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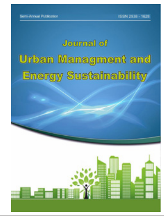

CASE STUDY RESEARCH PAPER

An Analytical Approach to the Typology of Informal Settlements for Deriving Architectural Indicators: Evidence from the Periphery of Yasuj City, Iran

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ABSTRACT

Informal settlements on the periphery of rapidly growing Iranian cities are commonly read as homogeneous zones of deprivation, a framing that has produced uniform, and frequently ineffective, upgrading prescriptions. The problem this study addresses is the absence of a context-grounded, physically explicit typology that can differentiate such settlements and translate that differentiation into architectural guidance. The aim is therefore to develop an analytical approach for the physical typology of informal settlements and to derive weighted architectural indicators for their assessment and improvement, using the periphery of Yasuj city as the case. A sequential exploratory mixed-methods design was applied: seventeen candidate factors distilled from the literature were refined through four rounds of a fuzzy Delphi with a fifteen-member expert panel, weighted through a fuzzy analytic hierarchy/network process, and validated through a partial least squares measurement model; field-surveyed units were then classified through hierarchical clustering and interpreted morphologically across three clusters form, space, and materials. The findings converge on five core weighted indicators physical durability, spatial legibility, physical safety, social interaction, and functional accessibility (Kendall's W = 0.79) and identify four physical types along a continuum of physical transformation: compact spontaneous, organic hillside, semi-consolidated, and upgrading, with intervention-priority indices of 0.86, 0.68, 0.50, and 0.34, respectively. Within the three-cluster structure, space carries the strongest discriminating role (path coefficient β = 0.52), ahead of form and materials. The study concludes that typology can be advanced from a descriptive device to an instrument for context-based architectural intervention: each type carries an internal logic that dictates a distinct, stage-appropriate strategy, offering planners a means to target scarce resources toward the most vulnerable fabrics.

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INTRODUCTION

The proliferation of informal settlements is among the defining spatial signatures of urbanization in the global South, where a substantial share of urban dwellers occupies fabrics produced outside formal planning and building control (UN-Habitat, 2003; Davis, 2006). Far from being residual or transient, these fabrics have become a structural, self-organizing mode of city-making (Roy, 2005). In Iran, accelerated rural-to-urban migration and the shortage of affordable housing have reproduced this pattern on the edges of provincial capitals, where settlement occurs incrementally and precedes the provision of infrastructure and services (Sarrafi, 2008; Irandoost, 2007). The scale of the phenomenon, and the persistence of the fabrics it produces, mean that eradication is neither feasible nor desirable; the policy question has shifted from removal to differentiated improvement. Yasuj city, a young provincial capital established in the 1960s and marked by high in-migration, exemplifies this dynamic. Its peripheral growth has been largely spontaneous, generating a mosaic of settlements that differ markedly in age, position, density, and construction practice. Conventional policy has tended to treat this mosaic as a single, undifferentiated problem, prescribing uniform interventions that neither recognize the internal variety of the fabric nor exploit its latent capacities. Because Yasuj is comparatively recent, its informal periphery still exhibits the full spectrum of stages from the newest, most precarious shelters to consolidating, self-improving neighborhoods which makes it an unusually legible laboratory for a stage-based typology.

From a pathological to a typological reading

A long tradition in settlement studies has moved from viewing informality as pathology toward reading it as an ordered, adaptive system. Turner's (1976) argument that housing is best understood as a process controlled by its users, and his insistence on incremental self-help, reframed the settlement as a resource rather than a defect. Subsequent morphological scholarship has shown that informal fabrics possess a discernible spatial logic (Hillier & Hanson, 1984; Sobreira, 2003), and that their forms emerge through generative processes of self-organisation and incremental adaptation (Kamalipour, 2016). This body of work motivates a shift from asking how informal settlements deviate from the formal city to asking how they can be differentiated among themselves that is, a shift toward typology. Typology has deep roots in the study of urban form. Urban morphology, as an interdisciplinary field, treats the physical form of the city as an object that can be decomposed, compared, and traced through time (Moudon, 1997). Marshall's (2009) evolutionary reading of urban form, and Kamalipour and Dovey's (2019) mapping of informal morphologies, supply the conceptual basis for interpreting settlement types not as static classes but as stages of a continuous transformation. Earlier typological studies of informal settlements such as the classification of slum clusters in Delhi (Ishtiyaq & Kumar, 2011) demonstrate the descriptive value of typology, yet stop short of linking types to weighted, actionable architectural indicators. The step that remains is to move from naming types to measuring, weighting, and prescribing for them.

