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"Warning in Spaces: Blending Heritage, Nature and Design"

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"Harmony in Spaces : Blending Heritage, Nature and Design"

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Urban Walkability and Resilience: An Assessment Of Climate-Responsive Public Spaces in Pasar Karat (Loken) Ipoh, Perak

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Abstract

In light of growing urban heat and social vulnerabilities, it is becoming more widely acknowledged that urban walkability and resilience are essential to building livable, climate-responsive cities. Although general urban centres have been the subject of much research, little is known about how traditional markets, such as Pasar Karat (Loken) in Ipoh, can be developed and modified to become resilient, walkable public areas that successfully address local climate and community needs. "In this study, we wanted to find out how the public spaces in Pasar Karat (Loken), Ipoh, can be assessed and improved through climate-responsive design to enhance urban walkability and resilience." We used a mixed-method approach to evaluate urban walkability and resilience in Pasar Karat (Loken), Ipoh, combining structured questionnaires with on-site observations, pedestrian counts, and microclimate measurements. This enabled us to record visitors' impressions of the area while assessing social interactions, accessibility, and thermal comfort. We were able to pinpoint the market's climate-responsive design's main advantages and disadvantages by combining empirical data with community input. According to our assessment, Pasar Karat (Loken) fosters lively social interaction and cultural identity, but the public areas are extremely susceptible to heat stress, with surface temperatures recorded there typically being 3–4°C warmer than in shaded areas. According to survey results, 68% of visitors experienced heat discomfort during peak hours, and there was a notable decline in the number of pedestrians at midday. In order to maintain walkability and resilience in the market environment, these findings emphasise the necessity of additional shading, greenery, and climate-responsive design elements. "This study demonstrates that maintaining walkability and resilience in Pasar Karat (Loken), Ipoh, requires improving climate-responsive elements like shade, greenery, and pedestrian-friendly design. The results highlight how crucial it is to combine environmental comfort and cultural vibrancy in order to inform future urban planning and policy in conventional market settings.

Keyword: Urban walkability; climate-responsive design; public space; green infrastructure; nature-based solutions;

INTRODUCTION

Resilience and urban walkability have become key issues in modern urban planning, connecting social cohesion, public health, mobility, and climate adaptation. While walkable environments encourage active transportation, local commerce, and place activation, resilient public spaces are designed to absorb, adapt to, and recover from climatic stresses like heat waves and flooding. Walkability and climate responsiveness must be combined for dense heritage market precincts like Pasar Karat (Loken) in Ipoh to continue serving social and economic purposes (Gorzka, Burda, & Nyka, 2025).

With its thriving marketplaces and rich cultural legacy, Ipoh, Perak, must urgently strike a balance between environmental resilience and urban growth. A unique case study for examining these issues is Pasar Karat (Loken), a historic flea market. The region is a major hub for culture and society, drawing both residents and visitors. However, it has several problems, such as a lack of climate-adaptive features, high urban heat exposure, and inadequate pedestrian-friendly infrastructure (de Gopegui, 2025; WeatherSpark, n.d.).

Problem Statement

- Inadequate Pedestrian Infrastructure and Connectivity
- Environmental Vulnerability and Lack of Climate Adaptation
- Safety Risks and Compromised Urban Vitality

Aim

This study aims to assess the level of urban walkability and climate resilience in Pasar Karat (Loken), Ipoh, Perak, by examining the physical, environmental, and social factors that influence pedestrian comfort, accessibility, and adaptive capacity in a heritage market context.

Research Objectives

- I. To access the current level of walkability and pedestrian comfort in Pasar Karat (Loken), Ipoh, in relation to issues of congestion, shading, and accessibility.
- II. To identify the climate-related challenges affecting public space usability, including urban heat, limited green infrastructure, and flood vulnerability within the market area.
- III. To proposed climate-responsive design strategies that enhance walkability, resilience, and cultural vibrancy of Pasar Karat (Loken) as a sustainable urban public space.

Research Questions

- How do the physical and environmental conditions of Pasar Karat (Loken) impact its walkability and pedestrian thermal comfort?
- What climate-responsive design strategies can be integrated into Pasar Karat (Loken) to enhance its walkability and resilience without compromising its cultural vibrancy?
- These RQs are aligned with the Aim and ROs, they are reflected in the current writings. The first question is analytical (assessing impact), and the second is prescriptive (seeking strategies). Mirroring the structure of ROs.

Keyword: Urban walkability, Climate resilience, Climate-responsive design, Public spaces, dense heritage

LITERATURE REVIEW

Integrating Walkability and Climate Resilience in Heritage Contexts

The pursuit of walkable urban environments is well established in contemporary literature, championed for its benefits to public health, social cohesion, and local economies (Mouratidis, 2021; Yigitcanlar et al., 2021). Similarly, modern principles of urban resilience focus on designing public spaces to absorb and adapt to climatic shocks such as extreme heat and flooding (Elsayed et al., 2022; Sharifi, 2021). While these agendas often align in theory, for instance, where shaded walkways enhance both pedestrian comfort and heat resilience, and permeable surfaces manage stormwater to create more accessible pathways, their practical integration in heritage-constrained precincts presents distinct challenges and tensions (O'Donnell

& Turner, 2020; Veldpaus & Pereira Roders, 2022).

The primary conflict arises from the inherent constraints of heritage conservation. The need to preserve authentic cultural character, building facades, and historic street patterns can severely limit the scope for standard interventions. For example, widening sidewalks to improve pedestrian flow may be impossible without compromising the historic building line, and installing modern, large-scale shading structures could visually intrude upon the architectural integrity of the streetscape (Foster, 2020). Furthermore, the application of contemporary resilient infrastructure, such as subsurface detention tanks or universal access ramps, must be carefully negotiated within archaeologically sensitive grounds.

This creates a critical design dilemma: how to introduce necessary performance-enhancing features without compromising the historic value that defines the precinct's identity. As emphasised in recent heritage guidelines, interventions in such settings must respect authenticity, often favouring reversible and minimally invasive solutions (ICOMOS, 2021). Therefore, in dense heritage market precincts, the goal shifts from applying generic models to developing context-sensitive strategies that are subtle, symbiotic, and respectful of the existing fabric. This study seeks to explore this precise challenge, investigating how walkability and resilience can be synergistically woven into the historic urban tissue of a market like Pasar Karat.

