

Assessing Revitalised Alleys: Determination of Factors Influencing Quality of Alleys in Malaysia

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Abstract

Alleys are vital public spaces that enhance social interaction, cultural expression, and urban vibrancy. In Malaysia, numerous historic cities have implemented revitalisation efforts to transform back alleys into dynamic urban assets that support tourism and community life. However, despite these initiatives, some alleys remain underused or neglected, reflecting the uneven outcomes of revitalisation efforts. This study addresses the need for a systematic evaluation of alley quality to guide ongoing and future interventions. Specifically, it aims to identify the key variables influencing the quality of revitalised alleys and to determine which factors significantly contribute to user perceptions. Drawing on a systematic literature review of 26 scholarly articles, five variables were established: Accessibility, Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment, and operationalised into a 21-item questionnaire. A total of 197 respondents participated across 18 revitalised alleys in Penang, Perak, and Terengganu. The reliability of the questionnaire was ensured through Cronbach's Alpha test, then the data was analysed using linear regression. All five variables were found to significantly influence perceived alley quality, with 'Accessibility' identified as the most critical variable in need of targeted improvement. These findings highlight the multi-dimensional nature of perceived alley quality and the importance of addressing accessibility barriers. The study concludes with recommendations for urban planners and decision-makers to optimise the potential of revitalised alleys as valuable urban assets.

Keywords: alley revitalisation; heritage districts; public spaces; measurement tool; urban planning; user experience

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Introduction

While the focus on revitalising streets is increasing, it is essential not to overlook the unique role that alleys play in urban life (Aşilioğlu & Çay, 2020). Research consistently indicates that they are not just passageways, but fundamental elements of public spaces, playing a critical role in fostering social interaction, promoting physical activity, enabling cultural expression, and facilitating a diverse array of activities that improve the overall quality of life for individuals and communities (Hague & McCourt, 1974; UN-Habitat, 2020). These spaces are designed to be accessible, inclusive, and welcoming to individuals of all ages, backgrounds, and interests (Gehl, 1971). Specifically, streets and alleys serve as the backbone of urban life, providing essential areas for people to engage with their surroundings, access local amenities, and partake in social activities.

Acknowledging their significance, considerable efforts have been made to revitalise streets, recognising them as vital drivers of urban prosperity (Mehta & Bosson, 2009; Rahman et al., 2016; Sulaiman et al., 2017; Deore & Lathia, 2019; Umstattd Meyer et al., 2019; Guo et al., 2023). Numerous studies have concentrated on evaluating street quality through various metrics, including street scores (Yao et al., 2019), walkability indexes, and walk scores (Frank et al., 2021; Labdaoui et al., 2021), as well as assessments of street-level urban greenery (Li et al., 2015; Ye et al., 2019). These evaluations have identified key factors that influence the quality of the physical environment, such as street scale, connectivity, building density, traffic convenience, and the diversity of public service facilities. Such metrics provide urban planners and decision-makers with essential insights into the quality of street spaces, serving as valuable resources for making informed decisions regarding enhancing these areas (Wan et al., 2022).

Efforts to revitalise alleys have been increasing but remain relatively limited, with contributions primarily from scholars such as Furneaux and Manaugh (2018), Blazy (2019), Brazeau-Béliveau and Cloutier (2021), Alawadi et al. (2021), Chua and Yahaya (2021), Weber and Schneider (2021), and Pham et al. (2022). In practice, however, city governments and community organisations have begun to recognise the potential of alleys and initiate improvement projects in historic urban districts. In Malaysia, numerous government and community-led initiatives have been launched to rejuvenate historic urban alleyways. Kuala Lumpur City Hall (DBKL) initiated an alley revitalisation program to turn previously blighted back alleys into cleaner, safer pedestrian spaces (Ng & Sze, 2021). The urban regeneration organisation Think City has collaborated with municipal councils to rejuvenate a 100-meter historic alley near Central Market, Kuala Lumpur, into a well-lit, pedestrian-friendly route with areas for eating and relaxation (Anand, 2017). In George Town, Penang, under the area's Special Area Plan, the neglected service lanes were transformed into attractive communal corridors with widened and beautified pedestrian links between streets, landscaped greenery, lighting, and art installations, while also improving infrastructure like drainage and utility trenches (ThinkCity, 2016).

Research on alley revitalisation has demonstrated positive outcomes, including improved community engagement and increased civic action (Brazeau-Béliveau & Cloutier, 2021), the creation of age-friendly and safe spaces (Furneaux & Manaugh, 2018), enhanced social interaction and local economic activity (Wan Hashimah & Low, 2016; Wan' Iffah, 2017), and overall improvements in local well-being (Weber & Schneider, 2021). However, studies on revitalisation efforts remain limited, possibly due to the absence of specific guidelines or frameworks to guide decision-makers and urban planners in evaluating alley quality and providing direction for revitalisation to enhance user experiences.

To address this gap, this paper focuses on the alleys, as they are one of the city's largest continuous public space networks and a platform for versatile city resources. Despite recent initiatives aimed at studying the safety, comfort, and liveability of alleys as public spaces, there is a clear need for a more comprehensive understanding of how to measure alley quality, primarily due to the limited availability of data. Consequently, this study aims to investigate the factors influencing the quality of alleys by integrating multiple determinants with an application to selected revitalised alleys in Malaysia. The key research questions guiding this study are: What are the variables that will influence the quality of alleys? Which variable should be prioritised for improvement to enhance alley quality? The objectives of the study include:

To identify the key variables that contribute to the quality of these alleys as public spaces;

To determine the variable requiring targeted improvement to enhance alley quality.

This study commences with a comprehensive literature review that underscores the significance of alleys. Following this, a summary of pertinent measurement indicators is provided. Next, the research methodology is thoroughly explained. The study then details the verification process of the questionnaire, accompanied by an in-depth analysis. Conclusively, the study discusses and proposes recommendations for future research endeavours.

Literature review

Importance of Alleys

This paper focuses on one understudied topic in urban morphology: the alley. The term alley comes from multiple lingual origins, like the Latin word 'ambulare' (Ratzlaff, 2020), the Arabic word 'sikkak' (Ruggles, 2012), and the French word 'allee' (Blazy, 2019). Alleys are unique for two main reasons: (1) alleys are transitional spaces between the public and private realms, which makes their ownership and maintenance responsibility ambiguous (Hage, 2008); (2) they are hidden spaces utilised for everyday uses or informal cultural expression (Martin, 1996; Abdelmonem, 2017; Cho & Kriznik, 2020).

Recent studies and advocates of urban planning ideals have offered new insights into the potential of alleys to increase connectivity, walkability, and social cohesion in urban settings (Blazy, 2019; Gehl, 2011). Wan Hashimah and Low (2016) and Ng and Sze (2021) have shed light on the significance of alleys as essential platforms for public space. Specifically, their studies reveal that back lanes are pivotal to the urban fabric, often referred to as the "public living room". These findings underscore the significance of alleys as dynamic spaces that promote social interactions, community engagement, and cultural exchange. Few studies have also emphasised the role of alleys as vibrant and active public spaces where people gather, socialise, and participate in various activities (Norngainy et al., 2013; Wan' Iffah, 2017; Chua & Yahaya, 2021). Alleys, also known as versatile platforms, allow various social interactions, providing opportunities for neighbours to interact and children to engage in play-based learning (Beasley, 1996; Martin, 2000). These areas serve as dynamic centres, promoting associations and affiliations among inhabitants.