Form, space, and materials as an analytical language

To make typology operational for architecture, this study organizes physical analysis around three clusters form (mass, density, height, and volumetric articulation), space (spatial organization, hierarchy, access network, and communal space), and materials (durability and construction quality). This tripartite structure draws on the phenomenological and cultural readings of built form (Norberg-Schulz, 1980; Rapoport, 2005) and on configurational analyses of settlement space (Hillier & Hanson, 1984). Grounding the indicators in the fabric itself, rather than importing external checklists, follows the logic of context-sensitive upgrading advocated across the upgrading literature (Payne, 2005; Huchzermeyer, 2009; Ward et al., 2021). The three clusters are treated not as independent silos but as interdependent dimensions whose combined reading defines a type; Figure 1 presents the resulting analytical framework. (Fig. 1)

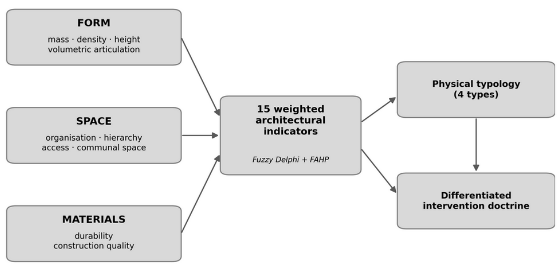

Figure 1: The three-cluster analytical framework linking form, space, and materials to weighted indicators, physical typology, and a differentiated intervention doctrine.

MATERIALS AND METHODS

Study area

The spatial scope is the belt of informal settlements on the periphery of Yasuj city, the capital of Kohgiluyeh and Boyer-Ahmad province in south-western Iran. As a young, high-migration city, Yasuj has expanded largely through spontaneous settlement on its northern, eastern, south-eastern, south-western, and western fringes. These five zones differ in slope, distance from the urban core, age of formation, and fabric density, and together provide a compact but internally varied laboratory for typological analysis. Steep topography on the western and south-western edges, and proximity to the older core on the north and south-east, produce sharply contrasting fabrics within a small geographic compass. The temporal scope covers an approximately three-year period of data collection, field observation, and analysis. Established only in the 1960s, Yasuj has grown far faster than its planning apparatus, drawing successive waves of migrants from the surrounding rural districts of Kohgiluyeh and Boyer-Ahmad. In the absence of an anticipatory framework for affordable housing, much of this population settled informally on the fringe, and the informal population expanded markedly over successive decades. Because settlement outpaced servicing, the resulting fabrics vary not only in density and construction but also in their stage of consolidation precisely the variation that a stage-based typology is designed to capture. (Fig. 2) The study is applied-developmental in aim and descriptive-analytical with an exploratory orientation in method. Philosophically it is situated within pragmatism, which privileges methodological fitness-for-purpose over strict allegiance to positivism or interpretivism and therefore licenses the combined use of qualitative and quantitative techniques. The reasoning is inductive-deductive: indicators are first induced from theory and expert judgement and then deductively tested and measured. A sequential exploratory mixed-methods strategy structures the work in four connected stages, in which the validated output of each stage forms the input to the next.

•Stage 1- Extraction: candidate factors and indicators are distilled from the theoretical framework and precedent literature (seventeen initial factors).

•Stage 2 -Refinement: factors are screened and stabilized through a fuzzy Delphi with an expert panel.

•Stage 3-Weighting and validation: stabilized indicators are weighted through the analytic network/hierarchy process and the measurement model is tested through partial least squares.

•Stage 4-Classification and prescription: field units are typologies through hierarchical clustering on the weighted indicators, and a differentiated intervention doctrine is formulated.

