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Vitality in Heterogeneous Everyday Open-Space Systems in Dense Urban Neighbourhoods

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Abstract

This study shifts the reading of open space from separate spatial categories toward a heterogeneous everyday open-space system, because characteristics that support use in one space type may not work similarly in another. In dense informal settlements, neighbourhood streets, house yards, residual land, fields, inundated vacant spaces, and river edges are collectively used for everyday activities.

The study examined 122 everyday open-space units in dense settlements along the Musi River, Palembang, Indonesia. Observations recorded space type, land condition, area, access width, facilities, user intensity, and activity diversity. Relationships were analysed using Wilcoxon rank-sum and Kruskal-Wallis tests, Spearman correlations, and negative binomial regression.

Space types differed significantly in user intensity and activity diversity. In the multivariable model, facility count, area, and space type remained associated with user intensity, whereas land condition and access width showed no independent relationship. Each additional facility type was associated with approximately 47% higher intensity. Seating showed the strongest positive relationship; small grocery shops were also positive, docks were not independently significant, and the relationship between vegetation and intensity differed by land condition.

Vitality was therefore not associated with a single physical attribute operating uniformly across spaces, but with context-dependent combinations of spatial character, environmental condition, and activity support. Reading these spaces as one system reveals differentiated but complementary roles in everyday life and directs management toward strengthening spaces that already work through interventions tailored to their conditions and functions.

1. Introduction

Rapid urbanisation in cities of the Global South produces complex urban environments. Cities are shaped by overlapping processes of formal planning, incremental development, infrastructure, mobility, economic activity, and everyday spatial practices. This complexity is particularly visible in dense informal settlements, where communal everyday life also contributes to the production of space [1], [2]. Where additional land is difficult to obtain, residents often use other open spaces or spaces between buildings for sitting, talking, playing, working, waiting, or observing nearby activities. These spaces may not be formally designated as public open space, yet repeated collective use gives them public functions [3]. Their use is shaped through negotiations among crowding, material constraints, and everyday practices, rather than by predetermined physical form alone [4].

The literature on urban open space commonly examines vitality through the characteristics of spaces already recognised as public, such as parks, streets, plazas, and waterfronts. Vitality research has largely been organised around particular public-space types and built-environment attributes, reinforcing the value of comparative analysis across heterogeneous everyday spaces [10]. Studies have shown that accessibility, size, spatial configuration, environmental quality, and facilities are associated with the

intensity and diversity of space use [5], [6], [7], [8], [9]. This work provides an important basis for understanding relationships between physical conditions and use.

However, the literature on informal settlements points to a different condition. Functional categories become less adequate in dense settlements where public life does not occur only in spaces formally designated for public use. Neighbourhood streets, house yards, residual land, spaces between buildings, and other spaces located between private and public realms can acquire collective functions through repeated use [12], [13]. Circulation routes can also become social spaces, yards can accommodate collective activities, and small commercial points can form local activity nodes. Such functional overlap produces settlement environments in which open-space vitality grows out of residents' everyday needs [11].

In complex high-density riverine environment, this system becomes more complex because it also includes river edges, docks, wetlands, and surfaces whose usable capacity changes with water conditions [14]. These spaces differ physically and functionally, but residents use them adaptively rather than as isolated parts. They can all accommodate movement, work, conversation, play, waiting, domestic activities, or everyday economic activity. In self-built neighbourhoods, public space is shaped by practical arrangements, negotiation of private-public boundaries, and everyday needs that are often poorly represented by formal design approaches [15]. Community spaces can also persist as infrastructure for everyday life because they are sustained by collective practices, informal economies, and local adaptation [16].

There is therefore a need to shift the analysis from the vitality of separate spatial categories toward the vitality of a heterogeneous everyday open-space system. The question is no longer only which characteristics make a park, street, or waterfront lively, but how different everyday open spaces are used under different spatial conditions. This shift matters because characteristics that support use in one type of space may not work in the same way in another. Wider access, vegetation, larger area, or particular facilities can have different meanings on a neighbourhood street, in a house yard, on residual land, or at the water's edge. A more relational perspective is needed because spatial networks in informal settlements emerge through the co-evolution of buildings, access, activities, and local conditions, while different public spaces can work together as community infrastructure [17].

