

Optimizing urban pedestrian streetscapes for residents and tourists: A literature review based on the PRISMA technique



Tong Jia^{1,*}, Nor Zarifah Maliki¹, Tong Sen², Zheng Jiao³

¹School of Housing, Building and Planning, Universiti Sains Malaysia, Penang, Malaysia

²Faculty of Management, Shinawatra University, Pathum Thani, Thailand

³School of Education, Ningxia Sports Vocational College, Yin Chuan, China

ARTICLE INFO

Article history:

Received 11 September 2024

Received in revised form

19 January 2025

Accepted 2 February 2025

Keywords:

Urban pedestrian streets

Sustainable development

Walkability and safety

Cultural preservation

Smart technology integration

ABSTRACT

This systematic review explores strategies to optimize urban pedestrian streets for residents and tourists, employing Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocols to ensure a comprehensive and transparent analysis. Key design elements, including walkability, safety, aesthetics, and smart technology integration, are identified as essential for creating functional and attractive urban spaces. The study emphasizes balancing the needs of locals and visitors, ensuring streets provide essential services and connectivity while delivering memorable experiences for tourists. Furthermore, the review underscores the importance of sustainable development and cultural preservation, advocating for eco-friendly methods that respect diverse traditions. Analyzing 46 studies, the research offers practical recommendations for enhancing pedestrian streets, providing valuable insights for policymakers and urban planners to foster inclusive, sustainable, and vibrant urban environments.

© 2025 The Authors. Published by IASE. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Urban pedestrian streetscapes serve as the city's lifeblood, allowing residents and tourists alike to navigate and experience urban environments (Kim, 2019). These spaces are not just channels for movement; they are places where people interact, exchange culture, and do business. The design of a street can greatly affect the quality of city life in various ways, such as public safety or environmental sustainability, and even impact the economic viability of local enterprises. As cities grow larger and more crowded through urbanization, there is a need for well-designed streetscapes that cater to different user groups with diverse needs (Zipori, 2022). For locals, pedestrian streets form part of their everyday routines, providing them with spaces for work, travel, rest, entertainment, etc. Accessibility, safety, and convenience are some of the priorities set by this category of users, as discussed by Wang et al. (2020). They therefore require not

only functional but also liveable streets that meet everyday demands such as easy service, access, clear directions, and comfort in public places (Ali and Baper, 2023). On the other hand, tourists perceive these same streets differently, often taking them as attractions within cities themselves (Li et al., 2022). Jiefangbei Pedestrian Street and Hongyadong in Chongqing, China, embody both tourist sites and places where locals live, thus offering commercial activities, cultural heritage, and scenic spots, among others, which appeal to residents as well as visitors at once (Mengyuan and Jiawei, 2018). Tourists look for aesthetic uniqueness, cultural significance, and leisure opportunities during their exploration journeys through towns, cities, etc. It is at this point that the design atmosphere comes into play since it can leave everlasting memories about any city visited based on its general outlook through public spaces. The challenge faced by urban planners and designers lies in balancing the conflicting needs of different groups of users. To achieve functionality while maintaining beauty when creating such multifunctional street designs, one must be able to appreciate various components, such as landscaping, lighting, seating, signage, and pedestrian flow (O'Neill, 2021). Further considerations, such as eco-friendliness, social inclusiveness, and technological advancement, are increasingly gaining currency within contemporary streetscape design (Wang et

* Corresponding Author.

Email Address: tongjia@student.usm.my (T. Jia)

<https://doi.org/10.21833/ijaas.2025.02.019>

Corresponding author's ORCID profile:

<https://orcid.org/0009-0002-7174-9767>

2313-626X/© 2025 The Authors. Published by IASE.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

al., 2020). Therefore, green infrastructure needs to be integrated into streetscapes as cities move towards sustainability and resilience. Buildings should also be designed in a way that caters to all types of people who may want to access them via different modes of transport, including those that have not yet been invented. Despite numerous studies on urban planning and design, adequate literature on how to best optimize streetscapes for residents and tourists concurrently is lacking. Much of the existing research tends to concentrate on one group or aspect of safety aesthetics without fully incorporating wider perspectives about these environments. This gap therefore necessitates comprehensive synthesis across various investigations to develop an all-inclusive perception of what constitutes an optimized street environment based on this. This study aims to perform a systematic review of the literature on urban pedestrian streetscapes, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. With the purpose of finding street design components that contribute to satisfaction among both inhabitants and tourists, this study examines and combines previous studies. The assessment will also investigate how these two user groups' needs can be balanced to develop guidelines for future projects. The wider context of the design of these spaces is discussed in terms of their impact on sustainability and livability in cities; it argues that well-designed areas for pedestrians can help reduce the environmental burdens imposed by large cities while fostering social integration as well as supporting local economies. The findings should therefore have practical implications not only for policymakers at different levels but also for professionals involved in city planning across various disciplines who would like to know what works best when creating streetscapes that are fairer, environmentally sustainable, responsive, vibrant, safe, inclusive, healthy places that cater to all people living, working, traveling and recreating within them. This study also hopes to extend our knowledge about pedestrian streetscapes as vital parts of multifunctional cities by comprehensively reviewing current studies, identifying research gaps, and suggesting new areas for investigation to contribute to making cities more liveable and resilient.

2. Methodology

2.1. PRISMA technique overview

The PRISMA method is a broad system that provides direction to researchers while carrying out systematic reviews that are more transparent, rigorous, and consistent. Developed with the purpose of addressing bias and inconsistency in literature reviews, PRISMA is a structured process that starts by searching through all relevant databases exhaustively (Cooper et al., 2018). This is then followed by the application of specific inclusion

and exclusion criteria aimed at selecting only those studies that meet standards. PRISMA insists on clear reporting so that others can reproduce this work if necessary; therefore, steps such as study selection should be described well enough to allow their tracking down mostly via flow diagrams (MacMillan et al., 2019). With respect to urban pedestrian streetscape review, PRISMA has gained even greater importance because it enables systematic integration of findings from many different disciplines, such as city planning, architecture, and sociology, among others, hence ensuring an inclusive and impartial analysis. Through the following recommendations provided by PRISMA during this study, the main themes are established alongside best practices coupled with existing knowledge gaps in the literature, thus establishing a strong basis for future investigations into urban design applicable at various levels.