Fuzzy Delphi refinement

A purposive panel of fifteen experts in architecture, urban design, and informal-settlement studies evaluated the candidate factors over four iterative rounds. The Delphi technique is well suited to consensus-building under uncertainty through anonymous, iterative questionnaires with controlled feedback (Hsu & Sandford, 2007). Fuzzy triangular numbers were used to accommodate the vagueness of expert linguistic judgement, with linguistic terms mapped onto triangular fuzzy sets and defuzzied by the center-of-gravity method. Retention thresholds were tightened progressively across rounds (mean > 2.5, then > 3.5, then > 4.0) so that weak or overlapping indicators were removed and consensus sharpened. Agreement on the final ranking was assessed with Kendall's coefficient of concordance.

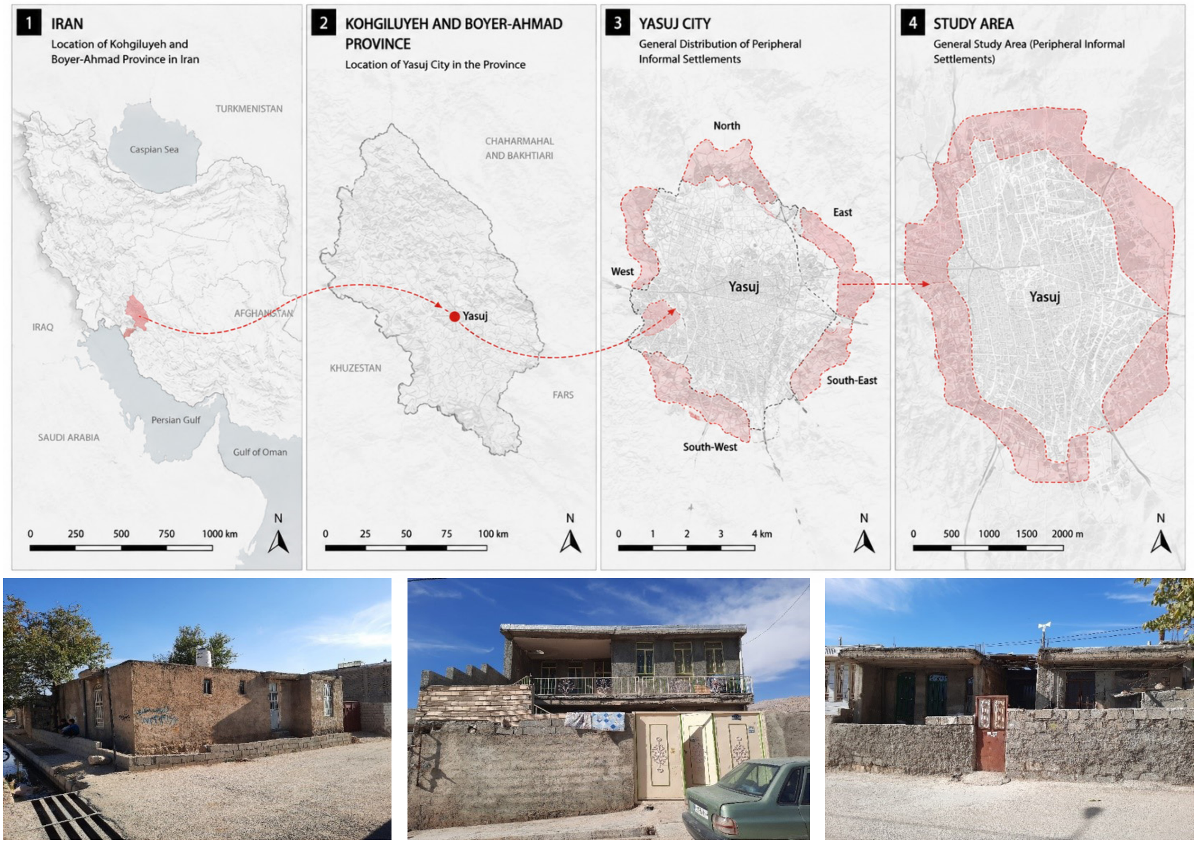

Figure 2: (Up): Location of the general study area and peripheral informal settlements in Yasuj City, Kohgiluyeh and Boyer-Ahmad Province, Iran. (Down): Yasuj city peripheral informal settlements (Source: Authors)