Resilience and climate-responsive design

Resilience in urban public spaces emphasises both resilient infrastructure, such as drainage systems and permeable surfaces, to ensure functionality under climatic stress, and adaptive design, such as cooling features, flexible spatial layouts, and shade provision. In order to mitigate the effects of extreme weather, design interventions are essential, as scholars emphasise that public space resilience depends not only on its ability to absorb shocks but also on its capacity to adapt and recover (Thermal Hazards in Urban Spaces, 2025). Because of their high density, cultural significance, and variety of activities throughout the day, market precincts in particular offer special opportunities as well as challenges. These places are social and economic hubs, but because they are open air and pedestrian-only, they are more vulnerable to flooding and urban heat. (Gorzka, Burda, & Nyka, 2025).

For cultural continuity and tourism in historic marketplaces, design strategies that maintain heritage character are essential (Abastante, Bottero, & Masala, 2020). In densely populated areas, climate-responsive features like tree canopies, water features, reflective pavements, porous materials, and shelters can also improve stormwater management and lessen thermal stress.(Amani, Tanzadeh, Moghadas Nejad, et al., 2025).

Related theories and frameworks

There are several theoretical strands that support this study. According to Koohsari, Sugiyama, Mavoa, Villanueva, Badland, Giles-Corti, and Owen (2016), street integration, intersection density, and connectivity are strongly correlated with walking for transportation and pedestrian flows, which explains how spatial layout affects pedestrian movement patterns. Principles like human-scale design, multimodal priority, mixed land use, New Urbanism, and Complete Streets all support walkability. Research has shown that pedestrian-friendly layouts, environments that prioritise non-motorized transportation, and environments that embody the "3Ds" (density, diversity, and design) are more likely to encourage active

travel behaviours (Koohsari et al., 2016; Walkability Indices-The State of the Art and Future Directions, 2024).

Social-ecological resilience theory, which views human-natural systems as interdependent and places an emphasis on redundancy, adaptive management, and the ability to adapt to disruption, frames public spaces. Thermal comfort frameworks (e.g., PET, UTCI) and microclimate modelling techniques like Computational Fluid Dynamics (CFD) are used to establish quantifiable relationships between design interventions and human comfort. Furthermore, the Nature-Based Solutions (NBS) theory encourages the use of ecological processes such as vegetation, wetlands, and green infrastructure to produce a number of co-benefits related to climate adaptation. Recent research on NBS classification and scoring, for instance, shows how different forms of urban greening contribute to the mitigation of heat islands, enhance environmental resilience, and provide ecosystem services (Castellar, Popartan, Pueyo-Ros, Atanasova, Langergraber, Saumel, Corominas, & Acuna, 2021; Pinto, Russo, & Sudoso, 2025).

Previous studies and empirical findings

The benefits of integrating microclimate-sensitive design into pedestrian zones are consistently demonstrated by empirical research. For instance, more pedestrian activity and longer outdoor stays are encouraged by shaded walkways and greater tree canopy cover, which lower air and surface temperatures (Shashua-Bar, Pearlmutter, & Erell, 2011; Johansson, Emmanuel, & Krüger, 2014). It has also been demonstrated that small-scale interventions, like permeable pavements, shading devices, and strategic tactical urbanism upgrades, can enhance outdoor comfort and economic vitality without sacrificing heritage values, especially in historic market districts in Southeast Asia (Rijal, Humphreys, & Nicol, 2018; Kubota, Zakaria, & Abe, 2020). These results demonstrate how climate-responsive design has the potential to preserve the cultural and economic significance of heritage marketplaces while simultaneously reducing urban heat.

Research highlights the significance of governance and stakeholder engagement in addition to physical design in order to achieve resilient and sustainable results. In order to ensure that cultural and economic needs are met, successful retrofits frequently incorporate vendor collaboration, community-led placemaking, and municipal investment (UN-Habitat, 2015; Gehl, 2010). Scholars warn, however, that ignoring socioeconomic factors could have unforeseen repercussions, like uprooting unofficial vendors or increasing maintenance expenses that put a strain on local government (Dovey, Cook, & Achmadi, 2019; Yung, Zhang, & Chan, 2017). These observations highlight the necessity of rethinking urban public areas like Pasar Karat (Loken) in Ipoh using comprehensive strategies that incorporate social, cultural, and environmental factors.

RESEARCH METHODOLOGY

Research Design and Approach

This study employs a convergent parallel mixed-methods design centred on a single case study of Pasar Karat (Loken) in Ipoh, Perak. This approach was selected to triangulate findings, allowing quantitative and qualitative data to be collected concurrently, analysed separately, and then integrated to provide a comprehensive understanding of the research problem. The rationale for this design is that the numerical trends from surveys will be explained and enriched by the in-depth perspectives gathered from interviews

and observations. In this research, the qualitative component consists of on-site observations, while the quantitative component is represented by structured questionnaires, aligning with the core principles of mixed-methods integration (Creswell & Plano Clark, 2018). This design ensures that both datasets complement each other, enhancing the validity and completeness of the findings through methodological convergence (Fetters, Curry, & Creswell, 2013).

