comfort. A good urban design setup will increase the likelihood of people enjoying their experience and foster deeper connections with their surroundings. Southworth (2005) emphasised designing a pedestrian-friendly environment must prioritise community well-being, minimise car dependency, and improve social connections. Features such as shaded benches and continuous walkways enhance the walking experience. Moreover, streets designed to accommodate everyone, including seniors and persons with disabilities, promote accessibility, equity, and active transportation, contributing to healthy communities.

Convenience

Hrushowy (2006) discovered that pedestrian convenience is more noticeable at the street or block level than at the broader neighbourhoods' scale. Key elements such as visibility, distance, and urban aesthetics play a crucial role in enhancing pedestrian convenience and encouraging walking as a sustainable mode of transportation. Convenience is reflected in the seamless connectivity of city streets and pathways which make neighbourhood exploration easy and enjoyable. Mendzina & Vugule (2020) emphasised the importance of obstacle-free streets and well-marked of safe crossing points in ensuring pedestrian comfort. Similarly, Spoon (2005) argued that the visual appeal of the city, the availability of destinations, and opportunities for social connections significantly influence walking activity, independent of health state.

A convenient city street enables individuals to walk easily between residential, commercial, and recreational areas located in close proximity to each other. These key features are essential for developing pedestrian-friendly urban streets, encouraging walking as a sustainable and health-conscious mode of transport.

Continuity and Visibility

Southworth (2005) emphasised the importance of continuity and visibility in urban street design for promote physical activity among pedestrian and cyclists. Important factors such as grid layouts, mixed land uses, and connections play a crucial role in achieving this. Emphasising on continuity and visibility will highlight the significance of infrastructure design in building accessible and interconnected urban environments. On a smaller scale, Mansouri (2014) argue that shorter and more direct routes improve urban connectedness. This is consistent with Krier's (1979) and Bambawale's (2019) emphasis on the role of crossings in establishing linkages within cities.

Convivial

The effective integration of a street with its surrounding environment is essential for emphasising streetscape elements such as building facades, facilities, signage, green areas, pathways, and functional factors such as land usage (Mansouri, 2014). This integration enhances the vibrancy and charm of the urban streetscapes increasing local participation and encouraging walkability. The functional environment and appealing streetscapes will play a pivotal role in promoting walkability (Rafiemanzelat et al., 2017). The functional environment focuses on connectivity and land use. Meanwhile, streetscape contains the visible components of urban streets, such as sidewalks, greenery, buildings, signage, and facades, which create a sense of place and influence user perception.

Good Health

A car-dependent lifestyle promotes passive behaviour, which negatively impacts overall health and well-being (Hsu et al., 2021; Giallourous et al., 2020; Koohsari et al., 2018). In contrast, walking not only reduces carbon dioxide emissions but also decreases air pollution and greenhouse gas emissions, contributing to climate change mitigation and a more liveable urban environment.

Strategic urban design is crucial for encouraging physical activity and enhancing health and mental well-being. Sallis et al. (2016) found urban design elements including green areas, bike lanes, and pedestrian routes can improve health outcomes. These elements promote community involvement and social interaction, fostering a sense of belonging and acceptance among city inhabitants. Additionally,

attractive architecture, pedestrian-friendly infrastructure, and dynamic street life can also improve the overall quality of life.

Climate

Baobeid et al. (2021) emphasised the need to consider the risks of extreme weather conditions, such as extreme hot and cold weather in designing urban streets for pedestrians. Severe temperatures raise the risk of heat-related disorders like heat exhaustion and heat stroke, as well as cold-related conditions like hypothermia and frostbite. Note that weather or climate change significantly affects people's walking behaviour (Kinyingi et al., 2020; Shamsuddin et al., 2012). In general, cooler weather is preferable to hot as it lowers the chance of heat-related illnesses and discomfort.

Integrating natural elements, technology solutions, and architectural design is essential to mitigate weather or climate change. These elements provide shade and reduce the risk of climate change and helps to create a more comfortable walking environment. Meanwhile, a cooler temperature typically promotes walking by alleviating heat-related pain. For example, the availability of shade is one (1) of the most essential factors encouraging walking in hot and cold weather (Baobeid et al., 2021).

RESEARCH METHODOLOGY

The process of establishing the aim, objectives, and research question is crucial for conducting a systematic literature review, as mentioned by Okoli (2022). According to Okoli, the review process begins by developing a specific research question or hypothesis which guides the identification, classification, and summarise existing research and to identify areas and opportunities for future research.