Operationalization of the candidate indicators

The candidate indicators were operationalized within the three-cluster structure so that each could be assessed consistently in the field and by the panel. Table 1 groups the principal candidate indicators by cluster and states the operational definition used for assessment; this operational scheme underlies both the Delphi refinement and the subsequent morphological profiling. (Tab. 1)

Table 1: Operational definitions of the principal candidate indicators by cluster

Cluster	Indicator	Operational definition
Form	Physical durability / stability	Structural soundness and resistance of the building mass over time
	Physical safety	Freedom from structural, fire, and access-related hazards
	Construction quality	Standard of workmanship and detailing in the built fabric

Space	Spatial legibility	Clarity and readability of the spatial organization and hierarchy
	Functional accessibility	Ease of reaching dwellings and services through the lane network
	Social interaction	Capacity of the fabric to host collective and unneighborly life
	Spatial flexibility	Ability of spaces to adapt to changing household needs
	Open-space quality	Quantity and quality of usable open and communal space
	Functional coherence	Integration of dwelling, access, and communal functions
	Landscape quality	Visual and environmental quality of the settlement setting
Materials	Material durability	Longevity and robustness of construction materials
	Climatic adaptation	Fit of materials and form to local climatic conditions
	Environmental health	Sanitary quality of materials and the immediate environment

Weighting: fuzzy AHP / analytic network process
The stabilized indicators were weighted using a fuzzy analytic hierarchy process embedded in an analytic network logic, which captures interdependence among criteria rather than assuming strict independence (Saaty, 2005). Pairwise comparisons, expressed in triangular fuzzy numbers, were checked for consistency and aggregated to produce global weights for the final indicators, establishing their relative importance within the architectural assessment framework.

Measurement-model validation: PLS

A partial least squares structural-equation measurement model was used to test the reliability and validity of the three-cluster structure (form, space, materials) and to estimate path coefficients linking the clusters to the typology construct (Hair et al., 2017). PLS was selected for its suitability to exploratory, theory-building work and to the modest sample sizes typical of expert-informed studies. Reliability was assessed through Cronbach's alpha and composite reliability, and convergent validity through the average variance extracted (AVE).

Typology and morphological analysis

Field-surveyed units were classified through agglomerative hierarchical clustering (Ward's linkage) on the weighted indicators; the number of clusters was fixed at the cut that maximized separation and stability. Each resulting type was then documented morphologically figure-ground pattern, representative dwelling plan, and section/massing and profiled across six key metrics (density, spatial coherence, path quality, material durability, communal space, and structural stability). Finally, an importance–performance analysis and an indicator–type matrix was used to translate the typology into intervention priorities.

Reliability, validity, and ethical considerations

Reliability of the expert instrument was supported by the declining dispersion of scores across Delphi rounds and by the concordance coefficient; validity was supported by grounding indicators in an established theoretical framework and by the convergence of independent methods (Delphi consensus, AHP weighting, and PLS validation). Because detailed official field data are limited in informal contexts, quantitative values integrate field observation, expert judgement, and satellite-image interpretation and are reported in standardized form; the analytical structure is robust to the substitution of more detailed field data. Fieldwork observed the privacy and dignity of residents, and participation in the expert panel was voluntary and anonymized.

FINDINGS AND DISCUSSION

Fuzzy Delphi refinement of indicators

In the first round the panel evaluated seventeen candidate factors. Thirteen scored above the retention threshold of 2.5 and were carried forward; factors tied to external policy frameworks—path-network continuity, accessibility and permeability, local governance, and development flexibility—fell below the threshold and were removed (Tab. 2 and Fig. 3). The pattern indicates that experts treated governance- and infrastructure-dependent variables as secondary to spatial and environmental attributes at the scale of architectural intervention.