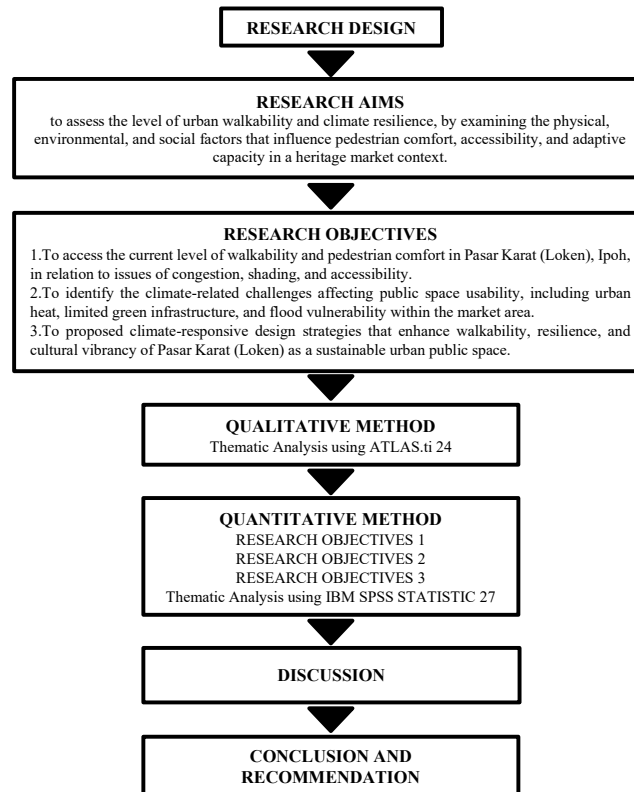


Diagram 1: Research Design

Site Selection

The research focuses on Pasar Karat (Loken), Ipoh, a historic flea market that has evolved into a vibrant social and cultural hub, attracting both locals and tourists and contributing significantly to the city's urban identity and heritage. Despite its cultural value, the market faces challenges such as overcrowding, heat stress, and limited infrastructure, which reduce pedestrian comfort and resilience. These issues highlight the need to rethink public space design to improve safety, walkability, and climate adaptability, especially in traditional community settings. Using Pasar Karat as a case study provides meaningful insights into how climate-responsive strategies can sustain cultural vibrancy, strengthen urban resilience, and support the adaptation of heritage spaces within rapidly urbanising environments (Gehl, 2011; Lynch, 1960; Newman & Beatley, 2020).

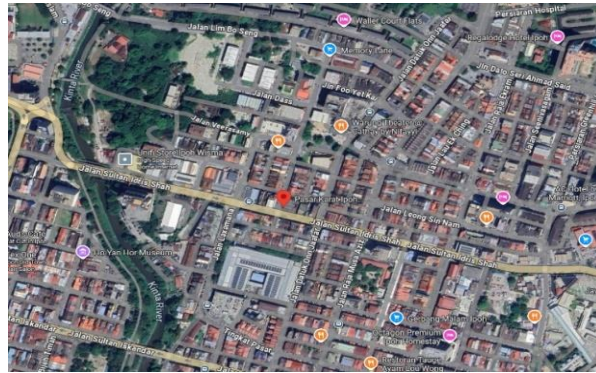


Figure 1: Map Pasar Karat (Loken)

Data Collection Methods

The quantitative component of this research seeks to quantify pedestrian perceptions and physical comfort through a closed-ended questionnaire administered to visitors and vendors. In accordance with previous walkability frameworks (Ewing & Handy, 2009; Nasrudin, Sarimin, & Ibrahim, 2018), the first section measures safety, accessibility, and sidewalk quality using a 5-point Likert scale. The second section captures thermal, auditory, and visual comfort using semantic differential scales, a common practice in environmental psychology to assess pedestrian comfort (Nikolopoulou & Steemers, 2003; Johansson et al., 2014). Finally, the survey utilizes frameworks for urban resilience and climate adaptation to gauge awareness of vulnerabilities such as flooding and heat stress (Meerow, Newell, & Stults, 2016; Sharifi, 2016).

Qualitative Site Observations and Spatial Analysis Complementing the survey, qualitative site observations are conducted to assess walkability and pedestrian comfort by documenting spatial conflicts between market stalls and visitor flow. This process involves recording physical barriers, overcrowding during peak hours, and the lack of integrated shading that contributes to pedestrian fatigue. As (Gehl 2011) suggests, direct observation of how people navigate and utilize a space is essential for identifying the environmental factors that either encourage or hinder social interaction and movement within an urban setting (Gehl, 2010; Marans & Stimson, 2011). These observations provide a ground-level understanding of the market's current functional limitations.

Furthermore, the observation phase specifically identifies Climate Challenges and Design Resilience, focusing on the lack of green infrastructure and resulting urban heat discomfort. By mapping localized "hot spots" and evaluating the effectiveness of existing drainage systems during rain events, the study gathers baseline data to propose climate-responsive interventions. As emphasized by (Nasir et al. 2015), the integration of natural cooling elements and sustainable drainage is vital in mitigating heat stress and enhancing the overall thermal comfort and usability of public spaces in tropical climates (Creswell & Poth, 2018; Rubin & Rubin, 2012). This systematic mapping ensures that proposed design solutions are grounded in the specific environmental realities of the site.

The Sampling Strategy and Administration to study population at Pasar Karat (Loken) consists of tourists, merchants, and local stakeholders, including organizers and civic representatives. A mixed-method approach is employed, using systematic random sampling to select every fifth bystander for the quantitative

survey, resulting in a total of 80 respondents. For the qualitative component, purposive sampling is applied to engage vendors and key informants, allowing for the collection of rich, diverse insights on urban walkability and resilience. Participants must be at least 18 years old and regular visitors or workers, ensuring that the findings are based on comprehensive stakeholder perspectives and authentic user experiences (Creswell & Creswell, 2018; Patton, 2015).

DATA ANALYSIS AND FINDINGS

The analysis and interpretation phase involve the integration of both quantitative and qualitative data, adhering to the convergent mixed-methods framework, which combines the analysis of individual datasets to produce comprehensive insights (Creswell & Plano Clark, 2018; Fetter, Curry, & Creswell, 2013). The thematic findings from the questionnaire survey like vendor descriptions of heat driving customers away and observational data like recorded lack of shaded areas will be directly compared and contrasted with the numerical patterns from the questionnaire like low scores for thermal comfort. By permitting corroboration across several sources of evidence, this triangulation reduces bias and increases credibility, strengthening the validity of the conclusions (Flick, 2018; Yin, 2018).

A comprehensive profile of Pasar Karat's present performance and context-sensitive strategies for improving its walkability and climate resilience are the ultimate goals of this integration, which will combine these datasets. In addition to identifying important intervention points, the analysis guarantees that suggested strategies are both evidence-based and culturally grounded by fusing quantitative measurements of pedestrian comfort with qualitative insights on stakeholder experiences and spatial observations (Tashakkori & Teddlie, 2010; Bryman, 2016).