In this context, specific objectives are defined to identify the Key Performance Indicator that most effectively measures walkability in urban environments. After identifying the specific aim, objectives, and research question, clear inclusion and exclusion standards are developed to ensure the focus remains on relevant literature which will have a direct impact on the analysis. Kumar et al. (2023) highlighted the importance of literature reviews in guiding and validating research by providing a solid foundation for understanding the research problem and identifying potential future research directions.

A comprehensive literature search was conducted using academic databases and focused keywords such as "walkability," "urban design," "walkability indicators," "city street," and "pedestrian infrastructure" after inclusion and exclusion criteria were developed. This is to explore the different elements and identify areas that require additional attention, such as walkability and related walkability indicators.

After identifying relevant studies, data were systematically extracted using comparative analysis and also examining different successful story of major cities such as Copenhagen, Seoul, Singapore and Bangkok. This approach aimed to identify critical factors that contribute and comparing walkability measures across various urban contexts. There is a need to identify critical aspects that contribute to walkable environments by evaluating gaps in infrastructure, public policy, and urban design. A successful story of walkability offers an in-depth study of best practices and actionable Key Performance Indicators.

The data will be synthesised and analysed qualitatively to find trends, patterns, and insights about Key Performance Indicators in walkability. Correspondingly, this will synthesise and analyse major findings from the literature and highlight gaps in existing research that require further research. These findings can

help to enhance urban design policies to promote walkability. Finally, the findings can help cities create more sustainable and healthy communities.

ANALYSIS AND DISCUSSION

Indicators, Key Performances, and Key Components are interlinked to create a comprehensive strategy for improving walkability in cities. Indicators will assist in identifying all of the elements contributing to a pedestrian-friendly environment. Subsequently, this indicator will assist the city administrator in developing aims, rules, and regulations and research the effectiveness of accepting the provision of walkways on city streets. In this theory, the indicators represent several characteristics or themes of walkability, including Safety and Security, Scenery, Comfort, Convenience, Continuity and Visibility, Convivial, Good Health, and Climate.

Key Performance refers to specific initiatives to improve urban design and planning that each indicator aims to accomplish. These Key Performance Indicators will assist in translating initiatives into achievable results. On a smaller scale, the components are the physical and functional features of the urban environment that contribute to the attainment of the Key Performance for each indicator. They are urban design infrastructure features that influence walkability, such as sidewalks, street furniture, travel lanes, and landscaping.

The identified indicators, Key Performance, and Components of walkability comprise Comfort, Convenience, Good Health, Security and Safety, Continuity and Visibility, Climate, Conviviality, and Scenery, which can impact the urban planning and design of a city street. This is to provide a structured approach to understanding and improving the urban environment to increase walkability. Furthermore, this framework enables systematic evaluation, helps identify strengths and weaknesses in urban design, and guides the implementation of solutions that make cities more pedestrian-friendlier.

Table 1. The Indicators, Key Performance, and Component of Walkability

Indicators	Key Performance	Component	Author
Safety & Security	1. Improving Accident Prevention	1. Sidewalk	1. Wan Mohammad et al. (2021)
	2. Ensuring Traffic Safety	2. Roadbed	2. Lee et al. (2021)
	3. Providing Comprehensive Mapping and Signage	3. Transit Facilities	3. Transport for London Street Management (2004)
	4. Prioritising a Thoughtful Urban Design	4. Street Activity	4. Gehl (2010)
	5. Integrating City Street Design Elements	5. Street Furniture	5. Southworth (2005)
	6. Reducing Sense of Fear	6. Travel Lanes	6. Afsar (2014)
		7. Ancillary Lanes	7. Painter (1996)
		8. Cycle Lanes	8. Alfonzo (2005)
			9. Turoń et al. (2017)
			10. Zakaria & Ujang (2015)
Scenery	1. Enhancing Landscape and Urban Planning	1. Roadbed	1. Wan Mohammad et al. (2021)
	2. Integrating between City and Built Environment	2. Street Activity	2. Lee et al. (2021)
	3. Effective and enjoyable Urban Street Scape	3. Street Furniture	3. Transport for London Street Management (2004)
		4. Building Edges	4. Rafiemanzelat et al. (2017)
		5. Planting	