Furthermore, alleys also known as transitional spaces, play a significant role in architectural practice, particularly within everyday architecture (Norngainy et al., 2013). These spaces serve as subaltern entities, establishing connections between different areas within cities. One of their essential functions is to provide a sense of experience that bridges the gap between the inner and outer worlds (Zimmerman, 2008). Referred to as intermediate areas or third areas by Mehta and Bosson (2009), transitional spaces serve as zones of exploration and encounter, where the influences of both the inner and outer realms converge. According to Long (2011), alleys serve as a space for social engagement, foster fundamental creativity, and function as an intermediary zone for recreational activities. Transitional spaces have the potential to shape and improve architectural experiences by facilitating the harmonious integration of diverse environments and facilitating individuals' dynamic interactions with their surroundings.

Global and Malaysia's Initiatives of Revitalising Alley

UN-Habitat (2024) has emphasised the need for urban regeneration to bring underutilised assets back into use and redistribute opportunities, thereby increasing urban prosperity and quality of life. The preservation and valorisation of historic and cultural heritage is a key opportunity for urban regeneration as well. Across the globe, urban alleys are increasingly reimaged as multifunctional public spaces

that contribute to sustainable and inclusive city-making. Contemporary alley revitalisation policies often promote a range of benefits, enhancing pedestrian connectivity, managing stormwater through green infrastructure, supporting local economies, and creating platforms for community interaction and cultural expression (Stewart, 2020; Newell et al., 2013). For instance, Montreal's "Ruelles Vertes" initiative exemplifies a successful grassroots model, where over 450 alleys have been transformed into vibrant communal spaces through resident-led greening, public art, and recreational activities (Pham et al., 2022). In Yangon, Myanmar, the social enterprise Doh Eain collaborated with residents and officials to convert neglected alleys into community gardens, murals, and play spaces, significantly improving sanitation, safety, and public health (Lwin, 2018). These projects demonstrate improved microclimates, increased biodiversity, reduced crime, new opportunities for small businesses and tourism, fostering safe, inclusive, and ecologically responsive micro-public spaces.

In Malaysia, alley revitalisation has gained momentum through both government-led initiatives and non-governmental interventions. Urban municipalities are beginning to integrate alley upgrades into city planning, targeting concerns such as sanitation, safety, and urban liveability. In the city council of Penang has converted approximately 9 km of back lanes into landscaped pedestrian corridors, improving walkability, cleanliness, and heritage tourism (ThinkCity, 2016). Similar efforts are evident in Muar, where the "Back-to-Back Lane" project enhances old town alleys with murals, lighting, and waste management systems. Non-government organisations such as Think City have been instrumental in advancing alley transformation as part of broader placemaking strategies. Working across cities including Penang, Butterworth, Kuala Lumpur, and Johor Bahru, their interventions combine infrastructure upgrades, ecological design elements, and heritage storytelling. A notable example is the Butterworth Art Walk, a 400-metre alley animated with murals, sculptures, and green features, co-designed and maintained through community participation.

Despite their potential, sustaining alley revitalisation remains challenging, particularly in resource-constrained settings. Without institutional support, long-term maintenance often deteriorates, as seen in Penang's Little India, where community engagement waned over time (Lim & Omardin, 2020). Key barriers include limited funding, diverse user needs, and resistance from adjacent property owners who may view alleys as extensions of private property rather than shared public assets. This perception, for example, in Malaysia, hampers both physical upgrades and collaborative upkeep. Additionally, the historical layout of many alleys featured narrow widths, uneven surfaces, or steps, posing accessibility issues, particularly for the elderly and disabled, which further complicates inclusive design efforts.

Factors Influencing the Quality of Alleys

To assess the quality of alleys, it is imperative to consider the broader context of public space quality. There has been a growing global interest in enhancing high-quality public spaces, with research on associated quality criteria becoming increasingly comprehensive (UN-Habitat, 2020). As noted by UN-Habitat (2020), measuring public space encompasses several factors, including accessibility, amenities and furniture, comfort and safety, and the presence of green environments. Established principles regarding adequate public spaces have been articulated (Gehl, 2011). Mehta and Bosson (2018) delineated four primary criteria for evaluating public space quality: inclusivity, meaningful activity, safety, and comfort-pleasurability. These criteria provide a foundational framework for the assessment of various public spaces.

Additionally, Mehan (2016) emphasised that the quality of urban living can be explored from three principal perspectives: functional, visual, and spiritual. Functional quality pertains to the practical utility and effectiveness of the space; visual quality addresses aesthetics and design, while spiritual quality relates to the emotional and cultural significance of the space. Functional accuracy and communicability are critical indicators of urban quality of life, significantly influencing the extent to which a space facilitates social activities and recreation. This influence is contingent upon various factors, including functional diversity, the availability of urban furniture and equipment, the quality of landscape elements, and public safety considerations.

Considering alleys as public spaces, applying these established criteria and perspectives to the specific context of alleyways is essential. While alleys have traditionally been overlooked in urban planning, they are increasingly recognised as valuable public spaces that contribute to the urban fabric (Aşilioğlu & Çay, 2020). Therefore, the criteria for successful public spaces can be wholly or partially applied to alleys to assess their quality and potential for revitalisation. To comprehensively evaluate alleys, critical criteria such as accessibility, safety, comfort, cultural significance, social interaction, and green environment must be carefully considered and adapted to the unique characteristics of these urban spaces. These criteria were identified through a systematic literature review, as elaborated in Section 3.0 (Methodology).

Accessibility represents a foundational criterion in the design and revitalisation of alleyways and is pivotal in determining whether the public can effectively utilise these spaces. As indicated by Wan Hashimah and Low (2016) and Alawadi et al. (2021), ease of access is essential for evaluating the functionality of an alley as a public space. An easily accessible alley enhances usability and invites diverse user engagement. Blazy (2019) further highlights the importance of a connected network of alleys, asserting that alleys linked without dead-end roads significantly improve movement fluidity and contribute to a more cohesive urban experience. Such connectivity simplifies navigation and indirectly enhances users' sense of safety, as well-connected spaces are typically more populated and visible, deterring potential criminal activity (Mehta & Bosson, 2009).

Furthermore, the design of pedestrian areas within alleys should be intricately integrated with urban transportation and environmental architecture. According to NACTO and GDCI (2020), pedestrian spaces must uphold the integrity of the urban framework, ensuring appropriate placement, distinct identity, and easy access via public transportation and nearby parking facilities. This perspective aligns with Blazy's (2019) assertion that accessibility should be evaluated based on ease of access for pedestrians, cyclists, and public transport users. Thus, the overall accessibility of an alley is a multi-dimensional concept encompassing both physical access and the alley's integration within the broader urban network.

Safety constitutes a fundamental aspect in the evaluation of alleys as public spaces. The perception and reality of safety within these environments are critical for promoting frequent usage. Blazy (2019) notes that a well-connected network of alleys enhances users' sense of security by increasing visibility and ensuring that these areas are well-frequented. Safety in alleys is typically assessed through various factors, including visibility, the concentration of human activities, and the presence of "eyes on the street", a concept introduced by Jacobs (1961) and further examined by Wan Hashimah and Low (2016) as well as Ng and Sze (2021). This concept refers to the natural surveillance afforded by individuals in the vicinity.