The figure 2 show the current conditions at Pasar Karat (Loken) are defined by deteriorating infrastructure and significant spatial conflicts, where uneven and potholed road surfaces lead to water ponding that reveals a drainage system vulnerable to flash flooding. The disorganized layout of market stalls and a lack of physical separation between vehicles and pedestrians create a congested and hazardous environment. Furthermore, the absence of shading elements and green infrastructure exacerbates heat stress, collectively undermining the area's walkability, user comfort, and overall climate resilience.



Figure 2: Shows the current conditions at the Pasar Karat (loken), Ipoh

Demographic Information

Table 1: Shows the demographic respondent in research

Variable	Category	Frequency	Valid Percent
Age	18-25	36	43.4
	26-35	17	20.5
	36-45	21	25.3
	46-55	8	9.6
	56+	1	1.2
Gender	MALE	31	37.3
	FEMALE	52	62.7
Purpose of Visit	VISITOR	58	69.9
	VENDOR	8	9.6
	LOCAL RESIDENT	17	20.5
Frequency of Visit	DAILY	4	4.8
	WEEKLY	16	19.3
	MONTHLY	34	41
	FIRST TIME	29	34.9

From table 1 the survey conducted at Pasar Karat (Loken), Ipoh, which involved a total of 83 respondents, the majority of participants were young adults aged 18–25 years (43.4%), followed by those aged 36–45 years (25.3%) and 26–35 years (20.5%). Respondents aged 46–55 years accounted for 9.6%, while those aged 56 and above represented the smallest proportion at 1.2%. In terms of gender, females constituted the majority of the sample at 62.7% (52 respondents), while males accounted for 37.3% (31 respondents).

Regarding the purpose of the visit, most respondents were identified as visitors (69.9%), followed by local residents (20.5%) and vendors (9.6%). The frequency of visits revealed that 41.0% of respondents visited on a monthly basis, while 34.9% were first-time visitors. Furthermore, 19.3% visited weekly, and only a small fraction of 4.8% visited daily. Overall, this demographic profile suggests that Pasar Karat (Loken) is particularly appealing to a younger female audience, providing critical insights for developing user-centric walkability and climate-responsive design strategies.

Research Objective 1: To access the current level of walkability and pedestrian comfort

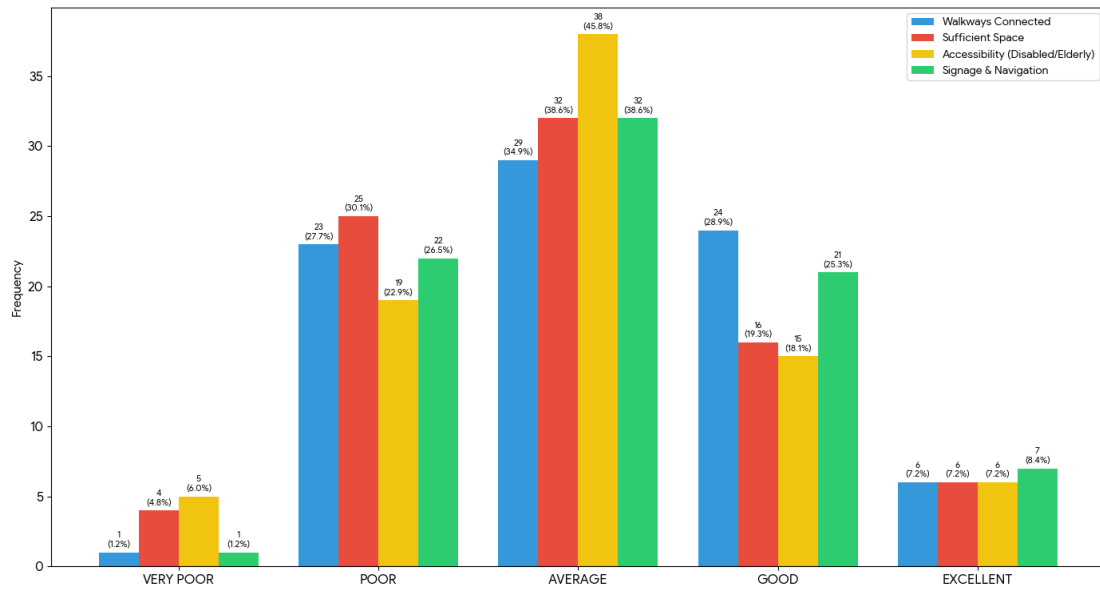


Figure 3: shows the total numbers of the respondents regarding their walkability and pedestrian

Based on figure 3 the survey shows data indicates that the majority of respondents rate the market's walkability as "Average," which suggests that while the space functions, it does not provide a high-quality or comfortable pedestrian experience. The variable with the highest average rating is accessibility for disabled and elderly users (45.8%), followed by clear signage and navigation (38.6%) and walking space sufficiency (38.6%). This shows that most users find the current infrastructure to be at a stagnant, baseline level that lacks specialized improvements for ease of use. Furthermore, when looking at the negative feedback, walking space sufficiency received a combined "Poor" and "Very Poor" rating of (34.9%), highlighting that physical congestion is a major concern for visitors.

A closer look at the extreme ends of the scale identifies three critical findings regarding the market's performance. First, accessibility for disabled and elderly users received the highest "Very Poor" score at (6.0%), confirming that the site fails to meet inclusive design standards for vulnerable groups. Second, this same variable holds the highest "Average" frequency at (45.8%), indicating that a significant portion of the population finds it merely tolerable rather than efficient. Third, while clear signage and navigation achieved the highest "Excellent" rating at (8.4%), the overall low percentages across all categories emphasize the urgent need for climate-responsive and pedestrian-focused urban design interventions.