	4. Reducing Crime; and		5. Whybrow (2014)
	5. Innovative Street Design.		6. Mansouri (2014)
			7. Özbil et al. (2015)
			8. Southworth (2005)
Comfort	1. Ensuring High-Quality Sidewalks and Facilities	1. Sidewalk – Traffic Calming	1. Alfonzo (2005)
	2. Enhancing Visible and Transparent Environment	2. Street Furniture – Benches, Streetscape	2. Southworth (2005)
		3. Travel Lanes	3. Lee et al. (2021)
		4. Ancillary Lanes	4. Transport for London Street Management (2004)
		5. Cycle Lanes	5. Gehl (2010)
		6. Planting	6. Zakaria & Ujang (2015)
			7. Rafiemanzelat et al. (2017)
Convenience	1. Balancing Mix Development and Open Space Land Use	1. Sidewalk - wayfinding	1. Mendzina & Vugule (2020)
	2. Prioritising Functionality of the Urban Area	2. Street Activity – Street Vending Spaces	2. Handy et al. (2005)
	3. Encouraging Diversity Activities		3. Hrushowy (2006)
	4. Effective Mode of Transport		4. Spoon (2005)
	5. Having Impact on Health and Place		5. Lee et al. (2021)
	6. Promoting Short Distance Destinations and Activities		6. Dobesova & Krivka (2012)
	7. Accommodating Multiple Uses with Wider Street		7. Transport for London Street Management (2004)
			8. Zakaria & Ujang (2015)
			9. Rafiemanzelat et al. (2017)
			10. Turoń et al. (2017)
			11. Whybrow (2014)
Continuity and Visibility	1. Enhancing Mobility with Other Modes of Transport	1. Sidewalk	1. Transport for London Street Management (2004)
	2. Enhancing Accessibility and ability to move	2. Roadbed	2. Gehl (2010)
	3. Promoting and Ensuring Social Equity	3. Transit Facilities	3. Alfonzo (2005)
	4. Promoting Short Distance Destinations and Activities	4. Travel Lanes	4. Dobesova & Krivka (2012)
	5. Enhancing and Improved Connectivity	5. Ancillary Lanes	5. Zakaria & Ujang (2015)
		6. Cycle Lanes	6. Rafiemanzelat et al. (2017)
		7. Planting	7. Whybrow (2014)
			8. Southworth (2005)
			9. Mansouri (2014)
			10. Krier (1979)
			11. Bambawale (2019)
Convivial	1. Encouraging Interaction with People, The Built and Natural Environment	1. Street Activities	1. Wan Mohammad et al. (2021)
	2. Increasing Engagement with Social and Community	2. Street Furniture	2. Haykal & Abdullah (2018)
	3. Enhancing Multiple Attraction Places	3. Building Edges	3. Transport for London Street Management (2004)
	4. Stimulating interest in Excitement in the Surrounding Area		4. Zakaria & Ujang (2015)
			5. Rafiemanzelat et al. (2017)
			6. Turoń et al. (2017)
Good Health	1. Improving Health and Place	1. Sidewalk	1. Merom et al. (2018)
		2. Transit Facilities	2. Koohsari et al. (2018)

	2.	Minimising Environmental Impact	3.	Street Activities	3.	Hsu et al. (2021)
	3.	Enhancing Green Space and Increase its Accessibility	4.	Cycle Lanes	4.	Giallourous et al. (2020)
			5.	Planting	5.	Sallis et al. (2016)
					6.	Fallahranjbar et al. (2019)
					7.	Tian et al. (2022)
					8.	Lee et al. (2021)
					9.	Rafiemanzelat et al. (2017)
Climate	1.	Climate Prevention and Protection Design	1.	Street Furniture	1.	Wan Mohammad et al. (2021)
			2.	Building Edges	2.	Hazrati (2012)
			3.	Planting	3.	Baobeid et al. (2021)
					4.	Kinyingi et al. (2020)
					5.	Shamsuddin et al. (2012)

Source: Authors (2024)

Based on Table 1, walkability will improve significantly as individuals feel safer on city streets from both accidents and criminal activity. It captures the indicators, key performance, component and references towards creating walkability in the city street. The effort to create walkable cities requires a comprehensive strategy that addresses Safety and Security, Scenery, Comfort, Convenience, Continuity and Visibility, Convivial, Good Health, and Climate.