Moreover, Gehl (2011) and UN-Habitat (2016) underscore the significance of security measures that differentiate between pedestrian and vehicular movements, ensuring all users' safety in these spaces. This differentiation is particularly vital in

alleys, where the narrowness of the passage may heighten the potential for conflict among various user types. Alawadi et al. (2021) researched pedestrian areas, indicating that these environments are frequently compromised by vehicles, visual pollution, noise, air pollution, and insufficient security. Such disruptions not only detract from the user experience but also undermine the overall safety and appeal of the space. Consequently, ensuring safety in alleys necessitates a synergistic approach involving thoughtful design, adequate lighting, and active surveillance to foster an environment in which users feel secure.

Comfort is a crucial determinant of the overall attractiveness and usability of alleys as public spaces. The experience of comfort within an alley is intricately linked to the physical condition and maintenance of the area (Fialko et al., 2019; Brazeau-Béliveau & Cloutier, 2021; Pham et al., 2022). Weber and Schneider (2021) assert that well-designed pedestrian spaces should encompass elements that enhance the pedestrian experience, such as clearly defined open areas, architectural uniformity, and visual landmarks that foster a sense of place and orientation. The perception of comfort is often influenced by cleanliness, adequate seating, shade, and additional amenities that encourage people to linger and enjoy the space (Alawadi et al., 2021; Ng & Sze, 2021).

Furthermore, Aşlıoğlu and Çay (2020) underscored the importance of maintaining urban alleys to enhance their perceived comfort and safety. A well-maintained alleyway becomes more attractive and is more likely to be perceived as secure and inviting. Sensory elements, including smell, sound, visual aesthetics, and the overall physical condition, significantly influence users' comfort levels, affecting their willingness to utilise the space (Sulaiman et al., 2017; Mehta & Bosson, 2018). Zhang et al. (2019) further emphasised that aesthetic factors, such as vegetation, cleanliness, regular upkeep, and the availability of amenities, are crucial in enhancing the comfort and overall appeal of pedestrian areas. These components establish a functional and pleasurable environment, encouraging frequent visits and ongoing use.

The cultural significance and social interaction aspects are equally vital when revitalising alleys, particularly when these spaces are transformed into "cultural corridors". This concept has been examined by various researchers, including Wan Hashimah and Low (2016), Blazy (2019), Chua and Yahaya (2021), and Ng and Sze (2021), who highlighted the potential of alleys to evolve into vibrant cultural spaces within urban settings. By integrating cultural activities and elements, alleys can be reimagined as destinations rather than mere passageways, thereby enriching the social and cultural fabric of the city (Wan' Iffah, 2017; Blazy, 2019). The transformation of alleys into cultural corridors involves incorporating art, music, and other forms of cultural expression, which can establish these locales as hubs for social interaction and community engagement (Ng & Sze, 2021). Chua and Yahaya (2021) emphasised that revitalised alleys play a fundamental role in fostering a cohesive urban fabric, improving pedestrian connectivity, enhancing social cohesion, and strengthening street networks. Such developments can stimulate local economies and fortify community identity by providing alternative access points to shops and commercial establishments.

Furthermore, the green environment is critical when designing and assessing alleys. Scholars such as UN-Habitat (2020), Brazeau-Béliveau and Cloutier (2021), and Pham et al. (2022) have thoroughly discussed the significance of green environments within urban spaces, including alleyways. Incorporating green elements, such as trees, grass, and other forms of vegetation, can substantially enhance the environmental quality of these spaces, fostering a balance between urban development and nature (UN-Habitat, 2016; Pham et al., 2022). Green spaces within alleys augment aesthetic appeal and provide practical benefits, including erosion control, noise pollution reduction, mitigation of the urban heat

island effect, and improvements in air quality (Aşilioğlu & Çay, 2020). These environmental considerations are essential for enhancing the overall well-being of urban residents (Weber & Schneider, 2021; Brazeau-Béliveau & Cloutier, 2021), transforming alleys from mere transit areas into places where individuals can experience respite from the demands of urban life.

Methodology

The variables contributing to the quality of alleys within the context of old shophouses were identified through a systematic literature review. This systematic search was conducted using the Web of Science (WOS) and Scopus databases, focusing on research articles published between 2013 and 2023. The search process was carried out in November 2023, utilising Boolean operators 'AND' and 'OR' to refine and structure the search query for identifying relevant variables (Table 1).

Table 1: Search Query for Screening Process

Search Query	Term Used
WOS and SCOPUS	(TITLE-ABS-KEY("alley" OR "alleys" OR "urban alley" OR "back alley" OR "public alley") AND TITLE-ABS-KEY("revitalisation" OR "urban planning" OR "public space" OR "sustainability" OR "community engagement" OR "pedestrian network")) AND PUBYEAR > 2012 AND (LANGUAGE("English"))

The initial findings from the systematic search yielded 28 articles from Web of Science (WOS) and 1,159 articles from Scopus. A screening process was conducted to exclude irrelevant articles, focusing on titles, keywords, and abstracts. This step resulted in a total of 26 articles deemed relevant. Subsequently, a second screening process involving full-text reviews was conducted to assess eligibility based on inclusion criteria. Articles that did not focus on alleys as public spaces were excluded, resulting in 21 eligible articles: 5 from WOS and 16 from Scopus. No articles were excluded following a consensus among the authors. Through this process, the factors influencing the quality of alleys were identified. However, it is important to acknowledge the limitations of this search. These include language constraints, the predefined time frame for included publications, and the possibility that some relevant studies were not indexed in the databases used for this study. Despite these limitations, the findings provide a valuable foundation for understanding the factors affecting alley quality.

Following the systematic literature review, five main variables were found to be critical factors including, Accessibility, Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment. As the study emphasises subjective measures, these variables were adapted into a 22-item questionnaire using a 5-point Likert scale to quantify the quality of revitalised alleys based on user perceptions. The questionnaire required respondents to indicate their degree of agreement or disagreement with items related to the quality of the revitalised alleys in Malaysia, with each item measured using a Likert five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Alleys in Penang, Perak, and Terengganu were chosen due to their distinct urban morphologies, heritage value, and documented revitalisation efforts. Penang, a UNESCO World Heritage Site, has undergone comprehensive heritage-led urban renewal, including alley greening and public art interventions that have demonstrably increased footfall and tourism interest (ThinkCity, 2016; Lim & Ouardin, 2020). In Perak, Ipoh's Old Town has undergone revitalisation of its alleys, galleries, and alleyway art installations, aimed at boosting tourism while preserving its heritage architecture (Wee et al., 2014; Nik Hashim et al., 2024). Terengganu's initiatives, such as alley greening and cultural embellishment, reflect efforts tied to heritage preservation and environmental enhancement in historic city centres (Loo et al., 2021).