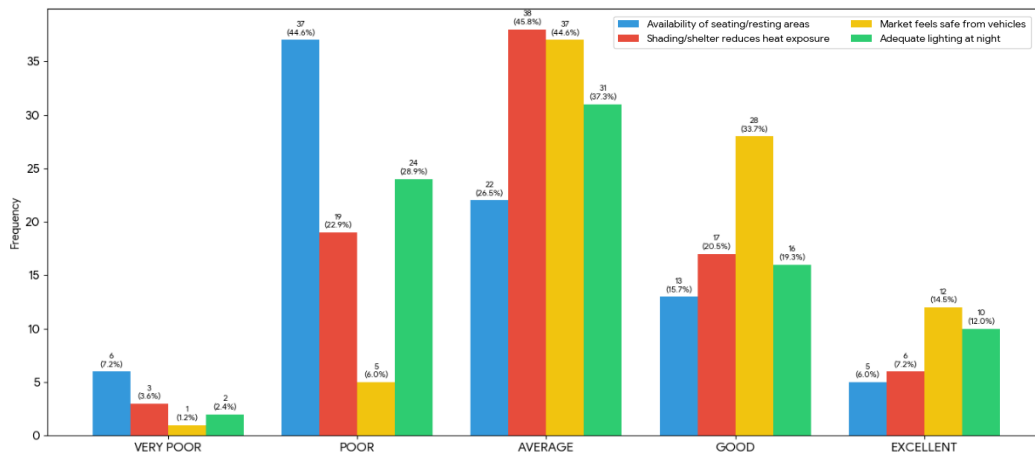


Figure 4: shows the total numbers of the respondents regarding their Pedestrian Comfort and Safety Perception

Based on figure 4 the survey shows data across both provided tables, the analysis reveals that the majority of respondents perceive the walkability and comfort of Pasar Karat (Loken) as mediocre or subpar. Most variables are concentrated in the "Average" category, specifically accessibility for disabled and elderly users and shading/shelter to reduce heat exposure, both peaking at (45.8%). This suggests that the current environment provides only the most basic functional requirements and fails to offer a high-quality or climate-responsive experience for users. Furthermore, the high percentage of "Poor" ratings for availability of seating/resting areas (44.6%) highlights a significant lack of essential amenities that are necessary to support a comfortable and vibrant public space.

A closer look at the extreme ends of the performance scale identifies three critical findings regarding the market's environment. First, the availability of seating and resting areas is the most critical failure, receiving the highest combined negative feedback and the highest individual "Very Poor" score at (7.2%). Second, the market's social and climate inclusivity remains stagnant, with accessibility for disabled users and heat-reducing shading both holding the highest "Average" frequency at (45.8%), indicating they are barely tolerable for the general public. Third, the most positive aspect of the market is safety from vehicles, which achieved the highest "Excellent" rating at (14.5%). While this is the best-performing metric, the overall prevalence of low and average scores underscores a pressing need for urban design interventions that prioritize pedestrian comfort and climate resilience.

Walkability and Pedestrian Comfort Indicators

Table 2: shows the site observation walkability and pedestrian comfort indicators at Pasar Karat (Loken) Ipoh

No	Indicator	Rating (1–5)	Comments / Evidence	Images
1	Pedestrian Path Quality	3	The pedestrian path at Pasar Karat Loken, Ipoh is usable but narrow and often blocked by stalls and crowds, especially during peak hours.	
2	Path Width	3	The path width at Pasar Karat Loken, Ipoh is generally narrow and becomes more restricted during market hours due to stalls and high pedestrian density.	
3	Accessibility (ramps, tactile paving)	4	Accessibility at Pasar Karat Loken, Ipoh is limited, with few ramps and no clear tactile paving for people with disabilities.	
4	Crosswalks and Signage	2	Crosswalks and pedestrian signage around Pasar Karat Loken, Ipoh are limited and not clearly marked, making pedestrian crossing less safe.	
5	Street Furniture (benches, lighting)	2	Street furniture at Pasar Karat Loken, Ipoh is limited, with few benches, bins, and basic lighting mainly provided by nearby shops and stalls.	
6	Connectivity between key areas	4	Connectivity between key areas at Pasar Karat Loken, Ipoh is moderate, with direct routes available but movement is often slowed by crowds and narrow paths.	

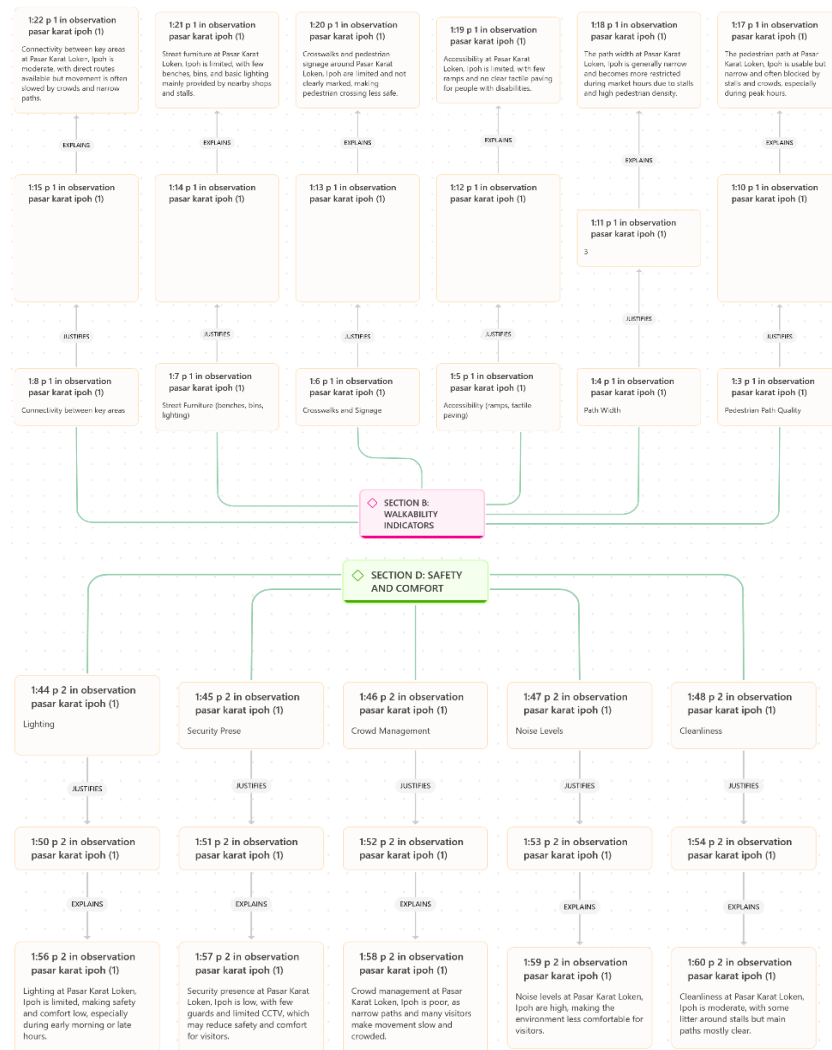


Figure 5: shows the site observation walkability and pedestrian comfort indicators analysis from Atlas-ti