On this basis, the study treats different everyday open spaces within one settlement as parts of a micro-scale urban spatial system and compares how physical-spatial characteristics and facilities are associated with their actual use. The research question is: how are physical-spatial characteristics and facilities associated with the vitality of different types of everyday open space in dense settlements, and how do these relationships vary by spatial context? Rather than seeking a universal physical attribute, the study identifies characteristics that remain associated with vitality across heterogeneous spaces and those whose relationships depend on spatial conditions. It therefore offers a reading of open space in dense settlements as an everyday system formed through relationships among spatial character, environmental conditions, facilities, and practices of use.

2. Conceptual Framework: Vitality in Heterogeneous Everyday Open-Space Systems

Urban complexity is often discussed through interactions among land use, mobility, environment, infrastructure, economy, and social life. At neighbourhood scale, these interactions become visible in small spaces that accommodate diverse activities and change dynamically. The conceptual framework therefore treats heterogeneity not simply as variation in the sample, but as a defining property of the everyday open-space system analysed in this study.

2.1. Vitality as Observed Use

Urban vitality refers to the capacity of urban space to attract, accommodate, and sustain human presence and activity. Although definitions of vital space vary, vitality is commonly understood as a condition in which a space is lively not merely because people pass through it, but because it also enables stopping, observing, meeting, talking, waiting, playing, working, and other stationary or social activities [9], [18].

The conceptual proposition of this study is that the vitality of everyday open spaces emerges from interactions among spatial capacity, environmental conditions, space type, and support for use. These relationships are expected to vary because heterogeneous urban spaces do not work in the same way. Rather than seeking one universal predictor, the study tests which characteristics remain associated with use under different spatial conditions and which are meaningful only in particular contexts.

Vitality is often approached through observable indicators including pedestrian flows, stationary activities, duration of stay, user density, activity diversity, and temporal continuity. Indicator selection needs to reflect spatial scale and analytical purpose. At neighbourhood scale, intensity and diversity are useful because they capture two different dimensions of public life: how strongly a space attracts people and how many everyday functions it can accommodate.

This study prioritises user intensity as the main indicator. It represents a space's capacity to attract and retain users during the observation period. Activity diversity is retained as a complementary indicator of the range of functions a space supports. One space may attract many users for a single purpose, while another may be used by fewer people but support several activities. Reading the two indicators together prevents vitality from being equated with crowding alone.

2.2. Physical-Spatial Characteristics and Staying Behaviour

Previous research linking spatial form and behaviour shows that people respond to more than geometric dimensions. Enclosure, boundaries, visibility, permeability, microclimate, opportunities to sit, and surrounding activities can influence whether a space remains a passage or develops into a setting for activity. Everyday open spaces are more layered because their physical form is rarely designed as a

complete composition for a single purpose. A yard may also serve domestic activities, a street may function as social space, a shop may extend into the circulation edge, and a river edge may alternate among access, work, domestic activity, and gathering [19]. Small-scale open spaces in dense kampungs likewise show that limited spaces can complement household activities, provide social space, and support everyday use when their physical characteristics correspond to user needs [20].

Relatively fixed characteristics and more adjustable forms of physical support are both part of urban dynamics. Space type and land structure are difficult to change, whereas usable area can change with surrounding development and environmental conditions. Facilities are more readily added, removed, or adapted. Testing these attributes together helps distinguish relationships associated with basic morphology and spatial capacity from those associated with physical support for everyday activities.

2.3. Heterogeneous Everyday Open Spaces as an Urban System

This study treats heterogeneous everyday open spaces as one neighbourhood system, offering an alternative way to read urban open space. Rather than viewing them as unrelated categories, this approach examines how different space types accommodate everyday life. Their roles may differ, but together they form a distributed and interconnected spatial system [21]. Understanding them as a system is particularly important because informal morphology develops through reciprocal relationships among access networks, buildings, and incrementally produced spaces rather than as a collection of separately planned objects [22].

This perspective is particularly relevant in dense settlements of the Global South, where formal spatial categories often overlap with incremental resident-led uses. It does not imply that all informal or everyday open spaces perform equally well; their heterogeneity is precisely the object of analysis. Comparing different spatial conditions with actual use can reveal where vitality is concentrated, where constraints occur, and how different spaces contribute to wider neighbourhood dynamics [23].

3. Methodology

3.1. Study Area and Unit of Analysis

The study was conducted in dense settlements along the Musi River in Palembang, Indonesia. The case represents a complex riverine urban settlement environment where high building density, narrow circulation, overlapping residential and economic functions, drainage problems, inundation, changing water levels, and limited formal open space occur simultaneously. This complexity is also marked by the river's continuing role in everyday activities, including washing, bathing, swimming, fishing, and boat movement [24].