2.2. Search for keywords

To include everything related to urban pedestrian streetscapes, this systematic literature review search strategy was constructed using keywords that are topic-specific and method-related. Web of Science, Scopus, and Google Scholar were used among other databases because they have many peer-reviewed journals, conference papers, and gray literature in the fields of urban planning, architecture, and related disciplines. The authors focused only on materials published between 2008 and 2024 so that they could concentrate on current trends in streetscape design. Table 1 shows how various words were selected during the search process, considering that urban pedestrian streetscapes have many sides. It was necessary to develop terms such as "urban streetscape," "pedestrian design," and "public space" since they directly address components making up a street design where people walk or cycle. These goals were then combined with sustainable development goals such as green infrastructure, with social cohesion being another aspect under consideration when considering the optimization of a city's environment through different land uses along its main thoroughfares. Having done this step-by-step across all selected databases according to their relevance criteria, which are known as Boolean operators, filters were applied starting from titles followed by abstracts before reading full texts to confirm if they met specific requirements for inclusion in the review. Empirical studies conducted at any level that considered the needs of both inhabitants and visitors formed the basis for selection, whereas those that did not provide evidence-based recommendations but focused only on motor-oriented spaces were excluded.

2.3. Study selection and data extraction

The study selection and data extraction process for this review followed a systematic and

transparent approach, as illustrated in the PRISMA flow diagram (refer to Fig. 1). The process began with an initial identification of 227 records through database searching. No additional records were identified through other sources, and duplicate records were removed, resulting in 227 unique studies. These records were then screened based on their titles and abstracts to determine their

relevance to the research objectives. The inclusion criteria for the initial screening involved relevance to urban streetscape design, a publication date between 2008 and 2024, and a focus on both residents' and tourists' needs. Studies that did not meet these criteria were excluded. As a result of this screening process, 156 records were excluded, leaving 71 studies for further assessment.

Table 1: Search keyword strategy

No.	Topic-related words	Method-related words	Search words
1	"Urban streetscape"	"Design"	"Urban streetscape" and "design"
2	"Pedestrian design"	"Sustainability"	"Pedestrian design" and "sustainability"
3	"Walkability"	"Accessibility"	"Walkability" and "accessibility"
4	"Public space"	"Green infrastructure"	"Public space" and "green infrastructure"
5	"Urban design"	"Social cohesion"	"Urban design" and "social cohesion"
6	"Tourism"	"Economic impact"	"Tourism" and "economic impact"
7	"Resident needs"	"Environmental footprint"	"Resident needs" and "environmental footprint"
8	"Cultural landmarks"	"Urban resilience"	"Cultural landmarks" and "urban resilience"
9	"Pedestrian flow"	"Adaptive design"	"Pedestrian flow" and "adaptive design"
10	"Public safety"	"Inclusive planning"	"Public safety" and "inclusive planning"

In the eligibility stage, the full-text articles of the 71 remaining studies were reviewed in detail to assess their alignment with the predefined inclusion and exclusion criteria. The inclusion criteria at this stage included empirical research, case studies, or theoretical frameworks that addressed key aspects of urban pedestrian streetscapes, such as walkability, safety, cultural preservation, and sustainability. Studies that lacked empirical data or did not provide evidence-based recommendations were excluded. This thorough evaluation led to the exclusion of 25 studies that did not meet the criteria, resulting in 46 studies being included in the final

analysis. Finally, these 46 studies were further analyzed and synthesized. The synthesis involved a narrative approach, identifying common themes, patterns, and gaps in the literature. Data extraction involved systematically recording relevant information from each study, such as study design, location, sample size, key findings, and the specific components of streetscape optimization discussed. This structured approach ensured that the extracted data were consistent and comparable across studies, facilitating a comprehensive synthesis of the literature.

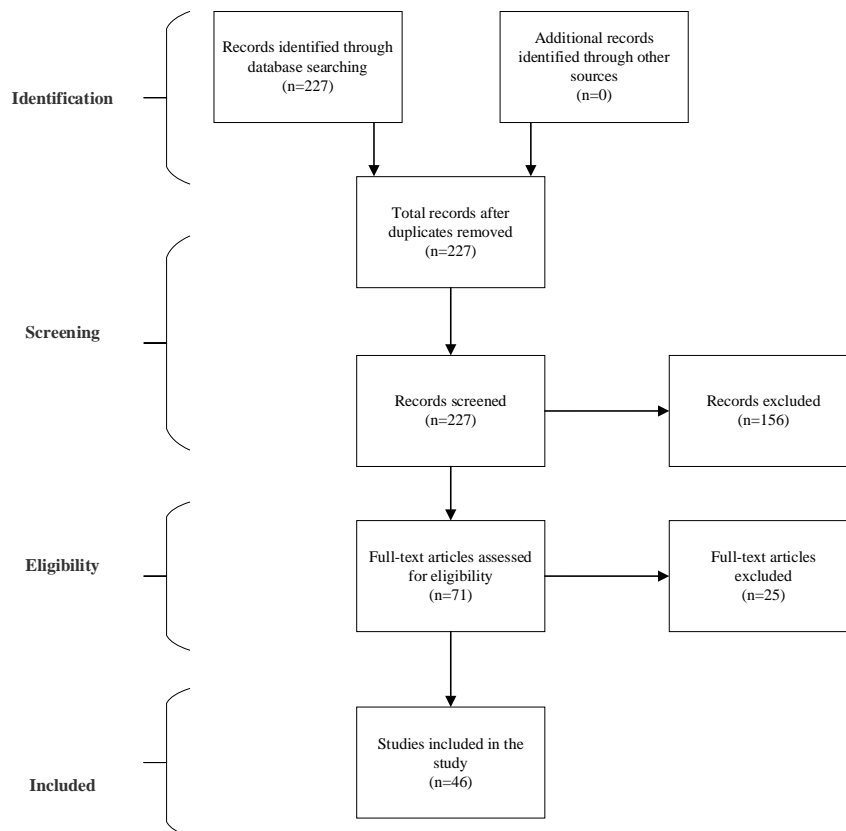


Fig. 1: PRISMA flow diagram of the study selection process

2.4. Literature characteristics and analysis

To fully understand urban pedestrian streets, we carried out a systematic review of a variety of studies. These papers were produced between 2008 and 2024, with the majority being written within the past five years. This suggests that designing street facades has become an increasingly important aspect of contemporary city planning, particularly in relation to sustainability and inclusivity.

The different types of studies included in this analysis are, among others, empirical research, theoretical frameworks or models, and case studies. Empirical works provide insights based on measured data, whereas theories provide frameworks for understanding how streets should be designed. Case studies show real-life applications of these ideas within specific urban settings.

Geographically, there is representation from North America, Europe, and Asia, especially rapidly urbanizing Chinese cities such as Chongqing, but not

limited to them only; other parts of Africa, such as Nairobi, are also featured in some articles that discuss different challenges encountered during the design process depending on location context.

Among the areas covered by the literature are those related to environmental friendliness (sustainability), cultural heritage conservation, and the application of smart methods/technology systems used in designing public spaces. Some notable works recognize the integration of sustainable infrastructures into street design thinking about cultural themes, whereas others consider the integration of advanced technology into streetscape design.