Finally, the indicators, key indicators performance and components complements each indicator and create comprehensive urban design that improves the quality of life for city inhabitants. These elements must be addressed together to build lively, healthy, and accessible urban environments that prioritise pedestrian needs. Each indicator addresses a specific aspect of urban design that contributes to enhancing pedestrian experience. The key performance metrics define the goals, and the components are the practical elements that make these goals achievable.

City Streets with sufficient lighting, traffic calming measures and clear signs can help decrease accidents and increase pedestrian safety. Meanwhile, Aesthetic aspects such as lush green areas and thoughtfully placed street furniture will enhance the surroundings and make walking more pleasurable as well as guarantee pedestrian comfort in a range of weather situations. The presence of green areas has a soothing impact, decreasing urban heat and adding to the overall well-being of city inhabitants. It is also clear that urban design elements such as artistic spaces, seats, and shelter from hot and wet weather may make pedestrian routes more pleasurable regardless of season.

Good amenities and easy access will encourage people to walk as their mode of transportation. The seamless integration of walking, cycling, and public transit networks improves overall mobility and accessibility across the city. When public infrastructure is reliable and accessible, an individual is more likely to prefer walking and make it as their daily routines. The integration of walking, cycling and public transit networks can improve overall mobility and ensure that all areas of the city are interconnected. This can reduce the dependency on motorised vehicular and able to have a sustainable urban lifestyle.

Public places like siting area and small commercial area built for social interaction and able to contribute to a sense of community and belonging. Urban planners may design city streets that promote sustainable, pleasurable and secure walking experiences for everyone by using both data-driven insights and human-centred approaches.

The current research also identifies successful story of walkability in cities like Copenhagen, Seoul, Singapore and Bangkok by using eight (8) key performance indicators. This city was chosen based on their achievement in developing and ensuring that the city's inhabitant have an excellent walkability. Singapore and Bangkok were included based on their rapid development and similar climates to Malaysia. The systematic literature review in Table 2 revealed patterns and best practices for developing functional and enjoyable pedestrian environments.

Table 2. The Findings of Key Performance Initiatives in Copenhagen, Seoul, Singapore, and Bangkok for Walkability

Indicators	Key Performance Initiatives			
	Copenhagen	Seoul	Singapore	Bangkok
Safety and Security	1. Designed pedestrian-only streets and areas	1. Reduce motorised vehicle lanes	1. Well-marked crosswalks	1. Introduction of policies for street cleanliness and safety
	2. Removing traffic from streets	2. Implementation of policies to improve pedestrian safety, accessibility and its environment	2. Pedestrian traffic lights	2. Resolving safety hazards
	3. Reducing crime through urban design	3. Pedestrian safety and community security education programs	3. Universal design principles to enhance pedestrian safety	3. Installing crossing lights
		4. Regular review of pedestrian environment improvement plans		4. Creating new routes for comprehensive walkability
Scenery	1. Enhancing landscape and urban planning	1. Creating pedestrian-friendly areas to support local businesses, such as commercial areas like Myeongdong Street or Namdaemun Street	1. Integrate greenery and landscaping into pedestrian infrastructure as well as facilities to provide shade with aesthetic appeal	1. Create visually appealing environment;
	2. Effective and enjoyable urban streetscape			2. "Returning the Pavements to the Public" campaign for cleaner and more attractive pedestrian spaces
	3. Innovative street design			
Comfort	1. Removing curbs	1. Increase pedestrian paths	1. Installing air conditioning in underground infrastructure	1. Reclaiming public pavements
	2. Ensuring high-quality sidewalks and facilities	2. Prioritising first and last-mile connections for public transportation users, including restructuring bus routes and maintaining subway and LRT lines	2. Implementing covered walkways, pedestrianised streets, and elevated pedestrian bridges to protect pedestrians from weather elements	2. Widening pedestrian paths
	3. Integrate street furniture			3. Removing obstructions and seamless pedestrian pathway to improve pedestrian comfort
	4. Enhancing visible environment			