The unit of analysis was an outdoor spatial unit that was visibly used, or had direct potential to be used collectively by residents, regardless of formal designation or ownership. A comprehensive initial survey

was undertaken to identify relevant spaces. For extensive and repetitive types, particularly neighbourhood streets and house yards, observation units were limited to sections showing evidence of everyday use. A total of 122 units were retained for observation. Space types included neighbourhood streets, vacant or residual land, fields, house yards, swamps or ponds, and river edges. The sample therefore represents spaces that already function, or have direct potential to function, as everyday collective spaces rather than all open space available in the area.

3.2. Variables and Observation

Physical-spatial variables comprised land condition, space type, area, access width, and facilities. Land condition distinguished dry from wet or inundated surfaces. Space area and access width were recorded in metres. Facilities were recorded by presence and standardised as binary indicators by type. Facility count was calculated as the number of facility types in each unit, representing the diversity of available physical support. Seating, vegetation, docks, and small grocery shops were analysed separately because they occurred frequently enough for statistical testing and represented different functional roles.

Field observation was conducted over one week. Each unit was observed once during the same two-hour period, from 15:00 to 17:00, to reduce variation caused by observation time. Users were recorded in five groups: adult women, adult men, adolescent girls, adolescent boys, and children. For each group, surveyors used field categories of 0, 1–3, 3–6, 6–9, and more than 9 people. These categories were converted to ordinal scores of 0–4 and summed across groups, producing an intensity score of 0–20. An estimated user count based on category midpoints was used as a sensitivity check.

Activity diversity was calculated as the number of different activity types observed in each unit. Eleven categories were used: sitting or observing, playing, talking, smoking, working, washing, bathing, swimming, fishing, waiting for a boat, and exercising. The two vitality indicators capture different dimensions: user intensity indicates how strongly a space attracts people at the observation time, whereas activity diversity indicates the range of everyday functions it accommodates.

3.3. Statistical Analysis

The analysis began with descriptive statistics. Because most variables were not normally distributed, bivariate relationships were tested using non-parametric procedures. Differences among space types were examined using the Kruskal-Wallis test. Relationships of space area and access width with the vitality indicators were tested using Spearman correlations. Dry and wet land conditions were compared using the Wilcoxon rank-sum test.

Facilities were analysed at two levels. First, facility count was used to test whether a greater diversity of physical support was associated with use. Second, selected facilities were tested individually to distinguish their functional mechanisms. Negative binomial regression was used for multivariable analysis of user intensity. The main model included facility count, land condition, space type, area, and access width. The detailed facility model replaced facility count with seating, vegetation, docks, and

small grocery shops and included a vegetation × land-condition interaction. Results are reported using beta coefficients, incidence rate ratios (IRR), and p-values. Model fit was compared using AICc and BIC.

4. Results

4.1. Physical-Spatial Characteristics and Space Use

The open-space units varied in their physical-spatial characteristics. Most were dry (59.0%), while 41.0% were wet or inundated. Vacant land was the most common space type (35.2%), followed by river edges (21.3%), fields (19.7%), and house yards (14.8%). Space area varied considerably, with a median of 326 m², while access was generally narrow, with a median width of 2 m (Table 1).

Facility support also varied, with a median of two facility types per space. Seating was the most common facility (35.2%), followed by paving (31.1%), vegetation (29.5%), lighting (24.6%), small grocery shops (23.8%), and docks (22.1%). Overall, the distribution shows that kampung open spaces do not share a uniform set of attributes. Instead, they are formed through different combinations of site condition, space type, spatial dimensions, and facilities. These variations were then tested against use intensity and activity diversity.

Table 1
Descriptive characteristics of the open-space units.

Source: Authors' analysis.

Variable	Category/measure	n (%) / Median	IQR / Range	Description
Environmental condition				
Land condition	Dry	72 (59.0%)	—	More than half of the units were dry
	Wet/inundated	50 (41.0%)	—	Wet spaces formed a substantial share and were relevant for comparison
Space type	Vacant land	43 (35.2%)	—	Most common space type
	River edge	26 (21.3%)	—	Directly connected to the water
	Field	24 (19.7%)	—	Relatively large open surface
	House yard	18 (14.8%)	—	Collective use adjacent to housing
	Neighbourhood street	7 (5.7%)	—	Linear/circulation space
	Swamp/pond	4 (3.3%)	—	Least common and strongly affected by water conditions
Space area	m²	326	IQR 114.75–1,162.5	Space size varied widely
Access width	m	2.0	IQR 1.0–3.0	Access was generally narrow, consistent with dense kampung conditions
Facilities				
Facility count	types	2.0	IQR 1.0–3.0; range 0–8	Most spaces had only a few facility types
Facility	Seating	43 (35.2%)	—	Most frequently observed facility
	Paving	38 (31.1%)	—	Common surface support
	Vegetation	36 (29.5%)	—	Found in almost one-third of the units