Table 2: First-round fuzzy Delphi results for candidate architectural indicators (SD = 0.8)

#	Factor	Mean	Decision
1	Physical durability / stability	4.1	Retained
2	Spatial legibility	3.8	Retained
3	Physical safety	3.9	Retained
4	Landscape quality	3.2	Retained
5	Open-space quality	3.0	Retained
6	Spatial flexibility	3.3	Retained
7	Social interaction	3.6	Retained
8	Functional accessibility	3.7	Retained
9	Material durability	3.1	Retained
10	Climatic adaptation	3.5	Retained
11	Construction quality	3.4	Retained
12	Environmental health	3.2	Retained
13	Path-network continuity	2.3	Removed
14	Accessibility & permeability	2.4	Removed
15	Local governance	2.2	Removed
16	Development flexibility	2.1	Removed
17	Functional coherence	3.6	Retained

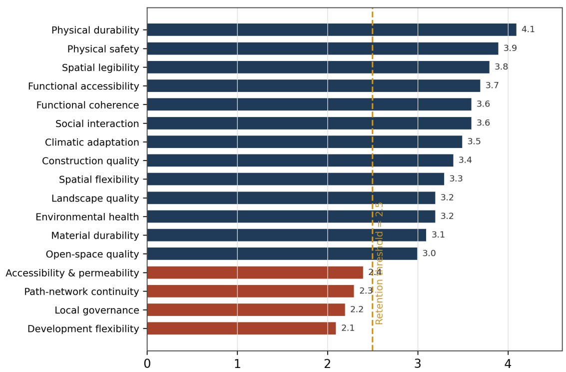

Figure 3: First-round fuzzy Delphi mean scores; the dashed line marks the 2.5 retention threshold.

Across the subsequent rounds consensus sharpened as thresholds rose. The second round retained eleven of thirteen factors (mean > 3.5); the third retained nine (mean > 4.0); and the fourth stabilized a compact set of five decisive indicators. The declining standard deviation across rounds signals reduced dispersion and rising analytical stability, and the coefficient of concordance for the final ranking reached Kendall's W = 0.79, an acceptable level of agreement given the panel size and the proximity of the mean scores. Fig. 4 summarizes the convergence, and the narrowing spread across rounds confirms that further iterations were unlikely to alter the ranking materially.

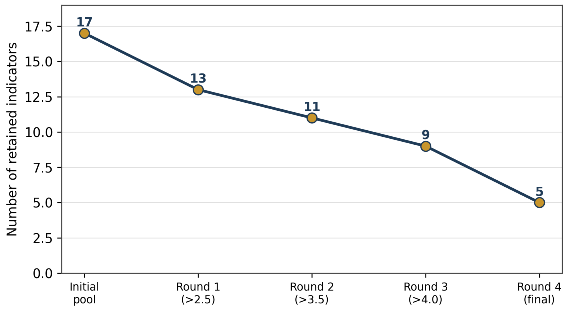

Figure 4: Convergence of retained indicators across the four Delphi rounds.

The five indicators that survived physical durability, spatial legibility, physical safety, social interaction, and functional accessibility jointly represent a balanced framework that integrates structural resilience, spatial clarity, safety, and human interaction, confirming that architectural quality in informal fabrics extends beyond physical form to social-spatial adaptability.

Weighting of the final indicators

The fuzzy AHP produced the global weights reported in Table 3 and visualized in Figure 4. Physical durability received the highest weight, reflecting its role as a precondition for sustainable upgrading; spatial legibility and physical safety followed closely, confirming that environmental perception and safety are foundational to improving informal living environments. The relatively even distribution of weights without extreme dominance by any single factor indicates that experts regard upgrading as a multidimensional design problem rather than a set of isolated technical fixes. (Tab. 3 and Fig. 5)

Table 3: Final five indicators: fourth-round mean importance, standard deviation, and FAHP global weight

Rank	Indicator	Mean importance	SD	Global weight
1	Physical durability	4.7	0.35	0.26
2	Spatial legibility	4.5	0.33	0.22
3	Physical safety	4.4	0.34	0.20
4	Social interaction	4.2	0.36	0.17
5	Functional accessibility	4.1	0.37	0.15

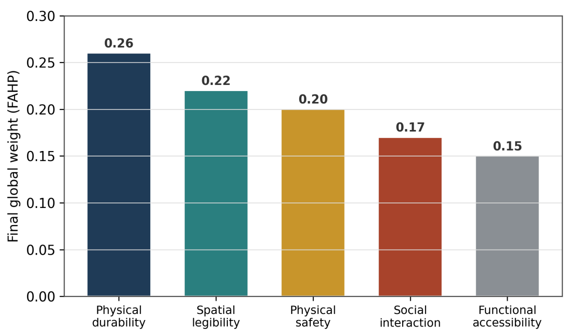

Figure 5: Final global weights of the five architectural indicators (fuzzy AHP).