Table 2 summarizes the key features reviewed in the literature according to publication date; type of study; geographical region, which is considered the most often cited location when referring to global trends; and the focus area addressed by each paper analyzed.

Table 2: Summary of literature characteristics and focus areas

Category	Details
Publication years	2008-2024 (notable concentration from 2018-2024)
Types of literature	Empirical studies: Ali and Baper (2023) , Ma et al. (2021) , Mishra and Verma (2020) , Yao et al. (2024) , Andersen et al. (2019) , Fouda et al. (2021) , Gerike et al. (2021) , Jha and Pathak (2021) , Li et al. (2022) , Li et al. (2020) , Tang et al. (2020) , Wang et al. (2020) , Ruiz and Seguí-Pons (2018) , Prebensen et al. (2013) , and Vassallo et al. (2009)
	Theoretical frameworks: Ek et al. (2008) , Moscardo (2009) , Kim (2019) , Vale (2022) , White and Langenheim (2021) , Zipori (2022) , and Harrison-Hill and Chalip (2013) Case studies: Jin (2022) , Chen and Luo (2024) , Mengyuan and Jiawei (2018) , O'Neill (2021) , Patandianan and Shibusawa (2020) , and Edelman and Triantafillou (2012) Master's theses: Dai (2020) , Kadiyam (2021) , and O'Neill (2021) Doctoral dissertations: Zipori (2022) Practical guides: MacMillan et al. (2019) and Cooper et al. (2018)
Geographical focus	North America: John et al. (2022) , O'Neill (2021) , Zipori (2022) , Cooper et al. (2018) , and MacMillan et al. (2019) Europe: Vassallo et al. (2009) , Prebensen et al. (2013) , Gerike et al. (2021) , Ruiz and Seguí-Pons (2018) , Henriksson et al. (2021) , Ek et al. (2008) , Andersen et al. (2019) , Fouda et al. (2021) , and Kadiyam (2021)
	Asia (China, Indonesia): Chen and Luo (2024) , Yao et al. (2024) , Mengyuan and Jiawei (2018) , Li et al. (2020) , Li et al. (2022) , Tang et al. (2020) , Ma et al. (2021) , and Patandianan and Shibusawa (2020) Middle East: Kordi and Galal Ahmed (2023) Global: Harrison-Hill and Chalip (2013) , Moscardo (2009) , Vale (2022) , White and Langenheim (2021) , and Wang et al. (2020) Sustainability: Mishra and Verma (2020) , Vassallo et al. (2009) , Henriksson et al. (2021) , Prebensen et al. (2013) , and Wang et al. (2020)
Main focus areas	Cultural preservation: Li et al. (2020) , Mengyuan and Jiawei (2018) , Chen and Luo (2024) , and Jin (2022) Smart technologies: Li et al. (2021) , Andersen et al. (2019) , and O'Neill (2021)
	Tourism and public space: Ek et al. (2008) , Moscardo (2009) , Patandianan and Shibusawa (2020) , Yuan and Marzuki (2024) , and Harrison-Hill and Chalip (2013) Streetscape identity and livability: Ali and Baper (2023) , Fouda et al. (2021) , Gerike et al. (2021) , Ma et al. (2021) , and Edelman and Triantafillou (2012)

3. Findings

3.1. Core elements of streetscape optimization

Urban planning cannot overlook streetscape optimization—an effort aimed at improving the visual attractiveness, usability, and quality of urban spaces for drivers, walkers, and cyclists ([Gerike et al., 2021](#)). There are several key factors of successful optimization in any city pedestrian environment, including landscape analysis, task mapping, trajectory optimization, and shape optimization ([Ma et al., 2021](#)). These components ensure that street designs are not only beautiful but also sustainable and functional. To optimize streetscapes, one must analyze the streetscape. This should be done systematically, as proposed by [Tang et al. \(2020\)](#), who suggested employing advanced technologies in

comprehending and improving street landscapes. For example, researchers from Dujiangyan City in China have used street view image recognition combined with Python and ArcGIS to capture panoramic images that provide insights into the urban scape of the city itself. New York has also adopted this approach, where street-level imagery is used during the evaluation stage to identify how best these spaces can be improved while considering all user needs, including tourists' perceptions of them ([Kadiyam, 2021](#)). However, while these technologies have demonstrated potential, there is a lack of research addressing the integration of users' real-time feedback during the optimization process. Future research could focus on incorporating real-time pedestrian data to improve streetscape responsiveness and inclusivity. Task mapping is another way of optimizing streetscapes, as shown by

Wang et al.'s (2020) work on the WAANSO framework. They used wavelet clustering integrated with the ant swarm optimization technique, which shows how tasks can be mapped onto different parts of an area, thereby making more functional streets or public spaces out of it. Tokyo applied this effectively, where planners used task mapping methods for optimizing allocation within congested areas, leading to a better flow of pedestrians and reducing traffic jams caused by cars moving slowly due to heavy congestion.

Although task mapping shows promise in enhancing streetscape functionality, there remains a gap in understanding the long-term effects of such optimization on pedestrian behavior and congestion patterns. Future research should consider longitudinal studies to evaluate the sustainability of these optimization techniques.

Trajectory optimization plays a critical role in managing pedestrian flow and vehicle movement effectively in streetscape design. In Singapore, trajectory optimization algorithms have been implemented to manage the pedestrian flow and vehicle movement in real-time, ensuring smooth transitions and reducing bottlenecks (Andersen et al., 2019). Despite these successes, further investigations are needed to assess the adaptability of such algorithms to varying environmental conditions, such as changing weather or unexpected surges in pedestrian density. This highlights a research opportunity to increase the flexibility of trajectory optimization models to account for unpredictable urban dynamics.

Shape optimization also significantly improves streetscaping. Research by Jha and Pathak (2021) on fuzzy-based integrated zero-order shape optimization techniques for structural elements, such as steel-concrete-steel sandwich beams, demonstrated this. In Dubai, shape optimization methods, including pedestrian walkways connecting Burj Khalifa with other parts of the downtown area (Kordi and Galal Ahmed, 2023), were used during construction stages to achieve aesthetic appeal and structural integrity at the same time. While shape optimization has demonstrated effectiveness in enhancing both aesthetics and functionality, a critical gap remains in evaluating user satisfaction with these optimized designs. Future research could benefit from assessing the public perception of shape-optimized structures to ensure that both aesthetic and functional goals are met in urban streetscapes. Overall, while streetscape optimization incorporates various advanced techniques, such as landscape analysis, task mapping, trajectory optimization, and shape optimization, the current literature lacks comprehensive critical analysis regarding their long-term impacts and adaptability to diverse urban settings. Addressing these gaps through empirical research, particularly focusing on user feedback and adaptability, could guide future urban streetscape designs to be more resilient, inclusive, and effective in meeting the needs of both residents and tourists.