Variable	Category/measure	n (%) / Median	IQR / Range	Description
Environmental condition				
	Lighting	30 (24.6%)	—	Available in about one-quarter of the units
	Small grocery shop	29 (23.8%)	—	Indicates economic activity in everyday space
	Dock	27 (22.1%)	—	Specific waterfront function
	Car parking	24 (19.7%)	—	Support for local mobility
	Motorcycle parking	23 (18.9%)	—	Support for local mobility
	Waste bin	20 (16.4%)	—	Cleaning facilities remained limited
	Play facility	3 (2.5%)	—	Very rarely found
	Sports facility	3 (2.5%)	—	Very rarely found
	Worship facility	1 (0.8%)	—	Very rarely found
	Toilet	1 (0.8%)	—	Almost unavailable
	Bridge	1 (0.8%)	—	Highly specific and rare
Space use				
Intensity score	0–20	2.0	IQR 0–7	Generally low to moderate, with considerable variation
Activity diversity	0–11	2.0	IQR 0–4	Most spaces supported few activities, while some were more diverse

Relationships between physical-spatial characteristics and space use differed across the two indicators of vitality. Space type differed significantly for both user intensity and activity diversity ($p < 0.001$), indicating distinct patterns of use among space types. Space area was not significantly correlated with user intensity ($\rho = 0.127$; $p = 0.165$), but had a weak positive relationship with activity diversity ($\rho = 0.179$; $p = 0.049$). Access width, by contrast, was positively correlated with user intensity ($\rho = 0.266$; $p = 0.003$), but not significantly related to activity diversity ($\rho = 0.155$; $p = 0.088$). Land condition also differed for use intensity ($Z = -2.72$; $p = 0.0065$), whereas activity diversity did not differ significantly between dry and wet spaces ($Z = -1.48$; $p = 0.1392$).

Space type was the only physical-spatial characteristic consistently related to both indicators of vitality. Area, access width, and land condition showed more specific relationships with either user intensity or activity diversity (Table 2).

Table 2
Relationships between physical-spatial characteristics and space use.

Source: Authors' analysis.

Characteristic	Test	User intensity	Activity diversity	Description
Space type	Kruskal–Wallis	H = 27.96; p < 0.001	H = 29.79; p < 0.001	Significant differences among space types for both indicators
Space area	Spearman	ρ = 0.127; p = 0.165	ρ = 0.179; p = 0.049	Not significantly related to intensity; weak positive relationship with diversity
Access width	Spearman	ρ = 0.266; p = 0.003	ρ = 0.155; p = 0.088	Positive relationship with intensity; not significant for diversity
Land condition	Wilcoxon	Z = − 2.72; p = 0.0065	Z = − 1.48; p = 0.1392	Intensity differed between dry and wet spaces; activity diversity did not

Land condition showed different patterns for intensity and activity diversity. Dry spaces tended to have higher use intensity than wet spaces, and the difference was statistically significant (p = 0.0065). Activity diversity, however, did not differ significantly between the two conditions (p = 0.1392). Descriptively, the mean intensity score was 4.79 in dry spaces and 2.72 in wet spaces, while the corresponding mean activity-diversity scores were 2.71 and 2.08.

Table 3
Simultaneous relationships between physical-spatial characteristics and space-use intensity.

Source: Authors' analysis.

Predictor	β	IRR	p	Description
Facility count	0.382	1.47	< 0.001	One additional facility type was associated with 47% higher intensity
Dry vs wet condition	0.264	1.30	0.235	Not significant after accounting for other predictors
Access width	0.041	1.04	0.376	Not significant
Space type	—	—	0.0098	Significant overall difference
Space area per 100 m²	0.0166	1.017	< 0.001	Positive relationship

In the bivariate analysis, access width and land condition were significantly related to use intensity. When analysed simultaneously with other spatial characteristics, neither retained a significant independent relationship. Facility count, space area, and space type, in contrast, remained related to use intensity (Table 3).