Convenience	1.	Improving pedestrian flow	1.	Prioritising first and last-mile connections for public transportation users	1.	Focus on underground pedestrian walkways	1.	Shifting vendors to designated area to give space for pedestrian pathway
	2.	Promoting short-distance destinations and activities			2.	Connection of main buildings and transit stops	2.	Pedestrian amenities design suitable to the site such as pedestrian pathway adjustments and crossings
	3.	Multiple land uses with wider streets	2.	Creating pedestrian-friendly area to support local businesses	3.	Emphasising mixed-use developments around transportation nodes to maximise accessibility		
	4.	Enhancing accessibility and ability to move						
	5.	Enhancing and improved connectivity						
	6.	Balancing mixed development and open space land use						
Continuity and Visibility	1.	Integrate the city and built environment	1.	Active participation from individuals and government entities in ensuring pedestrian rights	1.	Encourage mixed-use developments around transportation nodes to reduce commute time and distance	1.	Creating new routes to enhance walkability and ensure continuous pedestrian pathways
	2.	Promote and ensure social equity					2.	Comprehensive maintenance approach to keep pedestrian pathways in optimal condition
	3.	Enhance mobility with other modes of transport	2.	Implementation of policies to improve pedestrian accessibility	2.	Pedestrian flow to main buildings and transit station		
	4.	Prioritise the function of the urban area						
Convivial	1.	Encourage the interaction of people, the built and natural environment	1.	Creating pedestrian-friendly zones that contribute to economic growth and support local businesses	1.	Mixed-use developments around transit nodes, enhancing social interactions by bringing residential, commercial, and recreational spaces together	1.	Cooperation between local government and community
	2.	Enhance the engagement with social and community					2.	Strong political will and collaboration among various agencies
	3.	Enhancing various of attraction places					3.	Awareness and capacity-building programs to encourage community participation
	4.	Stimulating interest and excitement in the surrounding area						
	5.	Encourage more diversity in activities						
Good Health	1.	Walking as the main mode of transportation	1.	Promoting walking as a healthy and			1.	Cleanliness policies contribute to a healthier

	sustainable mode of transportation			pedestrian environment
Climate	1. Implement Climate prevention and protection design	-	1. Incorporating greenery and landscaping for shade	1. Resilience and adaptability to local climate conditions during Design, planning, and management stages
	2. Enhancing green space and increasing its accessibility		2. Covered walkways, pedestrian pathway and elevated pedestrian bridges to protect pedestrians from weather	

Source: Authors (2024)

Walkability in Copenhagen, Seoul, Singapore and Bangkok focused on the pedestrian safety by reducing motorised traffic and implementing security elements. For example, Copenhagen implemented pedestrian-only streets, Seoul reduced vehicle lanes, Singapore emphasise well-marked pedestrian pathways and universal design principles in designing city street and Bangkok enacted city street cleaning and safety legislations.

The city streets have evolved to prioritise pedestrian pathways as well as reduce its obstacle. In Copenhagen the barriers were removed and consolidated street furniture, Seoul widened their sidewalks, Singapore developed air-conditioned underground walkways and Bangkok widened pavements and level walkways. All these initiatives are to make the pedestrian user convenience to walk in the city.

Another similarity is the effort to increase and improve connectivity the city streets especially for pedestrians. Copenhagen improves pedestrian flow with unified street design, Seoul emphasises first and last-mile connections with public transportation, Singapore creates seamless connections between transit hubs and major buildings and Bangkok reclaims pavement and organises vendors to clear sidewalks.

Meanwhile, to enhance conviviality are evident as all cities prioritise vibrant public spaces by focusing on mixed-use developments especially in Copenhagen and Singapore. Seoul and Bangkok take different initiatives by creating pedestrian-friendly commercial zones and reclaiming pavements for public use individually. Cities also take the climate action initiatives by providing shaded walkways, green and climate sensitive elements to increase pedestrian comfort. Additionally, community engagement is promoted through few efforts including inclusive planning (Copenhagen), education programs (Seoul), universal design (Singapore), and public awareness campaigns (Bangkok).

The findings highlight a critical transformation in urban planning especially in providing walkable city street. Integrating walkability as a central design principle to addresses the needs of pedestrians and aligns with the vision of achieving sustainability, inclusiveness and economic resilience of cities as well as balanced living. These cities are seen to demonstrate the ability to achieve walkability not only about infrastructure but also about creating an environment that is interconnected with people and the environment as one (1) as well as the need to value the urban environment. Copenhagen mission is to have a healthy citizen which aligns with its vision of being a liveable city, while Singapore's economic strategy shows that walkability can foster urban prosperity. Bangkok's cultural conservation efforts reveal how walkable cities can also protect heritage. As a result, different city may have its unique objectives in

designing walkability to guarantee that communities, surrounding and environment adequately cared for and valued.