3.2. Addressing resident needs

Streets are the best way to meet the specific needs of city dwellers and foster their environmental and mental well-being. The integration of environment-enhancing elements that promote urban sustainability as well as resilience is one key consideration in designing streetscapes. Mishra et al. (2020) noted the necessity for bioretention filter basins in parking lots, along roads, and throughout streetscapes for storing and purifying stormwater runoff in cities. This approach is particularly applicable to Chongqing, which has high precipitation due to its hilly topography. By incorporating bioretention systems into street landscaping approaches, authorities can lower waterlogging risk in addition to preventing flash floods, thus making such places safer for people living there (Edelman and Triantafyllou, 2012). However, further research is needed to assess the long-term maintenance and effectiveness of bioretention systems in different urban contexts. Understanding these aspects could help optimize the design and implementation of stormwater management solutions across various cities.

In addition to environmental concerns, the social and health needs of vulnerable people should also be considered when planning streetscapes. One way of doing this is to involve homeless persons themselves during the formulation stages of health interventions within these spaces. Although this approach promotes inclusivity, there is a lack of empirical evidence on the impact of involving vulnerable groups during the planning phase. Future studies should focus on evaluating the outcomes of such participatory planning approaches to better understand their effectiveness in improving social equity. Hence, even rapidly growing metropolises such as Chongqing, where some communities face eviction because they may offer the required services alongside easily accessible public areas, thereby fostering equality among different societal classes while at the same time improving overall welfare indicators for all residents (Vale, 2022).

Moreover, closeness together with community linkage forms part of any good street design, especially when considering people who prefer staying in closer home areas, whereas Henriksson et al. (2021) noted that the streetscape must focus on accessibility enhancement ideas, particularly in socially deprived neighborhoods within cities such as ours. Further research is required to comprehend the distinct accessibility obstacles encountered by inhabitants in these neighborhoods and to formulate customized solutions that effectively address these challenges. Another example relates to what Yao et al. (2024) proposed concerning the creation of pedestrian-friendly environments around metro stations since these environments directly affect local connections by residents within Chongqing city limits. Despite the benefits of such initiatives, there is limited research on the long-term impact of pedestrian-friendly environments on community

cohesion and local businesses. Future studies could investigate these aspects to provide a more comprehensive understanding of the broader benefits of streetscape improvements.

In fact, there is a need to develop street designs that enable individuals to access various nearby facilities, as proposed in the Jiulongpo District renewal project, so that they can serve their purpose well and make them more usable daily, which leads to liveability enhancement within urban environments. This is because light studies carried out at Chongqing University show that good outdoor space design, including lighting, can improve both psychological and visual perceptions, thus making the overall experience much better for those people who spend time within such settings (Huang et al., 2024). However, more empirical studies are needed to explore how different lighting designs specifically influence psychological well-being across diverse demographic groups.

In conclusion, streetscapes have immense potential when optimized to meet the multiple needs of dwellers by incorporating environmental features for sustainability and adopting an inclusive approach during planning, especially for disadvantaged groups, in addition to promoting simple connections between different parts of a locality. Future research should focus on the long-term impacts of these design interventions, including their effects on community well-being, social equity, and resilience, to ensure that streetscapes effectively serve all residents.

3.3. Enhancing tourist experience

A critical part of urban design and destination management is the optimization of streetscapes for a better tourist experience in a locality; this implies creating an environment where the differentiating features of a place are seamlessly mixed with activities that attract and involve visitors. Scholars say that everything about tourism reflects this place, whereas Harrison-Hill and Chalip (2005) described how sports marketing can be used along with destination promotion to increase its attractiveness, which means that there should also be spaces provided for such games within street designs. On the other hand, according to Ek et al. (2008), who talk from a dynamic systems theory perspective towards understanding the tourist experience as a time-space performance within an economy based on events, well-designed streetscapes will offer opportunities for visitors' active involvement through well-signed routes showing various points capable of entertaining people throughout their stay there or until they decide to leave again. Despite this, a deficiency exists in assessing the efficacy of including sports and energetic activities in streetscape design. Future research may examine the direct effects of these activities on visitor engagement and satisfaction, yielding empirical support for their integration into urban planning.

In addition, Hongyadong transformed neighborhoods such as these into vibrant commercial complexes where traditional architectural values were combined with contemporary needs, thereby attracting both domestic and international travelers alike, who may wish to savor some cultural context during their trips (Mengyuan and Jiawei, 2018; Jin, 2022). This example serves as evidence supporting my argument that successful street scaping involves reflecting upon the cultural diversity embedded within physical settings to help foster socioeconomic development through increased arrivals at places that act as magnets for tourists. Nonetheless, the long-term sustainability of these transformed neighborhoods, in terms of maintaining cultural authenticity while catering to tourist demands, remains underexplored. Future studies should focus on balancing cultural preservation with commercial interests to ensure sustainable development.

Optimization can also be based on mindfulness theory since it provides insights into making tourist experiences most meaningful. Prebensen et al. (2013) argued that value cocreation is what makes an experience memorable or satisfying; hence, personal service delivered by staff together with the environment around facilities should be considered when designing them. Therefore, such structures require high levels of social interaction among people from different backgrounds who may not know each other but share a common interest in visiting those sites. Moscardo (2009) argued that if visitors are more aware of where they are through design, then sustainable tourism development can be achieved by ensuring that there is enough space for leisure activities such as parks and other recreational areas within street designs. However, more empirical research is needed to determine the specific elements of design that effectively foster mindfulness and value co-creation. Future research could also examine how different demographic groups experience mindfulness in these spaces, leading to more targeted design strategies.

Another thing that must not be ignored during the transformation process is the integration of cultural aspects into streetscape architecture since they form part of enrichment program elements aimed at achieving desirable levels of scenic attraction value among places frequented by tourists. Li et al. (2020) showed that public facilities should be intelligently designed based on local culture to improve the service quality levels offered in scenic spots. By doing so, it becomes possible for visitors to feel a sense of authenticity while being immersed in different cultures, thereby making their stay memorable too. Despite these findings, there remains a gap in understanding tourists' perceptions of cultural authenticity and how it impacts their overall experience. Future research could benefit from surveys or interviews with tourists to evaluate their perspectives on authenticity and cultural immersion.

Moreover, Yuan and Marzuki (2024) conducted research on historical theme parks and discovered several factors affecting the tourist experience, such as the motivation behind going there and the satisfaction gained from services rendered during the visitation period coupled with quality customer care, among others. These findings indicate that meeting expectations through optimization may increase satisfaction, leading to positive post-trip behavior. However, the long-term impact of such optimization on repeat visitation and word-of-mouth promotion remains unclear. Further research could explore these aspects to determine the effectiveness of different optimization strategies in promoting sustainable tourism growth.