4.2. Facilities and Space-Use Intensity

Facility count was analysed as a combined indicator covering all facility types in each spatial unit. It had a strong positive relationship with space use. The Spearman correlation between facility count and intensity score was $\rho = 0.687$ ($p < 0.001$), while the correlation with estimated user count was $\rho = 0.684$ ($p < 0.001$). Facility count was also correlated with activity diversity ($\rho = 0.582$; $p < 0.001$).

The simultaneous model first confirmed that facility count remained related to use intensity after the other spatial characteristics were taken into account. Each additional facility type was associated with approximately 47% higher use intensity ($\beta = 0.382$; IRR = 1.47; $p < 0.001$). Space area also had a positive relationship ($\beta = 0.0166$ per 100 m²; IRR = 1.017; $p < 0.001$), and space type differed significantly overall ($p = 0.0098$). Land condition ($p = 0.235$) and access width ($p = 0.376$), however, had no independent relationship. The detailed model then replaced facility count with seating, vegetation, docks, and small grocery shops. Adding the vegetation × land-condition interaction improved model fit compared with the model without the interaction (AICc 508.27 versus 516.35), so the interaction model was used for final interpretation.

Table 4
Negative binomial regression for the detailed facility model with interaction.

Source: Authors' analysis.

Predictor/effect	β	IRR	p	Description
Seating	1.159	3.19	< 0.001	Strongest positive relationship
Small grocery shop	0.464	1.59	0.018	Positive relationship
Dock	0.087	1.09	0.675	Not significant
Vegetation in wet spaces	−2.302	0.10	0.002	Negative relationship in wet spaces
Vegetation in dry spaces	−0.227	0.80	0.350	Not significant
Vegetation × dry condition	2.075	—	0.007	Relationship of vegetation differed by land condition
Dry vs wet condition*	0.321	1.38	0.097	Conditional effect when vegetation was absent
Space area per 100 m²	0.0136	1.014	< 0.001	Positive relationship
Access width	0.005	1.01	0.883	Not significant
Space type	—	—	0.0108	Significant overall difference

Seating was associated with approximately 3.19 times higher use intensity ($p < 0.001$), while small grocery shops were associated with approximately 59% higher intensity ($p = 0.018$). Docks had no significant independent relationship. The relationship of vegetation differed by land condition: in wet spaces, vegetation was associated with lower intensity (IRR = 0.10; $p = 0.002$), while in dry spaces the relationship was weaker and not significant (IRR = 0.80; $p = 0.350$). The vegetation × dry-condition interaction was significant ($\beta = 2.075$; $p = 0.007$) (Table 4).

Seating and small grocery shops showed consistent positive relationships, vegetation depended on site condition, and docks reflected a specific waterfront function rather than an independent increase in use intensity. Adding the vegetation × land-condition interaction improved model fit, reducing AICc from 516.35 to 508.27 and BIC from 551.69 to 545.81. The interaction model was therefore used for final interpretation.

5. Discussion

5.1. Dynamics: Open Space as Part of Communal Life

High building density, limited dwelling space, narrow access, and little vacant land make the provision of new parks or public spaces difficult. This distinguishes dense settlements from many formal public spaces that are designed from the outset for recreational, social, or communal purposes. In incrementally developed settlements, collective space emerges through negotiation among residents' needs, private-public boundaries, land constraints, and gradual physical change [23].

Open spaces in dense informal kampungs are not merely amenities; they are part of everyday social infrastructure. They do not operate like formal public spaces, which generally have clearer functions, boundaries, and facilities. Their role is important because kampung life is built through proximity and relationships among residents. Spatial and resource constraints increase the need to share space, assist one another, and collectively use the environment around the home. Streets, yards, residual land, fields, and water edges can therefore alternate among movement, work, play, conversation, waiting, and domestic activities. Repeated collective use shows that public functions can emerge through everyday practice rather than formal designation alone [25], [26].

In informal settlements, economic activity and public space also meet directly at street-housing interfaces, so social, economic, and circulation functions occupy the same space. This helps explain why area and access width alone are insufficient to account for vitality. Larger spaces were not automatically more active, and the effect of access width disappeared when other characteristics were considered simultaneously. Facilities that directly support activity, by contrast, showed more consistent relationships. Each additional facility type was associated with approximately 47% higher user intensity. Seating showed the strongest relationship, while small grocery shops created reasons to stop, wait, talk, and meet. This pattern is consistent with evidence that informal economic activity can act as a social catalyst in everyday public space. Similar patterns have been reported for street vending in the in-between spaces of informal settlements, where economic activity flexibly occupies street-building interfaces and extends the social function of space [27].