Based on table 2 and figure 5 the site observation analysis reveals that Pasar Karat (Loken) currently functions at a suboptimal level due to significant physical and infrastructural constraints that hinder pedestrian movement and comfort. Pedestrian paths are noted to be usable but narrow and frequently obstructed by market stalls and high visitor density during peak hours, creating localized congestion. This is further exacerbated by a lack of essential street furniture, such as benches and lighting, and limited safety infrastructure like clearly marked crosswalks and pedestrian signage. Accessibility remains a critical challenge, with observations highlighting a severe lack of ramps and tactile paving for people with disabilities, alongside connectivity that is often slowed by the restrictive nature of the narrow paths. Overall, while the direct routes between key areas provide moderate connectivity, the prevailing environmental barriers and lack of integrated pedestrian amenities diminish the market's quality as a walkable and inclusive urban public space.

Research Objective 2: To identify the climate-related challenges

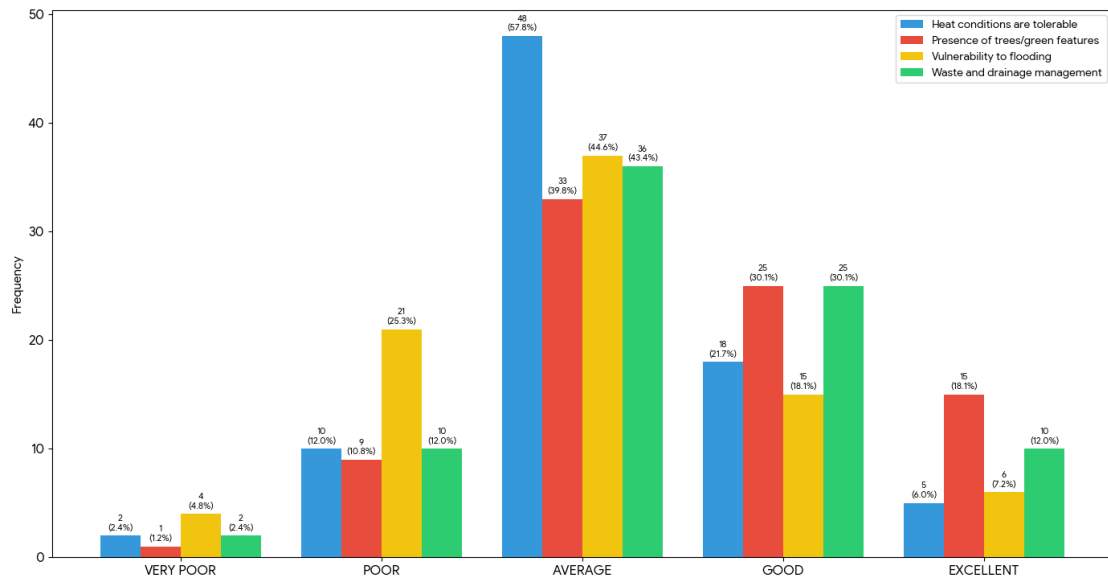


Figure 6: shows the total numbers of the respondents regarding their Climate and Environmental Conditions

From figure 6 the quantitative data provided in the tables, the analysis of climate-related challenges at Pasar Karat (Loken) indicates that environmental resilience is currently viewed as stagnant or inadequate. A majority of respondents rated climate-responsive variables as "Average," particularly regarding tolerable heat conditions (57.8%), proper waste and drainage management (43.4%), and vulnerability to flooding (44.6%). These results align with site observations documenting poor drainage surfaces and a lack of integrated green infrastructure to mitigate tropical weather. While the market remains operational, these neutral ratings suggest that the public space is not yet resilient enough to provide high-quality thermal comfort or reliable flood protection during adverse weather events.

The performance of specific climate variables reveals three distinct extremes that define the market's current environmental challenges. First, the market's vulnerability to flooding after rain stands out as the most significant weakness, recording the highest "Very Poor" frequency at (4.8%). This perception is supported by visual evidence of water ponding and deteriorating road surfaces that expose a lack of effective drainage management. Second, the highest "Average" rating was for tolerable heat conditions during market hours at (57.8%), indicating that while users can withstand the heat, they do not find the environment particularly comfortable or thermally responsive. Third, the presence of trees and green features achieved the highest "Excellent" rating at 18.1%, suggesting that existing natural cooling elements are the market's strongest climate-related asset, even though they are currently insufficient to offset overall heat stress.

In conclusion, while there is some appreciation for existing green features, the high prevalence of average and poor scores for drainage and heat tolerance emphasizes a critical need for design interventions. The lack of shading and ineffective waste management further complicates the usability of the public space, especially during peak tropical heat or heavy rainfall. For Pasar Karat to become a truly sustainable and inclusive urban area.

Climate-Responsive Features

Table 3: shows the site observation climate responsive features at Pasar Karat (Loken) Ipoh

No.	Indicator	Rating (1–5)	Comments / Evidence	Images
1	Shading Elements (trees, canopies, awnings)	4	Connectivity between key areas at Pasar Karat Loken, Ipoh is moderate, with direct routes available but movement is often slowed by crowds and narrow paths.	
2	Thermal Comfort (air flow, material heat retention)	3	Thermal comfort at Pasar Karat Loken, Ipoh is low, as limited airflow and heat from paved surfaces make the area feel hot, especially during busy hours.	
3	Green Infrastructure (planters, vegetation)	2	Green infrastructure at Pasar Karat Loken, Ipoh is minimal, with very few planters or vegetation to provide shade or cooling.	
4	Water Management (drainage, flood control)	2	Water management at Pasar Karat Loken, Ipoh is limited, with basic drainage that may cause minor flooding during heavy rain.	
5	Material Sustainability (permeable, reflective materials)	3	Material sustainability at Pasar Karat Loken, Ipoh is low, as most surfaces are concrete and asphalt that are not permeable or reflective.	