In general terms, therefore, the optimization process involves multilayered approaches when dealing with cultural components, value cocreation, mindfulness, and, finally, event integration into place-specific activities centered around its unique features. Urban planners need to take note of all these things so that any plan takes care of them to develop an attractive street environment capable of entering many people who wish to pass by or stay longer hours before leaving again. To achieve this goal, future research should focus on identifying best practices for integrating these components into streetscape design while also addressing the gaps in empirical evidence related to their long-term impacts on tourist behavior and satisfaction.

3.4. Balancing resident and tourist requirements

Creating sustainable and harmonious urban environments requires balancing the needs of residents with those of tourists in streetscape design. The problem is ensuring that both groups are served by streetscapes adequately, where they provide living spaces for locals as well as provide visitors with an exciting experience. Many studies have shown that this can be achieved by considering economic, social, and ecological aspects during planning stages, among others. For example, Vassallo et al. (2009) employed energy synthesis to evaluate sustainability in an Italian coastal zone by considering all subsystems, including those affecting both groups. This method emphasizes the creation of environmentally sustainable streetscapes that are socially inclusive and benefit the entire community. However, there is a need for further empirical research on the applicability of energy synthesis in diverse urban contexts, particularly in terms of balancing the needs of both residents and tourists. Future studies could focus on adapting this approach to other cities to determine its effectiveness in promoting balanced streetscape development.

The transportation infrastructure is an aspect of streetscape design that must serve residents equally well as tourists do. Ruiz et al. (2017) proposed a way of evaluating public bus demand vis-à-vis their needs, among other things, such as dual attention to transport, which highlights the need for an intuitive and friendly street environment from a local resident

perspective while at the same time being convenient and accessible from an international visitor's point of view so that cities can integrate various options to enhance connectivity among different modes, thereby improving the overall urban travel experience. Given these insights, further research is necessary to investigate the long-term effects of transit infrastructure enhancements on local happiness and the visitor experience. Subsequent research should assess the impact of developing technologies, including intelligent transit systems, on the effective equilibrium of transportation requirements.

Efforts aimed at enhancing walkability also contribute greatly to addressing the needs of both residents and tourists within any given locality or city setting. Walkability is a good practice example of how the best streetscapes can be designed with consideration not only for locals but also for outsiders, who may visit such places. Improving pedestrian pathways coupled with creating safe, attractive streetscapes encourages frequent use by citizens, thereby making the municipality more people-friendly even while making it easily reachable and enjoyable for non-residents, which is further supported through initiatives such as those suggested by Patandianan and Shibusawa (2020), who allocate substantial funds to upgrading streetscaping so that they become functional aesthetic public spaces. However, a critical gap remains in understanding the impact of improvements in walkability on economic outcomes for local businesses and overall social cohesion within neighborhoods. Future research should explore how walkability initiatives influence local economies and community well-being.

In addition, retail/commercial activities must be considered when streetscapes are designed to cater to the needs of both residents and tourists. John et al. (2022) stressed the importance of maintaining a balance between chain stores and local businesses so that both groups are served adequately; cities can have mixed retail options within their street environments by meeting demands from locals, who rely heavily on neighborhood services while simultaneously creating unique shopping experiences that attract international visitors. Similarly, Mayor Adams's reforms aimed at ensuring vibrancy and economic diversity along streets through street vendors' rights protection while still taking care of brick-and-mortar establishments. Despite these efforts, there is limited research on the effectiveness of mixed retail strategies in fostering economic resilience while ensuring equitable access for residents and tourists. Future studies should consider assessing the impacts of different retail compositions on community satisfaction and tourist attraction. Moreover, tourism development authorities such as the Buncombe County Tourism Development Authority always insist on considering residents' requirements during any streetscape planning process. Communities desire a sense of belonging to their surroundings; therefore,

enhancing their livability necessitates collaboration with individuals with diverse priorities, resulting in the development of vibrant, sustainable streets that cater to the needs of visitors as well. However, more empirical research is needed to understand the specific mechanisms through which community collaboration influences the success of streetscape projects. Future research should focus on evaluating different models of resident engagement and their effectiveness in creating balanced, sustainable streetscapes.

3.5. Best practices in streetscape optimization

One of the main ideas of streetscape optimization is walkability. Studies have shown time and again that areas designed for pedestrians are livelier because they encourage walking as the main mode of transport in cities. For example, transit-oriented development research highlights the need to create spaces around public transport nodes that support walking as a means of reducing reliance on private cars and promoting healthy living (Yao et al., 2024). Widening sidewalks, improving street lighting, and ensuring safe pedestrian crossings can make streets more accessible and attractive to both locals and visitors alike. Another important part of optimizing streetscapes is green infrastructure. This means that along with trees, bioswales or permeable pavements should also be included in streetscapes; this will not only make them look beautiful but also help cities deal with storms by managing runoff and reducing urban heat islands (Mishra and Verma, 2020). The best method would be to incorporate natural elements into design while providing places where people can relax within them, thus achieving environmental sustainability. Despite these benefits, more empirical evidence is needed to understand the long-term effectiveness of different green infrastructure elements in diverse urban settings. Future research should focus on quantifying the environmental and social benefits of green streetscapes to support broader adoption.

Cultural preservation and identity creation need to be considered when streetscapes are optimized. Streets represent local traditions and histories, so some aspects should be adopted that preserve these unique characteristics of places (Fouda et al., 2021). For example, traditional architectural styles can be fused with public art installations or historical landmarks so that residents can identify themselves with such spaces while visitors find them attractive (Li et al., 2020). Therefore, good practice in this regard involves working closely together with communities during design processes where their input forms an integral part of what is implemented along any given street plan. However, there is a gap in understanding how community input specifically affects cultural preservation and overall satisfaction with streetscape design. Future research could investigate the impact of different levels of community involvement on cultural sustainability and streetscape success.

Community involvement is crucial to successful streetscape optimization. The idea here is that if people are involved right from the beginning when different sections within city limits are being constructed, then their needs will always be met during the planning and designing stages. By doing so, it creates, among citizens, a sense of ownership towards those developments, which eventually leads to the development of more imaginative designs that cater to various parts. The ways through which communities can participate include organizing public forums for consultation purposes, holding workshops aimed at capacity building, and hosting joint sessions to develop better ideas on how to improve streetscapes (White and Langenheim, 2021). Despite these approaches, there remains a lack of empirical evidence on the most effective community engagement strategies for streetscape projects. Future research should explore the specific methods of community engagement that lead to higher levels of public satisfaction and more successful outcomes.