Measurement-model validation

The PLS measurement model confirmed the three-cluster structure. All three clusters exceeded the conventional thresholds for internal consistency (Cronbach's alpha and composite reliability above 0.70) and convergent validity (AVE above 0.50), as reported in Tab. 4. The structural estimates (Figure 5) show that space exerts the strongest influence on the typology construct ($\beta = 0.52$), followed by form ($\beta = 0.41$) and materials ($\beta = 0.33$), with the three clusters jointly explaining 68% of the variance in the typology construct ($R^2 = 0.68$). This ordering space ahead of form and materials is one of the study's central empirical results and directly informs the intervention logic. (Tab. 4 and Fig. 6)

Table 4: Reliability and convergent validity of the three clusters (PLS measurement model)

Cluster	Cronbach's α	Composite reliability	AVE	Path coefficient (β)
Space	0.88	0.91	0.67	0.52
Form	0.84	0.89	0.62	0.41
Materials	0.81	0.87	0.59	0.33

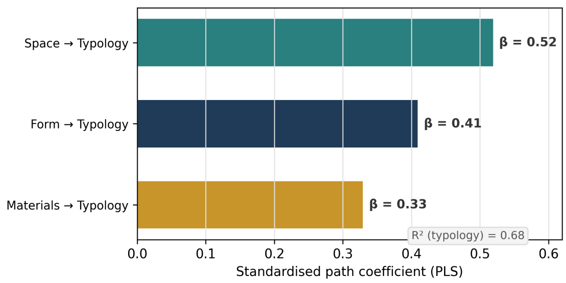

Figure 6: Standardized path coefficients of the three clusters on the typology construct (PLS).

Physical typology of the Yasuj city periphery

Applying hierarchical clustering to the weighted indicators yielded a stable four-cluster solution with clear separation in the form–space projection. Four physical types were identified: Type 1 (compact spontaneous), Type 2 (organic hillside), Type 3 (semi-consolidated), and Type 4 (upgrading). Table 5 summarizes the characteristic physical profile of each type across the three clusters of form, space, and materials. (Tab. 5)

Table 5: Characteristic physical profile of the four types across form, space, and materials

Type	Form	Space	Materials
Type 1: Compact spontaneous	Very high density; compact mass; single-story	Tangled organization; narrow lanes; no communal space	Temporary / recycled; low durability
Type 2: Organic hillside	High density; stepped placement on slope	Organic, slope-following; difficult access	Vernacular and temporary; variable
Type 3: Semi-consolidated	Moderate density; one-to-two stores	Semi-regular; emerging courtyard	Mixed; semi-durable
Type 4: Upgrading	Balanced density; two stores with setback	More regular; defined communal space and privacy	Durable; improving

The quantitative profile of the four types across six key metrics (Figure 6) makes their functional differentiation explicit: Type 1 combines the highest density with the lowest quality across every other metric, whereas Type 4 exhibits the most balanced profile. The intermediate types trace a graded improvement in spatial coherence, path quality, material durability, communal space, and structural stability. (Fig. 7)

Two relationships reinforce the reading of the types as stages of a single transformation. First, building density and perceived structural stability are significantly negatively correlated: the denser, more compact types are also the least structurally sound (Fig. 8). Second, the relative composition of materials shifts systematically from a dominance of temporary materials in Type 1 to a rising share of durable, industrial materials in Type 4 a signature of the consolidation-and-upgrading process (Fig. 9).