Research Objective 3: Cultural Experience & Public Space Quality

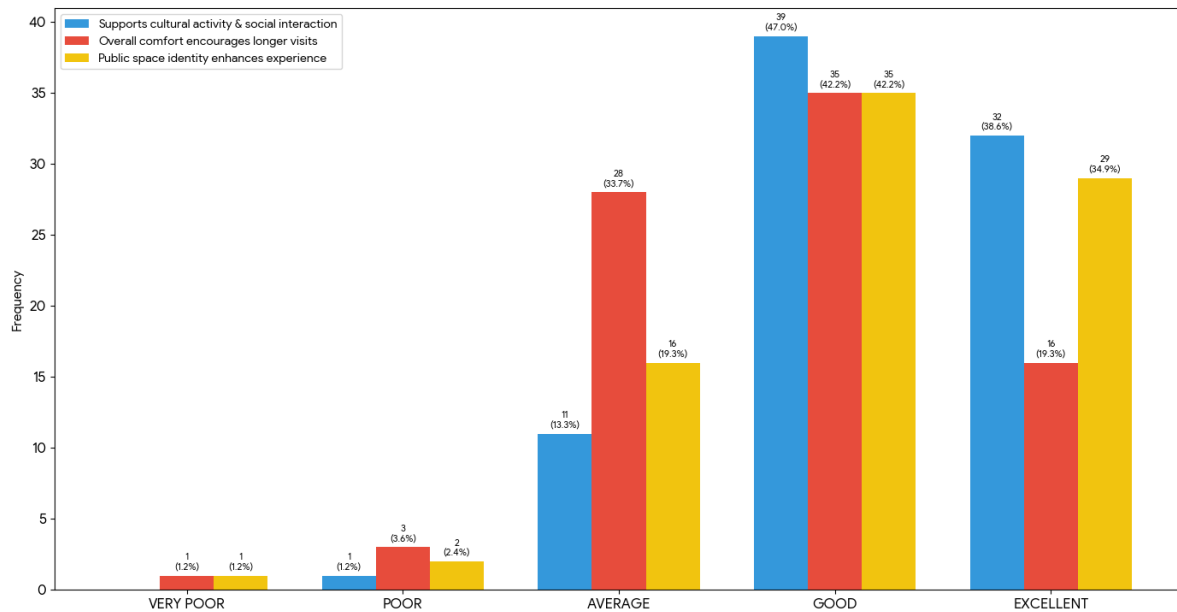


Figure 8: shows the total numbers of the respondents regarding their Cultural Experience & Public Space Quality

From the figure 8 the quantitative data analysis highlights that while Pasar Karat (Loken) holds high cultural value, its physical infrastructure requires significant climate-responsive upgrades to ensure sustainability. A strong majority of respondents view the market as a vital social hub, with (47.0%) rating its support for cultural activity as "Good" and (38.6%) as "Excellent". However, these social strengths are hindered by a lack of basic amenities, specifically the availability of seating and resting areas, which received the highest "Very Poor" rating at (7.2%). To enhance cultural vibrancy, design strategies must integrate functional "placemaking" elements, such as thermally comfortable seating areas, to better support the high levels of social interaction observed.

Environmental resilience is currently a major barrier to walkability and long-term usability, with stagnant ratings across most climate-related variables. Tolerable heat conditions were rated as "Average" by (57.8%) of respondents, while flood vulnerability remains a critical concern with a (4.8%) "Very Poor" rating. Site observations corroborate these findings, noting that material sustainability is low due to non-permeable concrete and asphalt surfaces that retain heat and contribute to minor flooding. Consequently, proposed strategies should prioritize the implementation of permeable materials and sustainable drainage systems (SuDS) to mitigate flood risks and reduce the urban heat island effect.

Finally, achieving an inclusive and sustainable public space requires a transition toward universal design and expanded green infrastructure. The data identifies accessibility for disabled and elderly users as a primary weakness, receiving a (6.0%) "Very Poor" score. Although the presence of trees is currently the highest-rated climate asset at (18.1%) "Excellent," (45.8%) of users still find shading to be only "Average". Future design interventions must therefore expand green canopies and install continuous shading structures to improve thermal comfort while integrating ramps and tactile paving to ensure the market is accessible to all visitor groups.

Social and Cultural Vibrancy

Table 4: shows the site observation Social and Cultural Vibrancy at Pasar Karat (Loken) Ipoh

No.	Indicator	Rating (1–5)	Comments / Evidence	Images
1	Public Interaction Spaces (seating, gathering areas)	3	Public interaction spaces at Pasar Karat Loken, Ipoh are limited, with few seating or gathering areas for visitors to socialize.	
2	Cultural Expression (heritage elements, art, signage)	4	Cultural expression at Pasar Karat Loken, Ipoh is visible through heritage buildings and local signage, adding charm to the market.	
3	Economic Activity (diversity of vendors)	4	Economic activity at Pasar Karat Loken, Ipoh is vibrant, with a diverse range of vendors selling food, antiques, and other goods.	
4	User Diversity (range of age, gender, background)	4	User diversity at Pasar Karat Loken, Ipoh is high, attracting people of different ages, genders, and backgrounds.	

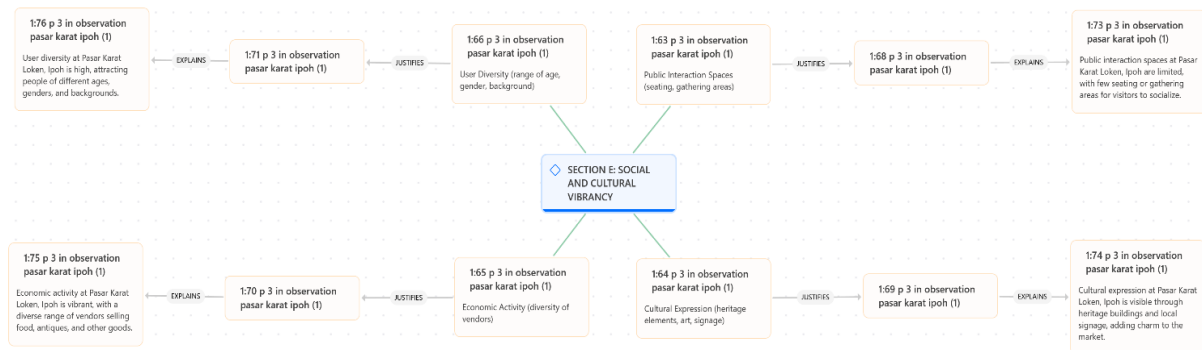


Figure 9: shows the site observation Social and Cultural Vibrancy analysis from Atlas-ti