5.2. Vulnerabilities: High Spatial Demand Confronting Constraints

This study distinguishes basic site characteristics from forms of physical support that vary across spaces. Land condition and space type represent environmental and morphological differences. Area and access width represent spatial capacity and entry conditions. Facility count represents the diversity of available physical support, while selected facilities-seating, vegetation, docks, and small grocery shops-were analysed separately because they represent different relationships among design, environment, movement, and everyday activity.

Relationships between physical form and vitality are rarely singular. Greater area can increase capacity but does not guarantee more frequent use. Access can facilitate movement, but an accessible space does not necessarily provide a reason to stay. Environmental constraints can reduce usable surface area without eliminating the capacity for collective activity. Wet spaces were used by fewer people than dry

spaces, yet their activity diversity did not differ significantly. Washing, bathing, swimming, fishing, and waiting for boats continued because these activities specifically depend on proximity to water.

On the kampung waterfront, ecological conditions are not only constraints; they are also part of the everyday spatial-use system. The riverine setting provides a range of spaces extending to river edges, docks, wetlands, ponds, and tidal surfaces whose effective usable area changes with water levels. Residents adapt their activities to these changing conditions, while the river remains part of movement, domestic activities, work, and social life.

Vegetation further demonstrates the contextual nature of these riverine conditions. In some wet spaces, vegetation grows on surfaces that are difficult to use or poorly maintained, so it may indicate site constraints rather than provide shade for activity. Facilities can support activity, but their use remains dependent on compatibility with residents' practices [8], [19]. The benefits of green infrastructure in informal settlements likewise depend on site configuration and implementation conditions, rather than on its presence alone [28].

Docks reveal a different form of vulnerability. They are important for river access and everyday activities, but they did not independently increase user intensity. Functional importance therefore does not necessarily correspond to vitality. A space may be used by relatively few people yet remain irreplaceable because it supports a function that cannot be relocated elsewhere.

5.3. Opportunities: Strengthening Spaces That Already Work

Dynamics, vulnerabilities, and opportunities can occur in the same space. A narrow street can become an active social space; a river edge can be vulnerable to wet conditions while still supporting diverse functions; and residual land can have poor physical quality yet remain valuable because it is used consistently. This complexity is important in reading cities of the Global South because spatial quality cannot always be inferred from formal form or physical standards. Management should therefore begin by recognising spaces that already work and strengthening their capacity without removing the flexibility that makes them useful in everyday life. The sustainability of community spaces in informal settlements depends on maintaining functions embedded in residents' practices rather than solely on formal recognition or investment [16].

This reading also changes the position of residual or informal spaces. A space not designed as public space is not necessarily a failed space. It can become an asset when it accommodates activities and relationships among residents. Limited land therefore does not mean that dense settlements entirely lack spatial assets for open space. Networks of streets, yards, residual land, and water edges that were originally formed for different purposes can acquire additional functions through repeated use and gradual adaptation, creating a multifunctional everyday spatial system.

The social capacity of space can be strengthened without increasing its area. Facility count shows that diversity of physical support is associated with use intensity even when space area is statistically controlled. Yet increasing vitality does not mean adding as many facilities as possible. Seating works because it directly supports stopping and staying; small grocery shops combine economic and social functions; vegetation requires suitable site conditions; and docks remain important even without generating high concentrations of users. Interventions should therefore begin with the fit among spatial conditions, existing activities, and the physical support required. Context-sensitive approaches are more appropriate than uniform facility packages where spatial character and practices of use differ among locations [29], [30].

6. Conclusion

The novelty of this study lies in reading heterogeneous everyday open spaces in dense settlements as a micro-scale urban spatial system. The findings show that vitality is not produced by a single physical attribute, but emerges from context-dependent combinations of space type, environmental condition, spatial capacity, and activity-supporting facilities. By comparing neighbourhood streets, house yards, residual land, fields, wet spaces, and river edges within one analytical framework, the study demonstrates that characteristics commonly assumed to support spatial quality do not generate the same vitality under different spatial conditions. The findings therefore shift attention from providing new open spaces toward recognising and strengthening everyday spaces that already work in residents' lives.