Urban planners, policy makers and developers can take the strategies and initiatives implemented by these cities in designing urban streets towards a pedestrian-friendly and more walkable urban environment. These strategies and initiatives can serve as models for increasing walkability and improving the general quality of urban living.

CONCLUSION

Walkability addresses the relationship between indicators, Key Performance, and Key Components in enhancing walkability in cities. It is an interdisciplinary theory that considers various characteristics, including safety, scenery, comfort, convenience, continuity, visibility, friendliness, and excellent health, and it is used to develop an inclusive and user-friendly urban environment. Notably, safety and security are crucial in enabling urban design interventions to ensure pedestrian-friendly layouts, and visibility enhancements such as accident prevention and better signage directly contribute to safer and more user-friendly roads. Meanwhile, scenic features such as landscape, green space, cityscape, and architectural design play an essential role in encouraging pedestrian activity and community well-being.

Furthermore, a comfortable environment with pedestrian routes, high-quality pedestrian walkways, and public amenities, as well as accessible and seamless connectivity services between public transport, promotes walking and develops a thriving community. This will encourage active commuting and improve the urban experience.

The development of walkable cities requires a well-structured framework that effectively incorporates indicators, essential performance measurements, and specialised urban design components. These factors provide a comprehensive approach for improving the pedestrian experience and promoting walkability. Indicators such as Safety and Security, Scenery, Comfort, Convenience, Continuity and Visibility, Conviviality, Good Health, and Climate provide thematic frameworks for analysing and enhancing walkability. These indicators serve as a compass for developing objectives, policies, and activities that are tailored to the specific requirements of urban areas.

Key Performance Indicators translate these broad concepts into actionable metrics for more targeted initiatives in areas such as accident prevention, landscape enhancement, and urban connectivity. These helps to bridge the gap between conceptual goals and real execution by ensuring that focused activities meet essential components of the pedestrian experience. Urban design components such as sidewalks, street furniture, landscaping and transport lanes will complement the Key Performance Indicators by serving as the physical and functional backbone of walkable cityscapes. Cities that emphasise these components may create welcoming, accessible, and integrated settings that prioritise pedestrian comfort while also encouraging sustainable and inclusive urban life.

The framework also emphasises the necessity of designing for climate adaptation and implementing health-focused urban planning to encourage physical activity and well-being. Establishing walkability in city streets requires a comprehensive approach that tackles numerous elements to promote active lives, community involvement, and environmental sustainability. Nevertheless, this framework offers urban administrators a comprehensive guideline for assessing, enhancing, and promoting walkability in the city that will contribute to vibrant and pedestrian-friendly urban environments.

In summary, the research objectives to identify the key performance, indicators and components of walkability has been achieved. This key performance, indicators and components includes factors that encourage people to walk as well as design elements that contribute to increased walkability on city streets. Overall, the findings and discussion have explored the key performance, indicators and components that support the achievement of these indicators through a systematic reading study conducted. However, This key performance indicator attempts to improve pedestrian access to city streets through considerate urban policy and design. However, to actually make our cities more walkable, we must consider additionally factors such as financial capacity to finance the development of pedestrian paths. This aspect is viewed as having the ability to provide long-term economic advantages while also ensuring that the costs of implementing and developing these efforts are sustainable.

Another factor that deserves attention involves the way to use modern technologies to make city walking easier and more fun. Sensors and Global Positioning System (GPS) can be used to monitor pedestrian traffic, identify crowded locations, and even inspect pavement conditions. This type of technology can provide real-time updates on pedestrian traffic, allowing cities to adapt their infrastructure to changing needs.

ACKNOWLEDGEMENTS

The authors are grateful to the College of Built Environment at Universiti Teknologi MARA, Shah Alam, and Puncak Alam, for their assistance and encouragement in completing this research. Special appreciation goes to the co-authors for their efforts and support of this journal. The authors also thank the reviewers for their informative remarks, which helped improve the journal before publication. This journal does not get any financing from the government or commercial sector.

CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests at all. The authors declare that they have no conflict of interest to the production of this journal.

AUTHORS' CONTRIBUTIONS

Siti Aisyah Zakaria carried out the research, wrote and revised the article. TPr. Dr. Marlyana Azyyati Marzukhi and Dr. Aidatul Fadzlina binti Bakri designed the research, supervised research progress, review, revised, and approved the article submission.

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