Smart technologies should also be included in streetscape designs, as they greatly improve functionality, safety, and adaptability in urban environments. An intelligent streetscape refers to one that is equipped with cutting-edge features such as smart lights, dynamic traffic controls, or real-time transportation information that responds dynamically to the changing needs of modern cities (Li et al., 2020). In addition to improving the user experience, these innovations also foster the efficient use of resources. For example, the application of Industry 4.0 technologies such as IoTs and big data analytics coupled with cloud computing makes continuous monitoring plus timely decision-making on street use based on traffic volume and environmental conditions possible (Zhang et al., 2021). Furthermore, intelligent infrastructures, including automated traffic controls, together with smart monitoring systems, allow for effective management of different parts of urban spaces, thus ensuring that streetscapes remain operative under all circumstances (Wang and Chen, 2021). However, the implementation of these technologies often faces challenges related to cost, maintenance, and public acceptance. Future research should focus on evaluating the cost-effectiveness and social acceptance of smart streetscape technologies in different urban contexts to ensure their broader adoption and sustainability.

Hence, during streetscape processes, it would be best practice to exploit these latest advancements to create environments that are not only adaptive but also sustainable in view of wider city resilience objectives.

3.6. Framework for optimizing urban streetscapes

As shown in Fig. 2, the proposed framework is constructed by synthesizing the findings from the systematic literature review and identifying five key

components that urban planners and policymakers should consider.

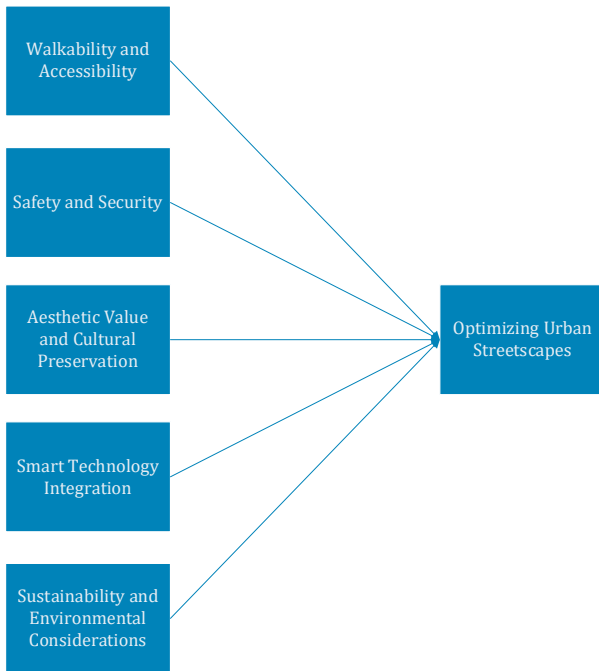


Fig. 2: Framework for optimizing urban streetscapes

Walkability and accessibility form the foundation of an optimized streetscape, ensuring that pedestrians can navigate comfortably and safely. Designing walkable streetscapes not only improves residents' quality of life but also enhances their experiences as they explore urban areas. By making spaces accessible to all, including individuals with disabilities, urban planners can create more inclusive environments that accommodate diverse user groups.

Another crucial component is safety and security, which significantly affects the perception of comfort for both residents and tourists. The inclusion of safety measures, such as adequate street lighting, well-designed paths, and emergency facilities, can help create a secure environment. Security measures, such as surveillance systems and the strategic layout of pathways, help minimize potential conflicts, making streetscapes more attractive and welcoming for all users.

Aesthetic value and cultural preservation also play important roles in optimizing urban streetscapes. Streetscapes must incorporate aesthetic elements that reflect the local cultural heritage, which enhances the appeal for tourists while fostering a sense of identity for residents. Urban design should incorporate cultural markers, local architectural styles, and historical landmarks, thus providing both residents and tourists with a visually appealing and meaningful environment that celebrates local culture.

The integration of smart technologies is another key component of the proposed framework. The use of smart technologies, such as interactive maps, smart lighting, and responsive infrastructure, can improve the functionality and adaptability of

streetscapes. These technologies enhance the pedestrian experience by providing real-time information, dynamic traffic management, and responsive environments that cater to varying user needs. This technology-driven approach contributes to creating public spaces that are not only more efficient but also future-proof.

Sustainability and environmental considerations are fundamental to creating resilient urban streetscapes. Integrating green infrastructure, such as bioswales, permeable pavements, and vegetation, helps mitigate environmental impacts while promoting healthier public spaces. Sustainable design principles contribute to creating streetscapes that are environmentally friendly and capable of overcoming the challenges posed by climate change. By prioritizing these elements, urban planners can foster resilience and ensure the long-term usability of public spaces.

By applying these components in streetscape design, urban environments can become more inclusive, adaptable, and appealing to all users.

4. Discussion

The outcomes of this audit show the convoluted connection between different design components in optimizing metropolitan people on foot streetscapes for both inhabitants and sightseers. The improvement of the streetscape concerns not only excellence but also capacity, security, and ecological support. Scene examination, task mapping, trajectory optimization, and shape optimization are among the central points of streetscape improvement featured in this survey; this demonstrates that it is vital to take a gander at things comprehensively to make these territories appealing, usable, and versatile for various urban needs. For example, while a scene examination is being performed, advancements such as road-see picture acknowledgment can be utilized (Tang et al., 2020) or the use of errand planning systems in thickly populated urban territories (Wang et al., 2020), which underpins the joining of innovation into the configuration process to address exceptional difficulties experienced by cutting-edge cities.

It is also important to focus on residents' needs when optimizing streetscapes. This involves the inclusion of green infrastructure such as bio-reference filter basins designed for stormwater management systems (Mishra et al., 2020); moreover, increasing proximity along with connectivity in socially deprived areas within residential zones should always be considered during the design phase (Henriksson et al., 2021). These features not only promote environmental sustainability but also enhance psychological health among city dwellers, especially those living in fast-growing towns such as Chongqing.

Designing with tourists' experience at heart is also equally important because it helps create attractive spaces that draw visitors into them. A case study on the Hongyadong area located in Chongqing

city has shown how cultural elements together with architectural design can be merged successfully, thus turning such places into tourist attractions where traditional and modern aspects blend seamlessly, creating memorable encounters for all the people involved (Mengyuan and Jiawei, 2018; Jin, 2022). This reveals the wider relevance of integrating cultural identity and mindfulness during the streetscape planning process about improving guest participation in such events.

However, it is not easy to strike a balance between what local people want and expect from their neighborhoods and those things that visitors may be looking for while touring different parts of town or city. According to this review, economic, social, and environmental considerations must all be considered if harmonious urban environments are to be created that cater to both groups equally well. Therefore, best practices such as having transportation infrastructure serving dual purposes, i.e., residents' needs plus catering for tourists' convenience (Ruiz et al., 2017), demonstrate how cities can achieve this through careful thoughtfulness in terms of planning and design stages.