Random sampling was used to select six alleys from each historic district, resulting in a total of 18 revitalised alleys from Perak, Terengganu, and Penang (Figure 1). The data were collected through a face-to-face questionnaire survey using Google Forms between January and March 2024, involving 197 participants across three states. The survey was conducted directly at selected revitalised alleys (see Figure 2), where alley users aged 18 and above were invited to participate voluntarily. Due to the informal and transient nature of alley usage, it was not feasible to determine the total population of users in each location. Therefore, a non-probability, voluntary response sampling method was employed. The inclusion of approximately 60 to 70 respondents per state meets the recommended minimum sample thresholds for regression analysis (Hair et al., 2019; Memon et al., 2020).

According to Hutcheson and Sofroniou (1999), Hair et al. (2019), and Memon et al. (2020), a sample size between 150 and 300 is generally considered adequate for conducting multivariate statistical analyses, including linear regression, particularly when model complexity is moderate and assumptions such as normality and linearity are met. The current sample ($n = 197$) falls within this accepted range, indicating sufficient power to produce reliable and generalisable regression estimates.

Upon completing data collection, we conducted diagnostic assessments to investigate the relationships between the variables in this study. The Pearson correlation coefficient was employed to analyse the linear association between the current variable and its counterpart, with the data being normalised for this purpose. Additionally, we conducted both the Kolmogorov-Smirnov (KS) test and the Shapiro-Wilk test to assess hypotheses and examine the normal distribution of the data. Moreover, we utilised the Kaiser-Meyer-Olkin (KMO) metric and Bartlett's test of sphericity to evaluate sample adequacy and intervariable correlation. We also employed Cronbach's alpha statistic to gauge instrument reliability, while variance-based methodologies were used for variance analysis. Data verification and analysis were conducted using the statistical software SPSS Statistics. Finally, the model estimation was estimated based on the equation below:

$$\begin{aligned} \text{Alleys' Quality}_i &= \alpha_0 + \beta_1 \text{Accessibility}_i + \beta_2 \text{Safety}_i + \beta_3 \text{Comfort}_i \\ &+ \beta_4 \text{Cultural Significance and Social Interaction}_i + \beta_5 \text{Green Environment}_i + \varepsilon_i \end{aligned}$$

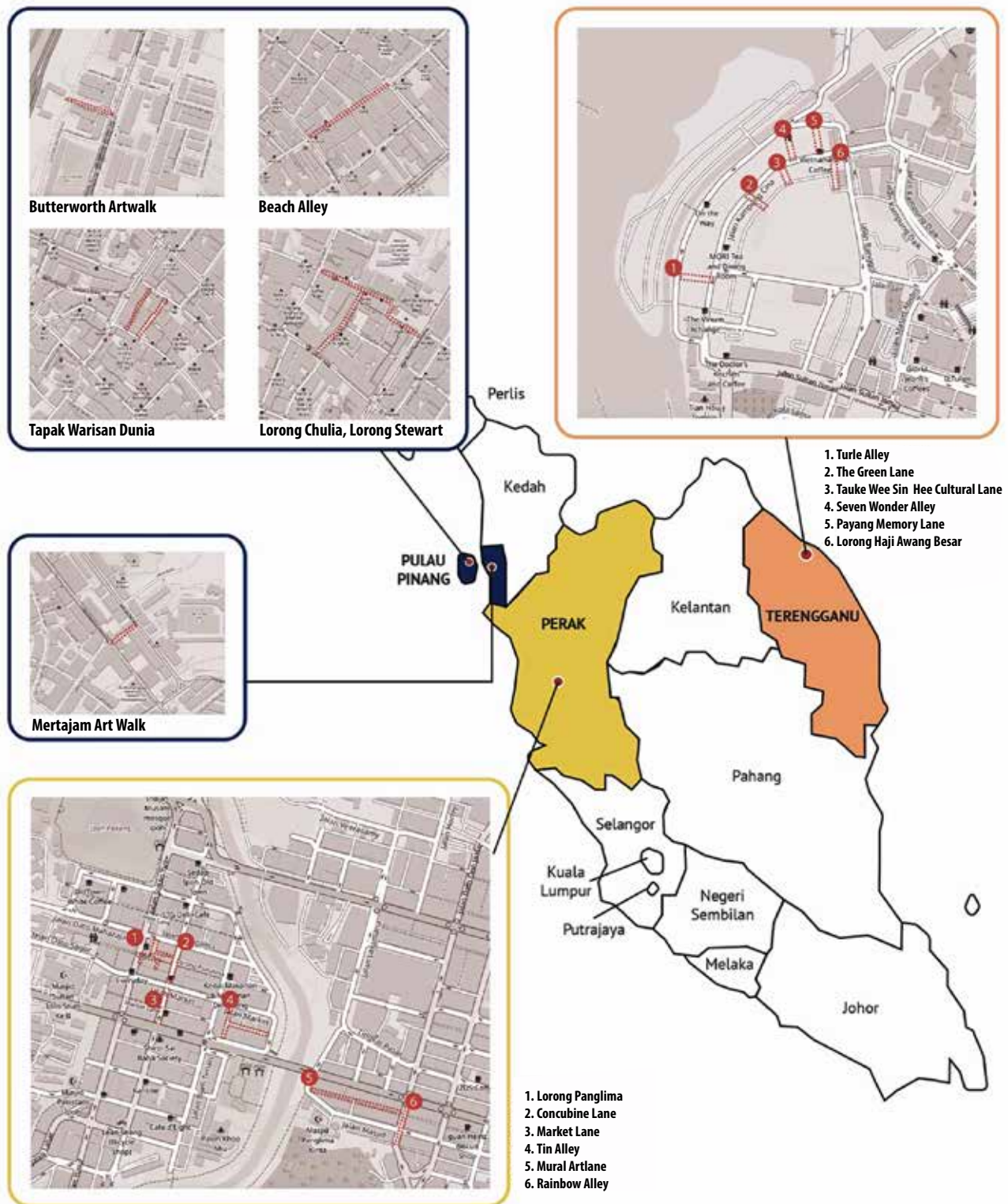


Figure 1: Selected 18 Revitalised Alleys from Penang, Perak and Terengganu.



Figure 2: Selected 18 Revitalised Alleys from Penang, Perak and Terengganu.

Results

The data collection process resulted in a total of 197 respondents, with an equal distribution of 67 participants each from Penang and Perak, and 63 participants from Terengganu (Table 2). The respondent pool was diverse, comprising locals, shop owners, tourists, and passersby, reflecting the multifaceted demographics of the users in these alleys. The study employed a structured questionnaire to assess various sub-factors of alley quality, categorised under the main dimensions of Accessibility, Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment.

Table 2: The Distribution of the Locations of the Respondents.

Location	Number of respondents (n)	Percentage (%)
Penang		
Butterworth Art Walk	13	6.6%
Mertajam Art Walk	14	7.1%
Tapak Warisan Dunia	10	5.1%
Beach Street	10	5.1%
Lorong Chulia	10	5.1%
Lorong Stewart	10	5.1%
Perak		
Lorong Panglima	15	7.6%
Market Lane	10	5.1%
Concubine Lane	10	5.1%
Mural Art Lane	11	5.6%
Rainbow Alley	11	5.6%
Tin Alley	10	5.1%
Terengganu		
Turtle Alley	11	5.6%
The Green Lane	10	5.1%
Tauke Wee Sin Hee Cultural Lane	11	5.6%
Seven Wonder Alley	10	5.1%
Lorong Haji Awang Besar	11	5.6%
Payang Memory Lane	10	5.1%
Total	197	100%

Before estimating the regression model, preliminary tests were conducted to ensure the reliability and suitability of the data. The reliability test yielded Cronbach's Alpha values of more than 0.70 (Table 3), indicating acceptable internal consistency for the variables. The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was 0.710, signifying that the sample size was adequate for factor analysis, and Bartlett's Test of Sphericity returned a chi-square value of 119.406, significant at the 1% level ($p < 0.01$). These results confirm that the data structure is suitable for the estimation of the model, ensuring the robustness and validity of the findings. The final estimated model of the study is presented in Table 4.