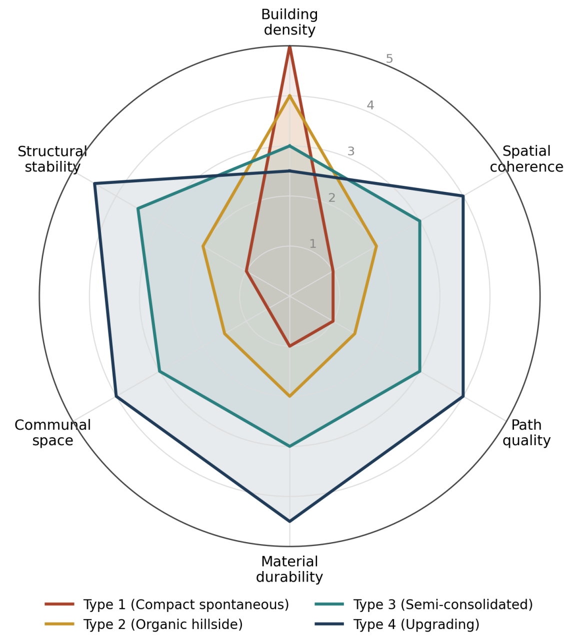

Figure 7: Radar profile of the four types across six key morphological metrics (standardized, 1–5).

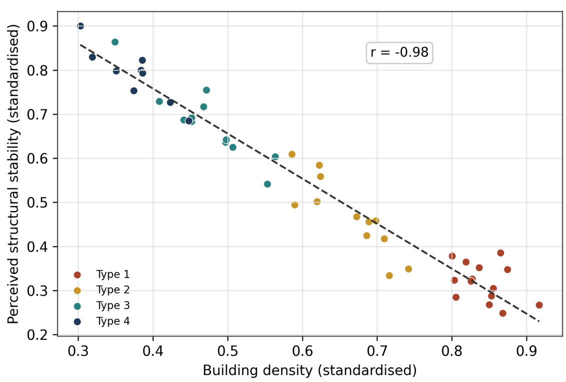

Figure 8: Relationship between building density and perceived structural stability across sampled units.

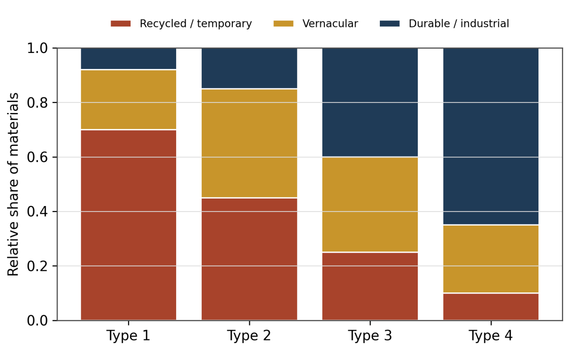

Figure 9: Relative composition of materials across the four types.

Reading of the four types

•Type 1 (compact spontaneous) is the most critical type morphologically and is concentrated near the older urban core. Very high density, compact interlocked mass, predominantly single-story placement, and the absence of setbacks severely limit daylight and natural ventilation; tangled, narrow lanes and the lack of defined communal space threaten both emergency access and collective life; and temporary, low-durability materials yield poor structural performance. The convergence of these three deficits raises its intervention-priority index to the highest value, and its dominant strategy is structural stabilization and the reopening of vital access routes.

•Type 2 (organic hillside) forms mainly on steep zones and is governed by topography: stepped placement, high density, and land-following massing. Its organic, contour-following organization makes access difficult and drainage critical, and its mix of vernacular and temporary materials is of variable quality. Its dominant strategy is slope-sensitive intervention improving access and drainage and stabilizing the slope to reduce hazard.

•Type 3 (semi-consolidated) represents an intermediate stage in which signs of consolidation have begun: moderate density, one-to-two-story placement, more regular massing, a semi-regular spatial organization, and an emerging central-courtyard pattern that signals the recovery of a privacy hierarchy. Its dominant strategy is to enhance communal space and lane quality and to guide the consolidation process.

•Type 4 (upgrading) is the most consolidated type, found mainly in zones farther from the core and characterized by balanced density, two-story placement with setback, a more regular organization with defined communal space and privacy, and durable materials. Its dominant strategy is fabric retention, reinforcement of local identity, and gradual integration with the formal city; because its upgrading is largely endogenous, it requires guidance and support rather than heavy intervention.

Zonal analysis and intervention priority

The distribution of the four types across the five peripheral zones follows a meaningful spatial pattern (Tab. 6 and Fig. 10). The northern and south-eastern zones low slope, near the core, very high density are dominated by Type 1; the south-western zone, steep and stepped, is dominated by Type 2; and the western zone, farther from the core and consolidating, is dominated by Types 3 and 4. The morphometric indicators extracted from satellite imagery corroborate this pattern: the south-eastern and northern zones exhibit the highest fabric compactness and the lowest access permeability, signaling greater vulnerability (Fig. 11).