The findings also show how heterogeneous neighbourhood spaces contribute differently to micro-scale urban dynamics. Space type shapes different functional possibilities, environmental conditions modify usability, and small-scale physical support can substantially strengthen stationary and other activities. Dense urban space is therefore better understood as a distributed system of streets, yards, residual areas, commercial nodes, and waterfront spaces whose roles overlap but are not interchangeable.

This study is limited to one riverine settlement area and observations during a single time period, and therefore does not capture changes in space use across the day, seasons, or different water levels. The quality, capacity, and maintenance condition of facilities were also not measured in detail. Future research should compare settlements with different physical and social characteristics and conduct observations at multiple times to test whether relationships among spatial characteristics, facilities, and vitality remain consistent across broader contexts.

Declarations

Clinical trial number

Not applicable

Consent to Participate

An application for a waiver of informed consent was submitted to the Health Research Ethics Committee, Faculty of Public Health, Universitas Sriwijaya, on 29 August 2026 and is currently under review. The study involved non-participant observation in publicly accessible spaces and did not involve participant recruitment, direct interaction, intervention, or the collection of personally identifiable information. The committee's official determination will be provided immediately upon issuance.

Consent to Publish

Not applicable, as no identifiable participant data or images are presented in the manuscript.

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Ethical Approval and Accordance

An application for an official ethics determination/waiver was submitted to the Health Research Ethics Committee, Faculty of Public Health, Universitas Sriwijaya, on 29 August 2026 and is currently under review. The official decision, reference number, date, and applicable ethical guidelines will be provided immediately upon issuance. The study involved non-participant observation in publicly accessible spaces, with no intervention, direct interaction, or collection of personally identifiable information.

Data Availability

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no competing interests.

Statement on the Use of AI for Language Editing

ChatGPT was used only to assist with translating the manuscript into English and improving readability. All scientific content, data, analyses, interpretations, and final wording were reviewed and edited by the authors.