Table 3: Factor Loadings and Cronbach's Alpha Values

Item/variable	Factor loadings	Cronbach alpha value
Accessibility		0.78
Connectivity	0.72	
Proximity to Public Transport	0.69	
Integration with Urban Structure	0.74	
Wayfinding and Signage	0.71	
Safety		0.82
Lighting	0.77	
Visibility and Sightlines	0.73	
Surveillance Camera	0.68	
Presence of Human Activity	0.70	
Pedestrian and Vehicular Separation	0.66	
Comfort		0.76
Cleanliness	0.75	
Seating and Amenities	0.70	
Shade and Shelter	0.72	
Sensory Experience (Smell, Sound, Sights, Touch, Taste)	0.68	

Item/variable	Factor loadings	Cronbach alpha value
Maintenance	0.71	
Cultural Significance and Social Interaction		0.81
Presence of Cultural Activities	0.78	
Integration of Art and Cultural Elements	0.74	
Social Interaction and Community Engagement	0.76	
Green Environment		0.74
Greenery and Vegetation	0.73	
Urban Heat Island Mitigation	0.69	
Air Quality	0.71	

Table 4. The Estimated Model of the Study

	Unstandardised Coefficients		t	p-value
	Beta	Std. Error		
(Constant)	2.898	.801	3.620	.000
Accessibility	-.251**	.120	-.092	.037
Safety	.326**	.110	2.964	.004
Comfort	.289*	.130	2.223	.028
Cultural Significance and Social Interaction	.319**	.115	2.773	.007
Green Environment	.211	.106	1.990	.050
R Square	.600			

Note: * Means significant at the 0.10 level, ** Means significant at the 0.05 level and *** means significant at the 0.01 level.

The regression analysis revealed several insights into the relationships between the independent variables and the dependent variable, which reflects the overall perceived quality of revitalised alleys in Malaysia. The constant, with an intercept value of 2.898 ($p = 0.000$), is statistically significant, establishing a baseline for the dependent variable when all other predictors are held constant.

Accessibility exhibited a negative coefficient (-0.251), which was statistically significant at 5% confidence interval level ($p=0.037$), suggesting that, in this context, increased “access” is likely operating as a proxy for vehicular permeability (e.g., motorcycle through-movement, curb intrusion, informal parking) rather than pedestrian connectivity. This indicates an inverse relationship, where increased accessibility corresponds to a decrease in the dependent variable, alley quality. Substantively, the finding is consistent with a threshold or overload interpretation: beyond a certain point, permeability invites traffic frictions that displace social use and erode perceived quality. This counterintuitive result does not imply that access is undesirable; rather, it implies the need to distinguish *pedestrian* accessibility from *vehicular* permeability and to implement calibrated access controls (e.g., bollards, time-based delivery windows, resident-only parking, micromobility bays) that preserve walkability while suppressing spillover traffic. This highlights the importance of strategic, context-sensitive approaches to enhancing accessibility, ensuring it contributes positively to alley quality rather than detracting from it.

Safety demonstrated a positive coefficient (0.326), statistically significant at 5% confidence interval level ($p=0.004$), positioning it as a foundational “enabler” of other attributes. Factors such as improved lighting, effective surveillance, and clear pedestrian-vehicular separation likely contribute to a heightened sense of security and overall user satisfaction. From a design-operations standpoint, investments in safety (sightlines, lighting continuity, conflict-free crossings) are likely to yield systemwide gains—not only direct perceptual benefits but also indirect boosts to

comfort, social activity, and dwell time through increased presence (“eyes on the alley”). These findings reaffirm the need to prioritise safety interventions as part of comprehensive urban design strategies.

Comfort, with a coefficient of 0.289, was statistically significant at 10% confidence interval level ($p=0.028$), indicating an independent contribution to perceived quality. Factors such as seating, shade, and sensory experiences contribute significantly to creating a more inviting and user-friendly environment, encouraging prolonged and diverse use of these spaces. Given the operational nature of comfort elements (benches, shade sails, misting or high-albedo surfaces), they represent relatively low-cost levers with outsized perceptual returns, particularly when sequenced after basic safety upgrades. The pattern is consistent with a mediated pathway in which Safety improves dwell time, and Comfort converts dwell time into positive evaluations.

Cultural Significance and Social Interaction yielded a positive coefficient of 0.319, significant at 5% confidence interval level ($p=0.007$). This positive association underscores the role of programming and place identity. The integration of art, cultural cues, and community spaces appears to add value net of physical upgrades, enhancing cohesion and vibrancy. Practically, episodic programming (markets, pop-ups, small performances) can act as a demand shock that normalises presence and informal surveillance, thereby reinforcing Safety and Comfort effects. In multicultural Malaysian contexts, culturally legible cues may also lower perceived territorial ambiguity, improving wayfinding and social permission to linger.

Green Environment, with a coefficient of 0.211, was significant at 5% confidence interval level ($p=0.050$). The borderline significance suggests a modest but meaningful contribution of greenery to perceived quality. Green features likely operate through multiple channels, thermal comfort, aesthetic softening, and acoustic buffering, whose effects accumulate when paired with lighting continuity and clear pedestrian priority. Accordingly, linear micro-green interventions (planter edges, treed walkways) may outperform isolated lawns by co-locating shade and legibility along primary paths.

The results indicate a significant in the explanatory power of the model, with an R Square value of 0.60, meaning that 60% of the variance in the dependent variable is explained by the included predictors. This substantial increase in explanatory power suggests that the identified variables, especially Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment, are critical to understanding and improving the quality of revitalised alleys. The pattern of coefficients is consistent with a layered mechanism: Safety functions as an enabling condition; Comfort converts presence into dwell time; Cultural/Social activity amplifies legibility and belonging; and Green features provide thermal and aesthetic relief along desire lines.

The findings underscore the significant yet nuanced role of Accessibility, as it negatively correlates with alley quality in this model, suggesting the need for strategic implementation. While other variables, Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment, remain vital to a holistic understanding of alley revitalisation. Taken together, these attributes appear complementary rather than substitutive, jointly shaping perceived quality.

The findings emphasise the importance of integrated planning approaches that balance accessibility with other critical dimensions to optimise the functionality and appeal of revitalised alleys in Malaysia. A practical sequencing follows from the model: (1) stabilise safety (lighting continuity, clear sightlines, conflict removal); (2) layer comfort (shade, seating, micro-amenities); (3) programme for presence (small cultural/social activations); (4) stitch greenery along primary pedestrian

paths; and (5) calibrate access to be pedestrian-first while constraining vehicular permeability. These results offer valuable insights into the critical role of enhancing accessibility in revitalised alleys. This aspect will be explored in greater depth in the following section, focusing on strategies to balance improved access with the preservation of functionality and user experience.