From table 4 and figure 9 the site observation analysis for Social and Cultural Vibrancy indicates that while Pasar Karat (Loken) is a highly active and diverse hub, it lacks the physical infrastructure to fully support public socialization. Observations show that the market has a high level of user diversity across different ages and backgrounds, and it remains economically vibrant with a wide variety of vendors. Cultural expression is also strong, with heritage buildings and local signage adding a unique charm to the area. However, the quality of public interaction spaces is limited because there are very few seating or gathering areas for visitors to rest and socialize. Consequently, while the market successfully attracts a large crowd and maintains its cultural identity, the lack of comfortable social nodes prevents it from reaching its full potential

DISCUSSION

The findings of this study align with previous research indicating that walkability in traditional market areas is often constrained by congestion, narrow pathways, and competing spatial uses. (Southworth 2005) emphasizes that effective walkable environments require continuous, unobstructed pedestrian networks and adequate spatial width to support comfort and safety. In Pasar Karat (Loken), pedestrian movement is frequently disrupted by stalls and crowd density, resulting in an environment that is functional but uncomfortable. Similar conditions were identified by (Gehl 2010), who notes that pedestrian experience deteriorates when urban spaces prioritize temporary commercial activities over human-scale design, reinforcing the need for pedestrian-first spatial planning.

Accessibility challenges identified in this study further reflect broader concerns in inclusive urban design literature. According to (Imrie and Hall 2001), the absence of universal design elements such as ramps, tactile paving, and clear wayfinding significantly limits access for elderly and disabled users, reducing social equity in public spaces. The “average” accessibility ratings in Pasar Karat mask deeper systemic barriers that exclude vulnerable groups. As highlighted by (UN-Habitat 2013), inclusive walkability is a core component of resilient cities, ensuring that public spaces remain usable for all populations, particularly during environmental stress events.

Climate-related discomfort, particularly heat stress and flood vulnerability, is a well-documented issue in tropical urban environments. (Emmanuel and Johansson 2006) demonstrate that extensive paved surfaces and limited vegetation contribute significantly to urban heat island effects, reducing outdoor thermal comfort. The findings from Pasar Karat reflect this condition, as non-permeable materials and insufficient shading lead to tolerable but uncomfortable microclimatic conditions. Additionally, (Ahern 2011) stresses that inadequate drainage and poor surface permeability increase flood risk in dense urban areas, further limiting public space usability during heavy rainfall.

To address these challenges, climate-responsive design strategies are widely recommended in contemporary urban resilience research. The integration of green infrastructure, permeable pavements, and shaded pedestrian corridors has been shown to improve both thermal comfort and flood mitigation (Gill et al., 2007). (Gehl 2011) further argues that providing seating, resting areas, and clear pedestrian zones encourages longer stays and enhances social interaction. Applying these principles to Pasar Karat would not only improve walkability but also strengthen the market’s capacity to adapt to climatic stress while supporting everyday pedestrian activity.

Finally, the strong cultural vibrancy of Pasar Karat highlights the importance of balancing physical upgrades with cultural preservation. Project for Public Spaces (PPS, 2016) emphasizes that successful public spaces integrate placemaking strategies that respect local identity while improving comfort and functionality. In the context of Pasar Karat, climate-responsive interventions such as shaded communal seating and culturally sensitive street furniture can enhance social interaction without diminishing the market’s heritage character. By integrating walkability, climate resilience, and cultural expression, Pasar Karat can evolve into a sustainable and resilient urban public space consistent with best practices in urban design and landscape architecture.

CONCLUSION AND RECOMMENDATION

This study concludes that Pasar Karat (Loken), Ipoh is a culturally vibrant and socially active public space, yet its current level of walkability and climate resilience remains suboptimal. Although the market successfully attracts a diverse range of users and supports strong economic and social interaction, pedestrian movement is frequently hindered by narrow pathways, congestion, and inadequate pedestrian infrastructure. Overall, the findings indicate that the market functions at a basic level of usability but does not yet provide a comfortable, safe, or high-quality walking environment.

In terms of pedestrian comfort and accessibility, the research highlights significant shortcomings, particularly for elderly and disabled users. While some respondents perceived accessibility as acceptable, on-site observations revealed a lack of ramps, tactile paving, seating areas, and clearly defined pedestrian crossings. These limitations reduce inclusivity and restrict independent movement for vulnerable groups. Improving universal accessibility is therefore essential to ensure that Pasar Karat can function as an equitable public space that accommodates users of all ages and physical abilities.

Climate-related challenges were identified as a major factor affecting the usability and resilience of the market. Heat stress during peak hours, limited shading, minimal green infrastructure, and inadequate drainage contribute to pedestrian discomfort and reduced activity levels. The presence of non-permeable surfaces further intensifies heat retention and increases the risk of minor flooding after heavy rainfall. These conditions demonstrate that without climate-responsive interventions, walkability improvements alone will not be sufficient to sustain long-term use of the market space.

Based on these findings, this study recommends the integration of climate-responsive and pedestrian-oriented design strategies to enhance walkability and resilience. Key recommendations include increasing shaded walkways through tree planting and lightweight canopy structures, introducing permeable and reflective paving materials, improving drainage systems, and providing adequate seating and resting areas. Reorganizing stall layouts to ensure continuous and unobstructed pedestrian paths is also essential to reduce congestion and improve overall pedestrian flow.

Finally, all proposed interventions should respect and reinforce the cultural identity and social vibrancy of Pasar Karat (Loken). As a heritage market and important social hub, design improvements should support placemaking without compromising local character. By integrating walkability, climate resilience, inclusive design, and cultural preservation, Pasar Karat has strong potential to evolve into a sustainable, comfortable, and resilient urban public space that continues to serve both the community and visitors in the long term.

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