Finally, smartness should also come into play during streetscape development because everything has become digital; hence, the need arises to make use of these innovations within our surroundings too. The utilization of industry four-point zero technologies characterized by intelligent systems that employ the IoT together with cloud computing is mandatory if responsive, adaptable urban settings have been built (Zhang et al., 2021; Wang and Chen, 2021). Such advancements not only increase functionality or safety levels within streetscapes but also contribute greatly to long-term sustainability, in addition to being able to withstand any future changes that may arise.

In summary, optimizing metropolitan pedestrian streetscapes requires a comprehensive approach that integrates environmental sustainability, cultural preservation, smart technologies, and community involvement. By addressing the needs of both locals and tourists, we can create vibrant, functional, and resilient streets that enrich urban life.

5. Conclusion

The multifaceted nature of optimizing an urban pedestrian streetscape is a challenge that necessitates the consideration of residents' and tourists' needs alike. This study therefore emphasizes the need to integrate key components such as landscape analysis, task mapping, trajectory optimization, and shape optimization to create not only visually appealing but also functional and sustainable streetscapes. For residents, streetscapes should provide easily reachable safe spaces that enhance daily activities as well as environmental sustainability. On the other hand, for tourists, the streetscape ought to be culturally rich, with aesthetic

environments that contribute to memorable experience creation.

Striking a balance between locals' and visitors' requirements is vital for ensuring harmony within cities while promoting their long-term development prospects through sustainable means. This can be done by incorporating green infrastructure, preserving culture, and using smart technology, which adjusts itself according to different needs generated by these dynamic modern-day metropolises, among others, into design processes on the basis of best practices adopted globally over time, indicating how well-planned street layouts have increased walkability, thereby increasing connectivity and thus fostering a sense of belonging not only among community members but also among outsiders, who might be passing through such areas.

To summarize, three words are very important for future tourism in any city: optimizing the streetscape. With the rapid increase in the urban population, city planners must now consider various factors, including environmental concerns, social dynamics, and technological advancements such as smart buildings, when designing cities. This includes giving careful thought to streetscapes, as they are the primary spaces where people spend a significant amount of time during weekdays, engaging in various activities or socializing.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- Ali AS and Baper SY (2023). Assessment of livability in commercial streets by placemaking. *Sustainability*, 15(8): 6834. <https://doi.org/10.3390/su15086834>
- Andersen H, Alonso-Mora J, Eng YH, Rus D, and Ang MH (2019). Trajectory optimization and situational analysis framework for autonomous overtaking with visibility maximization. *IEEE Transactions on Intelligent Vehicles*, 5(1): 7-20. <https://doi.org/10.1109/TIV.2019.2955361>
- Chen Z and Luo H (2024). Research on the enhancement of chongqing cyberpunk cultural tourism experience under the background of culture and tourism integration. *Proceedings of Business and Economic Studies*, 7(3): 140-148. <https://doi.org/10.26689/pbes.v7i3.7482>
- Cooper C, Booth A, Varley-Campbell J, Britten N, and Garside R (2018). Defining the process to the literature searching in systematic reviews: A literature review of guidance and supporting studies. *BMC Medical Research Methodology*, 18: 85. <https://doi.org/10.1186/s12874-018-0545-3>
PMid:30107788 PMCID:PMC6092796
- Dai A (2020). Designing future streetscapes using interactive design to integrate autonomous vehicles into urban street. M.Sc. Thesis, University of Georgia, Athens, USA.
- Edelman DJ and Triantafyllou M (2012). A case study of environmentally sensitive planning and urban design in