Discussion

The Role of Safety in Revitalised Alleys

The findings of this study underscore the importance of safety as a foundational element in the successful revitalisation of alleys. With a positive and statistically significant coefficient for safety (0.326, $p=0.004$), it is evident that safety profoundly influences how users perceive and interact with alleys. A sense of safety is not only a determinant of physical use but also a catalyst for social interaction, economic activity, and community engagement, all of which are essential to the functionality and vibrancy of public spaces (Lynch, 1960). Safety significantly affects user behaviour and their willingness to occupy alleys. Well-lit pathways, clear sightlines, and visible surveillance, whether through natural means or CCTV, are critical in fostering a sense of security (Chua & Yahaya, 2021). Studies have consistently shown that users are more inclined to engage with spaces they perceive as safe, thereby increasing foot traffic and enhancing social cohesion (Mehta & Bosson, 2009; Wan Hashimah & Low, 2016; Ng & Sze, 2021). Conversely, poorly lit and deserted alleys often evoke feelings of insecurity, deterring activity and contributing to their underutilization (Mehta & Bosson, 2018).

The data from this study further corroborates the importance of these safety measures. For instance, lighting was found to have a significant and positive impact (0.156, $p=0.000$) on alley quality. Proper lighting during both daytime and nighttime is essential to ensure user visibility, discourage illicit activities, and create a welcoming environment. Similarly, surveillance systems, such as CCTV, exhibited a strong positive relationship (0.165, $p=0.000$) with perceived safety, reinforcing the idea that monitored spaces are safer and more inviting. Furthermore, the presence of human activity was another critical factor (0.145, $p=0.001$) that contributes to the liveliness and perceived safety of alleys. The concept of “eyes on the street”, as proposed by Gehl (2011), emphasises the value of active human presence in creating a secure and engaging urban space. However, safety is not solely about crowd density; it is also about fostering a space that feels inviting, meaningful, and conducive to diverse activities. Visibility and sightlines also play a crucial role in enhancing user confidence and safety in alleys (0.134, $p=0.002$). Spaces with clear sightlines allow users to predict their movements and avoid blind spots, which are often perceived as threats. Gehl (2011) further highlighted that deserted spaces with minimal visual engagement, such as those without windows, frontages, or openings, send signals of insecurity to users.



Figure 3: Examples of Safety in Malaysia's Alleys. (a) Concubine Lane, Perak; (b, c) Mertajam Artwalk, Penang.

In Malaysia, many revitalised alleys suffer from this exact problem, where the lack of building openings or double frontages contributes to a sense of isolation. Chua and Yahaya (2021) suggest introducing double frontage design to increase visibility and transparency, thereby fostering activity and mitigating the perception of insecurity. Another sub-factor within safety is pedestrian and vehicular separation (0.125, $p=0.007$). In many alleys, conflicts arise from the presence of motorcycles and cars, which force pedestrians to remain constantly alert. This diminishes the quality of the space and its usability for walking or socialising. Gehl (2011) and UN-Habitat (2018) emphasised that well-designed public spaces prioritise the comfort and safety of pedestrians, enabling them to move freely and confidently. Effective measures such as designated sidewalks, traffic calming, and speed controls are essential to minimise risks and create a pedestrian-friendly environment (Aşilioğlu & Çay, 2020; Alawadi et al., 2021). Physical barriers or differentiated pathways can further enhance safety, ensuring that alleys can accommodate both pedestrian and vehicular functions without compromising user comfort.

Cultural Significance and Social Interaction as Catalysts

Cultural Significance and Social Interaction serve as catalysts for enhancing the quality of revitalised alleys, with a significant coefficient (0.319, $p=0.007$) highlighting the importance of integrating cultural elements into these spaces. The Presence of Cultural Activities (0.125, $p=0.005$) in Malaysia's alleys fosters local economic growth by supporting small businesses and artisans, while simultaneously attracting visitors and promoting cultural tourism. These activities not only generate revenue but also deepen the connection between the community and the historical identity of the alley.



Figure 4: Examples of Cultural Significance and Social Interaction in Malaysia's Alleys. (a, b) Lorong Haji Awang Besar, Terengganu; (c) Mural Artlane, Perak.

Additionally, the Integration of Art and Cultural Elements (0.112, $p=0.017$) brings historical narratives and artistic vibrancy to life, serving as a bridge between the past and the present. However, despite their significance, these elements often require more deliberate and thoughtful integration to sustain the long-term quality and appeal of alleys. A critical gap lies in the lack of comprehensive strategies to ensure that art and cultural elements are dynamic and reflective of the evolving identity of the space. For instance, curated art installations, rotating cultural exhibitions, or interactive displays could inject fresh perspectives into these areas, keeping them relevant and engaging (He et al., 2021). Moreover, collaboration with local artists and cultural organisations can help maintain authenticity while fostering community ownership of the space (UN-Habitat, 2016).

Social Interaction and Community Engagement (0.142, $p=0.002$) further amplify the role of alleys as vibrant public spaces. These interactions create opportunities

for locals to connect, organise events, and build stronger community bonds, transforming alleys into places of social cohesion. Such engagement also enhances the sense of place and belonging, which is crucial for both residents and visitors (Hashemnezhad et al., 2013). However, for these interactions to be meaningful, alleys must provide adequate infrastructure, such as shaded seating areas, flexible event spaces, and pedestrian-friendly environments, to encourage prolonged use and participation. To maximise the potential of Cultural Significance and Social Interaction, urban planners should focus on creating culturally inclusive spaces that celebrate local heritage while remaining adaptable to contemporary trends. Policies should encourage public-private partnerships to fund cultural initiatives, ensuring sustainability. Moreover, periodic evaluations of the effectiveness of cultural programming can help refine strategies and align them with community needs.

Comfort as a Key Driver of User Experience

Comfort plays a significant role in shaping user experiences in revitalised alleys, with a positive and statistically significant influence (0.289, $p=0.028$). It encompasses a variety of factors that collectively contribute to the usability and appeal of these spaces. Among these, cleanliness (0.089, $p=0.062$) stands out as a critical sub-factor, as alleys free of litter and debris create an inviting environment. A clean space not only enhances aesthetic appeal but also fosters a sense of care and safety, encouraging more frequent use by the public. Seating and amenities (0.072, $p=0.143$) remain integral components of comfort. These elements provide opportunities for users to rest, socialise, and engage in leisurely activities, transforming alleys into places for prolonged and meaningful interactions. Gehl (2011) highlighted that well-designed public spaces offer not only visual opportunities but also spaces for hearing and talking, creating what he termed a “talkscape”. Seating arrangements in alleys facilitate such social exchanges, making the space more dynamic and inclusive. Planners should consider the strategic placement of seating to maximise usability, ensuring that both standing and sitting opportunities are available for diverse user groups (Li et al., 2022).



Figure 5: Examples of Comfort in Malaysia's Alleys. (a) Lorong Panglima, Perak; (b) Beach Alley, Penang; (c) Butterworth Artwalk, Penang; (d) Seven Wonder Alley, Terengganu.