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Figures

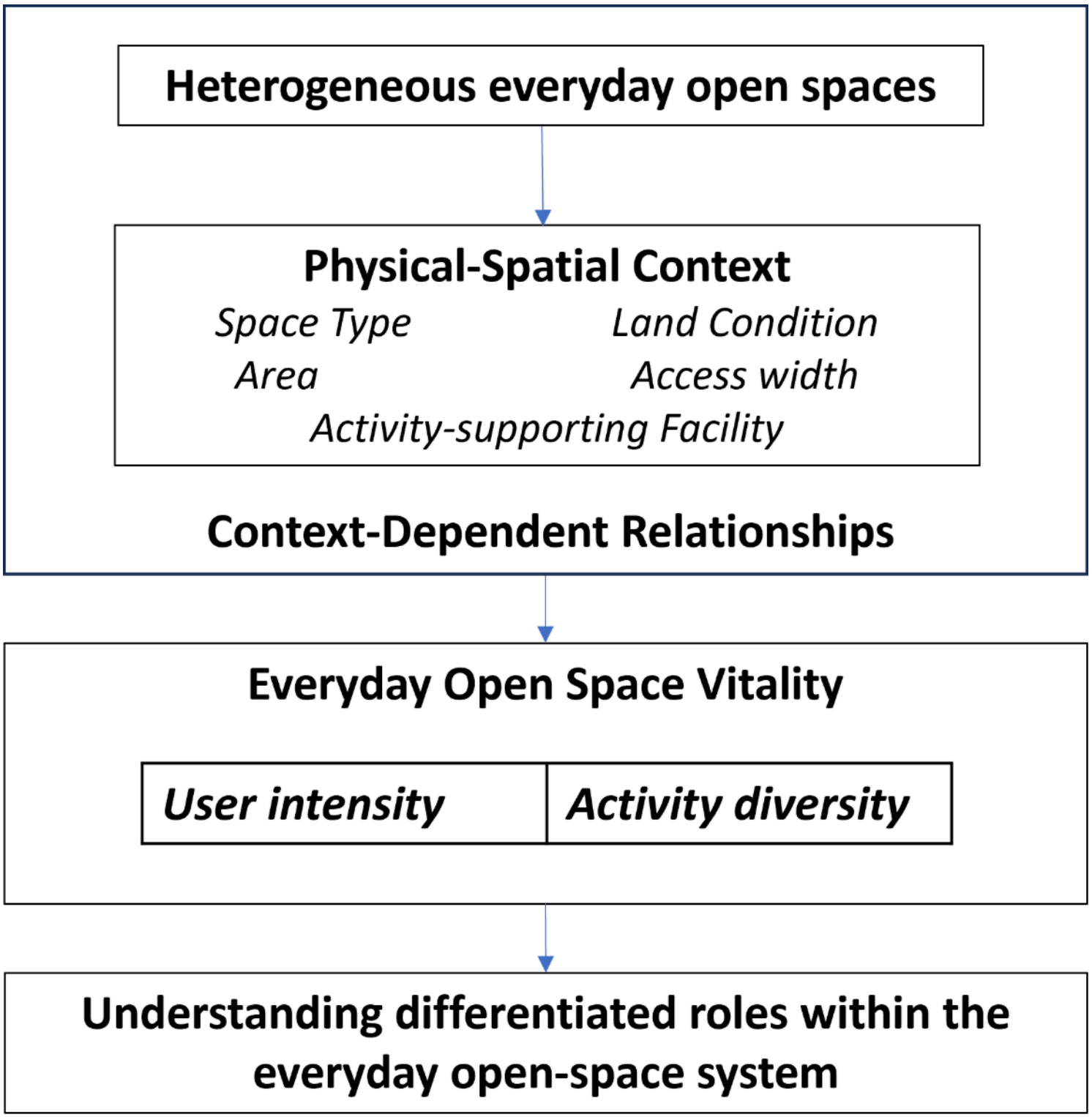


Figure 1

Conceptual framework of the heterogeneous everyday open-space system, physical-spatial context, and context-dependent vitality. Source: Authors' own elaboration.

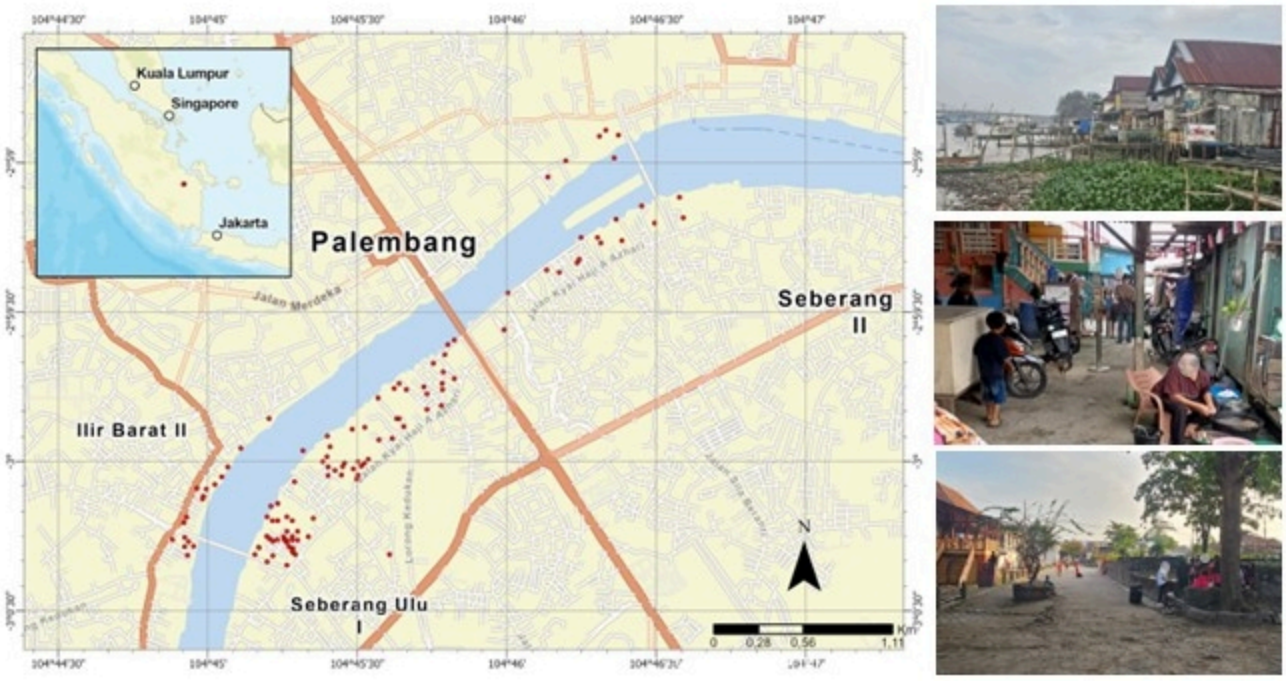


Figure 2

Location and characteristics of the study area. Dots indicate the observed units. Source: Authors' own elaboration.