- provincial China. *Theoretical and Empirical Studies in Urban Management*, 7(2): 22-66.
- Ek R, Larsen J, Hornskov SB, and Mansfeldt OK (2008). A dynamic framework of tourist experiences: Space-time and performances in the experience economy. *Scandinavian Journal of Hospitality and Tourism*, 8(2): 122-140. <https://doi.org/10.1080/15022250802110091>
- Fouda S, Farghaly T, and Ayad H (2021). Enhancing identity through streetscape composition. In the 26th International Conference on Urban Development, Regional Planning and Information Society, CORP-Competence Center of Urban and Regional Planning, Vienna, Austria: 325-336.
- Gerike R, Koszowski C, Schröter B, Buehler R, Schepers P, Weber J, Wittwer R, and Jones P (2021). Built environment determinants of pedestrian activities and their consideration in urban street design. *Sustainability*, 13(16): 9362. <https://doi.org/10.3390/su13169362>
- Harrison-Hill T and Chalip L (2013). Marketing sport tourism: Creating synergy between sport and destination. In: Gibson HJ (Ed.), *Sport tourism*: 170-188. Routledge, Oxfordshire, UK.
- Henriksson M, Berg J, Lindkvist C, and Lucas K (2021). Questioning mobility ideals—the value of proximity for residents in socially deprived urban areas in Sweden. *Mobilities*, 16(5): 792-808. <https://doi.org/10.1080/17450101.2021.1947134>
- Huang H, Zhang B, Cheng J, and Sun Y (2024). Psychological and visual perception of campus lightscapes based on lightscape walking evaluation: A case study of Chongqing University in China. *Buildings*, 14(3): 753. <https://doi.org/10.3390/buildings14030753>
- Jha I and Pathak KK (2021). Fuzzy-based integrated zero-order shape optimization of steel-concrete-steel sandwich beams. *Current Science*, 121(7): 941-949. <https://doi.org/10.18520/cs/v121/i7/941-949>
- Jin Y (2022). Urban verticality shaped by a vertical terrain: Lessons from Chongqing, China. *Urban Planning*, 7(4): 364-376. <https://doi.org/10.17645/up.v7i4.5810>
- John S, Winkler MR, Kaur R, DeAngelo J, Hill AB, Sundermeir SM, Colon-Ramos U, Leone LA, Dombrowski RD, Lewis EC, and Gittelsohn J (2022). Balancing mission and margins: What makes healthy community food stores successful. *International Journal of Environmental Research and Public Health*, 19(14): 8470. <https://doi.org/10.3390/ijerph19148470>
PMid:35886315 PMCID:PMC9315622
- Kadiyam P (2021). Crime rate prediction from street view images using convolutional neural networks and transfer learning. M.Sc. Thesis, University of Twente, Enschede, Netherlands.
- Kim SK (2019). Landscape with pedestrian-oriented streetscape design. In: Silva K (Ed.), *The Routledge handbook on historic urban landscapes in the Asia-Pacific*. Routledge, Oxfordshire, UK.
- Kordi AO and Galal Ahmed K (2023). Towards a socially vibrant city: Exploring urban typologies and morphologies of the emerging "CityWalks" in Dubai. *City, Territory and Architecture*, 10(1): 34. <https://doi.org/10.1186/s40410-023-00221-5>
- Li C, Li P, and Huang X (2022). Liked and disliked streetscape imagery: Relation to emotional motivation and block distribution from tourist bus visitors. *Sage Open*, 12(3). <https://doi.org/10.1177/21582440221117129>
- Li C, Yao X, and He F (2020). Intelligent design of public facilities in Jiangxi Longhu Mountain based on Taoist culture. In the International Conference on Intelligent Design, IEEE, Xi'an, China: 253-256. <https://doi.org/10.1109/ICID52250.2020.00060>
- Li Z, He Y, Lu X, Zhao H, Zhou Z, and Cao Y (2021). Construction of smart city street landscape big data-driven intelligent system based on Industry 4.0. *Computational Intelligence and Neuroscience*, 2021: 1716396. <https://doi.org/10.1155/2021/1716396>
PMid:34950197 PMCID:PMC8691993
- Ma X, Ma C, Wu C, Xi Y, Yang R, Peng N, Zhang C, and Ren F (2021). Measuring human perceptions of streetscapes to better inform urban renewal: A perspective of scene semantic parsing. *Cities*, 110: 103086. <https://doi.org/10.1016/j.cities.2020.103086>
- MacMillan F, McBride KA, George ES, and Steiner GZ (2019). Conducting a systematic review: A practical guide. In: Liamputtong P (Ed.), *Handbook of research methods in health social sciences*: 805-826. Springer, Singapore, Singapore. https://doi.org/10.1007/978-981-10-5251-4_113
- Mengyuan Z and Jiawei L (2018). The exploration and application of urban profile in city analysis, illustrated by the case of Chongqing. In the 24th ISUF International Conference, Book of Papers, Editorial Universitat Politècnica de València, Valencia, Spain: 139-146. <https://doi.org/10.4995/ISUF2017.2017.4800>
- Mishra A, Gupta B, Kumar N, Singh R, Varma A, and Thakur IS (2020). Synthesis of calcite-based bio-composite biochar for enhanced biosorption and detoxification of chromium Cr (VI) by *Zhihengliuella* sp. *ISTPL4. Bioresource Technology*, 307: 123262. <https://doi.org/10.1016/j.biortech.2020.123262>
PMid:32247278
- Mishra SS and Verma VK (2020). Design of bioretention filter basin for conservation and purification of storm water runoff in urban areas. *International Journal of Recent Technology and Engineering*, 9(4): 289-294. <https://doi.org/10.35940/ijrte.D5011.119420>
- Moscardo G (2009). Understanding tourist experience through mindfulness theory. In: Kozak M and Decrop A (Eds.), *Handbook of tourist behavior: Theory and practice*: 99-115. Volume 16, Routledge, Oxfordshire, UK. <https://doi.org/10.4324/9780203881804.pt4>
- O'Neill T (2021). Flexible fixtures: An exploratory study on the emergence and mobilization of the flexible streets concept in Ontario municipalities. M.Sc. Thesis, University of Waterloo, Waterloo, Canada.
- Patandianan MV and Shibusawa H (2020). Importance and performance of streetscapes at a tourism destination in Indonesia: The residents' perspectives. *Frontiers of Architectural Research*, 9(3): 641-655. <https://doi.org/10.1016/j.foar.2020.05.006>
- Prebensen NK, Vittersø J, and Dahl TI (2013). Value cocreation significance of tourist resources. *Annals of Tourism Research*, 42: 240-261. <https://doi.org/10.1016/j.annals.2013.01.012>
- Ruiz M and Seguí-Pons JM (2018). Diagnostic of the balance and equity of public transport for tourists and inhabitants. In: Žak J, Hadas Y, and Rossi R (Eds.), *Advanced concepts, methodologies and technologies for transportation and logistics*: 220-236. Volume 572, Springer International Publishing, Berlin, Germany. https://doi.org/10.1007/978-3-319-57105-8_10
- Ruiz M, Seguí-Pons JM, and Mateu-LLadó J (2017). Improving bus service levels and social equity through bus frequency modelling. *Journal of Transport Geography*, 58: 220-233. <https://doi.org/10.1016/j.jtrangeo.2016.12.005>
- Tang X, Zhang L, Chen Z, Wan J, and Li L (2020). Urban street landscape analysis based on street view image recognition. In the International Conference on Urban Engineering and Management Science, IEEE, Zhuhai, China: 145-150. <https://doi.org/10.1109/ICUEMS50872.2020.00040>
- Vale LJ (2022). *Just urban design: The struggle for a public city*. MIT Press, Cambridge, USA.
- Vassallo P, Paoli C, Tilley DR, and Fabiano M (2009). Energy and resource basis of an Italian coastal resort region integrated using energy synthesis. *Journal of Environmental*

- Management, 91(1): 277-289.
<https://doi.org/10.1016/j.jenvman.2009.08.017>
PMid:19783358
- Wang LJ and Chen MH (2021). Nonlinear impact of air quality on tourist arrivals: New proposal and evidence. *Journal of Travel Research*, 60(2): 434-445.
<https://doi.org/10.1177/0047287519899993>
- Wang X, Xi J, Wang Y, Bogdan P, and Nazarian S (2020). An efficient task mapping for manycore systems. In the IEEE International Symposium on Circuits and Systems, IEEE, Seville, Spain: 1-4.
<https://doi.org/10.1109/ISCAS45731.2020.9181267>
- White M and Langenheim N (2021). A ladder-truss of citizen participation: Reimagining Arnstein's ladder to bridge between the community and sustainable urban design outcomes. *Journal of Design Research*, 19(1-3): 155-183.
<https://doi.org/10.1504/JDR.2021.121067>
- Yao C, Li G, and Yan S (2024). Design strategies to improve metro transit station walking environments: Five stations in Chongqing, China. *Buildings*, 14(4): 1025.
<https://doi.org/10.3390/buildings14041025>
- Yuan L and Marzuki A (2024). What keeps historical theme park visitors coming? Research based on expectation confirmation theory. *Frontiers in Psychology*, 15: 1293638.
<https://doi.org/10.3389/fpsyg.2024.1293638>
PMid:38487662 PMCID:PMC10937583
- Zhang C, Chen Y, Chen H, and Chong D (2021). Industry 4.0 and its implementation: A review. *Information Systems Frontiers*, 26: 1773-1783. <https://doi.org/10.1007/s10796-021-10153-5>
- Zipori E (2022). The future of the urban street in the United States: Visions of alternative mobilities in the twenty-first century. Ph.D. Dissertation, New Jersey Institute of Technology, Newark, USA.