Shade and shelter (0.085, $p=0.084$) are also crucial to user comfort, providing protection from adverse weather conditions, such as rain or excessive heat. The inclusion of awnings, canopies, or natural shade elements like trees can significantly enhance user satisfaction. Chua and Yahaya (2021) emphasise the value of extended canopies from alley frontages, which can create shaded walkways that encourage pedestrian activity even during extreme weather. Sensory experiences (0.068, $p=0.141$), including seeing, smelling, hearing, tasting, and touching, enrich

users' interactions with alleys. These multi-sensory elements not only enhance the overall experience but also encourage exploration and engagement. Planners can capitalise on these aspects by integrating elements such as vibrant street art, fragrant plantings, or tactile materials in alley design to stimulate user curiosity and enjoyment. Finally, maintenance (0.075, $p=0.130$) plays a crucial role in maintaining comfort. Well-maintained walking surfaces and functional amenities signal care and investment, reinforcing users' trust in the space (Gehl, 2011). Conversely, neglected facilities or deteriorating infrastructure deter visitors and undermine the long-term viability of the alley as a public space. Regular upkeep schedules and responsive maintenance systems are essential to preserving the comfort and functionality of these spaces.

Integration of Green Environment in Alley

The integration of a green environment demonstrates a significant impact on the quality of revitalised alleys (0.211, $p=0.050$), emphasising its importance in creating sustainable and liveable urban spaces. Despite this, opportunities for improvement remain, particularly in maximising the potential of greenery and addressing environmental challenges. Greenery and Vegetation (0.095, $p=0.031$) offering both functional and aesthetic benefits. Strategically placed trees act as natural awnings, providing continuous canopy cover that shields users from inclement weather, such as rain and excessive sun exposure. This not only enhances user comfort but also adds to the visual appeal of the alley. The concept of "optimum canopy cover" is critical for improving microclimates within alleys, as it reduces heat absorption and enhances shade, making the space more inviting for prolonged use (Gehl, 2011; Adam et al., 2016). Urban planners should consider tree species with broad canopies and resilience to urban conditions to ensure long-term viability.



Figure 6: Examples of Green Environment in Malaysia's Alleys. (a) The Green Lane, Terengganu; (b) Lorong Panglima, Perak; (c) Mertajam Artwalk, Penang; (d) Tin Alley, Perak.

Urban Heat Island Mitigation (0.075, $p=0.114$) plays an essential role in improving the overall microclimate of alleys. Gehl (2011) highlights the importance of enhancing microclimates to encourage people to linger and engage in public spaces. Planting trees, incorporating vertical greenery, and using reflective or permeable materials for surfaces can help reduce heat accumulation in urban alleys (Weber & Schneider, 2021; Pham et al., 2022). These interventions not only address the thermal comfort of users but also contribute to broader urban sustainability goals. Air Quality (0.085, $p=0.084$) is another crucial factor for the quality of alleys, as it directly affects the health and comfort of users. Clean air free from pollutants enhances the overall user experience, encouraging repeated visits and longer stays. Green infrastructure, such as living walls and dense vegetation, can help filter airborne pollutants and improve air quality in alleys situated near busy streets or industrial areas (Ye et al., 2019; Brazeau-Béliveau & Cloutier, 2021). Additionally, encouraging non-motorised transportation within alleys can further reduce localised emissions and enhance air cleanliness (Alawadi et al., 2021).

To maximise the potential of green environments, urban planners and policymakers should adopt an integrated approach. This includes prioritising green infrastructure in alley designs, selecting tree species that provide optimal canopy cover, and ensuring consistent maintenance of vegetation to prevent overgrowth or decay. Furthermore, leveraging innovative solutions such as green walls, rooftop gardens, and water-sensitive urban designs can amplify the environmental benefits of revitalised alleys.

Improving Accessibility in Alley Revitalisation: Strategies and Implications

This study underscores the need for targeted enhancements and strategic interventions for 'Accessibility' due to its comparatively low coefficient (-0.251 , $p=0.037$). Improving physical access (-0.105 , $p=0.037$) is fundamental, as uneven surfaces, obstructions, and a lack of universal design elements often hinder usability. Planners must prioritise implementing ramps, tactile paving, and wide pathways to ensure alleys are accessible to individuals with disabilities, children, and the elderly (Gehl, 2011). Planners can also adapt perceptible information, which refers to the effective communication of necessary details to users by employing multiple modes, such as pictorial, verbal, and tactile methods, to cater to diverse sensory abilities (Adewale et al., 2022). Regular audits and user feedback can help identify and address specific physical barriers. Moreover, it is crucial to ensure pathways are smooth, level, and free of obstacles to accommodate wheelchairs, strollers, and individuals with mobility aids (Aşilioğlu & Çay, 2020). Meanwhile, connectivity (-0.115 , $p=0.024$), another sub-factor with a low coefficient, requires integrating alleys more effectively into the broader urban fabric. Enhancing connections to main streets, public amenities, and transit hubs will transform alleys from isolated spaces into essential links within the urban network. For instance, Yoshii (2016) highlighted ensuring alleys serve as pedestrian-friendly corridors between transport hubs and key destinations can increase foot traffic and functionality.

Proximity to public transport (-0.065 , $p=0.238$) also needs strategic improvement. Introducing signage, shaded waiting areas, and pedestrian pathways connecting alleys to nearby transit stops can make them more inviting and usable (Alawadi et al., 2021). Additionally, collaboration with transit authorities to improve public transport stops near alleys can further enhance their accessibility. For integration with urban structure (-0.081 , $p=0.128$), planners should consider embedding alleys into zoning and development plans to ensure they complement surrounding land uses. This could include transforming alleys into mixed-use spaces that support both residential and commercial activities. Wayfinding and signage (-0.075 , $p=0.151$) must also be addressed to improve navigability. Installing clear, visually appealing, and context-sensitive signage will help users easily orient themselves. Innovative digital solutions, such as QR codes leading to interactive maps or augmented reality features, can further enhance the wayfinding experience (Kim et al., 2015).

The synergy between accessibility and safety further amplifies the value of revitalised alleys. Blazy (2019) noted that well-connected and navigable alleys reduce perceptions of danger, fostering environments where users feel secure. However, accessibility without adequate safety measures can lead to unintended consequences, such as overcrowding or conflicts between pedestrians and vehicles. Ensuring clear pedestrian pathways, installing adaptive lighting, and integrating surveillance systems can enhance both accessibility and safety, making alleys welcoming for all users (Jacobs, 1961; Ng & Sze, 2021). Effective accessibility in alleys also relies on robust urban policy frameworks and collaborative governance. Policymakers must prioritise accessibility in alley revitalisation projects, ensuring alignment with broader planning goals. Collaboration among local authorities,

community stakeholders, and urban planners is essential for designing and implementing sustainable solutions. Engaging communities in the planning process ensures that accessibility improvements are context-sensitive and meet the specific needs of users, fostering a sense of inclusion and shared responsibility (Brazeau-Béliveau & Cloutier, 2021).

The integration of smart technology in alley accessibility represents a forward-looking approach to urban design. Digital wayfinding tools (Kim et al., 2015), real-time occupancy monitoring (Frank et al., 2021), and adaptive lighting systems optimise user experience while maintaining sustainability. For example, Ghafoor-Zadeh (2023) suggests developing mobile applications or interactive kiosks that provide navigation assistance and information about the alley and surrounding areas, helping users to navigate the alley easily. Planners can also install lighting that adjusts based on occupancy or time of day to improve safety and energy efficiency. Internet of Things (IoT) solutions enable data-driven design, allowing planners to monitor usage patterns and adapt designs to evolving needs (Kumar et al., 2019). These technologies not only enhance accessibility but also ensure that alleys remain dynamic and user-centric. Balancing accessibility with aesthetics is another critical consideration. Functional enhancements should not compromise the cultural and historical character of alleys. Discreet signage, context-sensitive urban furniture, and materials that harmonise with the existing environment ensure that accessibility improvements blend seamlessly with the alley's identity. Successful examples include alleys where modern accessibility features coexist with heritage elements, creating spaces that are both practical and visually appealing (Bratuškins & Treija, 2017).

However, improved accessibility can lead to challenges such as overuse, overcrowding, and gentrification. Increased foot traffic may strain resources, while the rising popularity of revitalised alleys could drive up property values, displacing existing communities (Matsumoto & Sawaki, 2017). Yee Sing and Yoh (2016) noted that mitigation strategies include maintaining equitable access, implementing policies to prevent over-commercialisation, and balancing revitalisation with affordability. By addressing these risks, urban planners can ensure that accessibility improvements benefit all stakeholders without causing unintended social or economic harm. Post-implementation monitoring and evaluation are essential for ensuring that accessibility improvements meet user needs and align with project goals. Regular assessments of user satisfaction, sustainability outcomes, and urban functionality provide valuable feedback for continuous improvement (Labdaoui et al., 2021). Mechanisms such as spatial analyses and digital monitoring tools can help planners measure the long-term impact of accessibility enhancements, ensuring that revitalised alleys remain relevant and effective in their role as public spaces (UN-Habitat, 2020).

Accessibility is a cornerstone of revitalised alleys, significantly enhancing their functionality, usability, and relevance in the urban context. Its impact on urban liveability is profound, fostering environments where diverse groups, including children, the elderly, and individuals with disabilities, can navigate with ease. Improved walkability and connectivity ensure that alleys function as integral parts of the city's pedestrian network, enhancing the quality of life for residents by providing safe and enjoyable spaces for movement and interaction (Gehl, 2011; Blazy, 2019). These improvements support inclusivity, ensuring that alleys are not just transitional spaces but destinations that cater to a wide range of users. Economically, enhanced accessibility drives increased foot traffic, which benefits local businesses and stimulates economic activity in the vicinity of revitalised alleys. The resulting visibility and engagement can attract investments, creating opportunities for small-scale economic activities such as street markets, pop-up shops, and artisanal displays (Wan 'Iffah, 2017; Sulaiman et al., 2017). Tourism

also flourishes in accessible alleys, where ease of navigation and vibrant urban experiences draw visitors and contribute to the local economy (ThinkCity, 2016). Revitalised alleys become economic hubs, generating income for communities and supporting the livelihoods of small business owners.

From a sustainability perspective, accessibility aligns with broader urban development goals, reducing dependency on vehicles and encouraging active transportation such as walking and cycling. Incorporating green infrastructure, like permeable pavements, bioswales, and shaded pathways, not only enhances accessibility but also mitigates environmental challenges such as urban heat islands and water runoff (Pham et al., 2022). For instance, Fialko et al. (2019) implement features that manage stormwater naturally, can reduce the burden on drainage systems and enhance the aesthetic appeal of alleys. These sustainable design elements improve the ecological health of urban areas while making alleys more comfortable and inviting for users. Accessibility improvements, when coupled with green solutions, represent a convergence of environmental stewardship and urban usability (Weber & Schneider, 2021). Socially and culturally, accessible alleys act as vibrant spaces for community interaction and cultural engagement. They become venues for public art, local festivals, and social gatherings, promoting local identity and heritage. By integrating cultural elements into accessible designs, alleys serve as bridges between tradition and modernity, celebrating the unique character of the community while catering to contemporary urban needs (McDonough & R. Wekerle, 2011). These spaces enhance community bonds, encouraging social interaction and creating a shared sense of ownership among residents.

Accessibility is not just a functional attribute but a transformative element in alley revitalisation. It influences urban liveability, stimulates economic opportunities, supports sustainability, and fosters social and cultural integration. By addressing challenges such as safety, aesthetics, and overuse, and leveraging smart technologies and inclusive governance, planners can maximise the potential of accessibility to create alleys that are dynamic, inclusive, and resilient urban assets. This holistic approach ensures that revitalised alleys contribute meaningfully to the broader goals of sustainable urban development and community well-being.

Conclusion

This study advances the discourse on urban alley revitalisation by developing and validating a perception-based measurement tool that systematically evaluates the quality of revitalised alleys. Drawing upon a systematic literature review, the tool integrates five critical dimensions: Accessibility, Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment into a 21-item questionnaire tested across 18 historic alleys in Malaysia. The empirical analysis confirms the tool's reliability and validity, providing urban researchers and practitioners with a robust framework to assess alley quality from the perspective of everyday users. This study demonstrates that all five variables significantly contribute to users' perceptions of revitalised alley quality.

On a side note, the results found that Accessibility is the strongest determinant of alley quality, though it demonstrates complex effects that may undermine user experiences if not carefully managed. Safety, Comfort, Cultural Significance and Social Interaction, and Green Environment, while less dominant in statistical weight, remain indispensable for shaping positive perceptions and ensuring holistic functionality. Together, these findings underscore that revitalised alleys thrive not through isolated interventions, but through integrated planning that balances mobility, safety, cultural vibrancy, and environmental quality. A critical insight of this study lies in the paradox of accessibility: while improvements enhance connectivity and usability, poorly coordinated interventions risk generating overcrowding, vehicular conflict, or erosion of cultural ambience. This calls for careful calibration

of accessibility within broader socio-spatial strategies. Complementary dimensions such as safety lighting, cultural programming, and micro-greening must work synergistically with access improvements to deliver inclusive, vibrant, and sustainable alley environments.

This study also presents detailed recommendations to address these accessibility challenges, such as conducting regular maintenance, regulating traffic flow, enhancing security measures, fostering community engagement, integrating cultural art and instalments, promoting holistic development, creating aesthetically appealing signage, and introducing interactive features. These meticulously formulated strategies aim to improve accessibility and enhance user satisfaction in Malaysian alleys, creating a more attractive and sustainable urban environment.

Nevertheless, the study has limitations. The reliance on perception-based measures may not capture the full complexity of behavioural patterns, while the sampling, though sufficient for regression analysis, cannot represent the entirety of Malaysia's diverse urban contexts. Future research should triangulate perception data with spatial or sensor-based analytics, expand to other cities and contexts, and explore longitudinal impacts of revitalisation policies. By doing so, subsequent work can refine this tool into a widely adaptable model, capable of guiding alley revitalisation beyond Malaysia and enriching the global discourse on adaptive reuse of historic urban fabrics.

In summary, the study underscores the importance of these recommendations in establishing accessible, enjoyable, and safe alleys for all users. Ultimately, this study offers robust recommendations for urban planners and decision-makers to enhance alley design and functionality, thereby contributing to the broader goals of urban sustainability, liveability, and inclusivity.

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