Table 6: Distribution of dominant types and characteristics across the five peripheral zones

Zone	Dominant type	Zone characteristics
North	Type 1	Low slope; near core; very high density
East	Types 1 & 2	Medium slope; tangled fabric
South-east	Type 1	Low slope; compact and older
South-west	Type 2	Steep slope; stepped placement
West	Types 3 & 4	Farther from core; consolidating

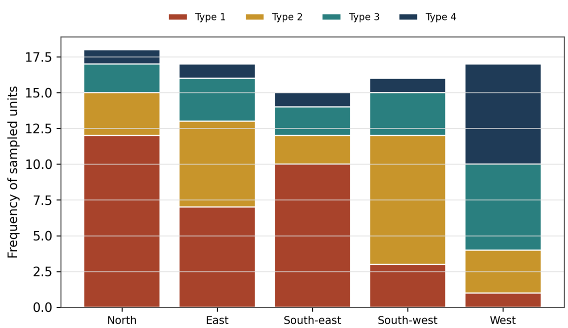

Figure 10: Frequency of the four types by zone (standardized counts).

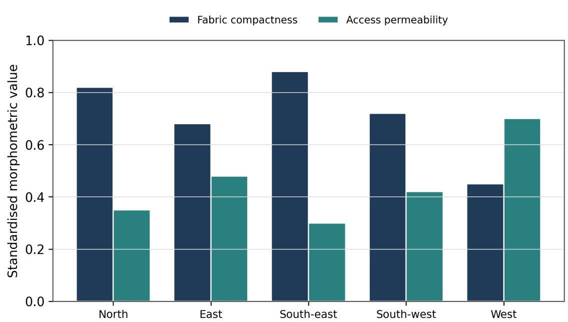

Figure 11: Fabric compactness and access permeability across the five zones.

The spatial logic behind this distribution is coherent: the most critical type gravitates to the flat, well-connected land nearest the historic core, where early and unregulated occupation produced the densest, most tangled fabric, while the more consolidated types occupy the outer, later-settled edges where lower land pressure allowed more regular plots and setbacks to emerge. Slope acts as a second ordering force, generating the distinct hillside type on the steep south-western fringe. Read together, distance from the core and terrain explain much of the observed variation, which means the typology is not merely a catalogue of forms but a spatial model in which a settlement's position on the periphery is a strong predictor of its type and therefore of the intervention it requires.

Importance–performance analysis and the indicator–type matrix

Comparing the importance of each indicator with its current performance produces an importance–performance map that supports

Table 7: Indicator–type matrix: status of key indicators across the four types

Indicator	Type 1	Type 2	Type 3	Type 4
Spatial organization	Critical	Critical	Moderate	Moderate
Path & lane network	Critical	Critical	Moderate	Adequate
Building density	Critical	Critical	Critical	Moderate
Local communal space	Critical	Moderate	Moderate	Adequate
Material durability	Critical	Moderate	Moderate	Adequate
Structural stability	Critical	Moderate	Adequate	Adequate

prioritization (Fig. 12). Indicators in the “concentrate here” quadrant high importance, low performance namely spatial organization, path network, and building density, constitute the first priority for intervention. The indicator–type matrix (Tab. 7; Fig. 13) then evaluates the status of each key indicator within each type on three levels (critical, moderate, adequate), producing an integrated picture of each type's critical points.

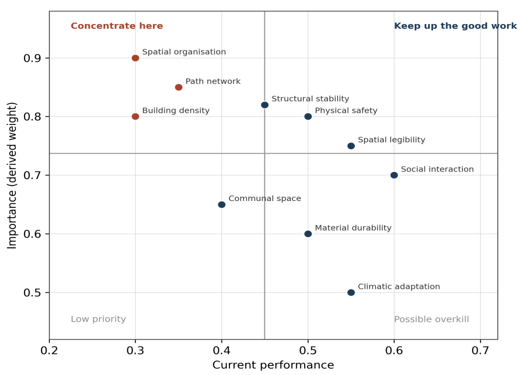

Figure 12: Importance–performance map of the architectural indicators.

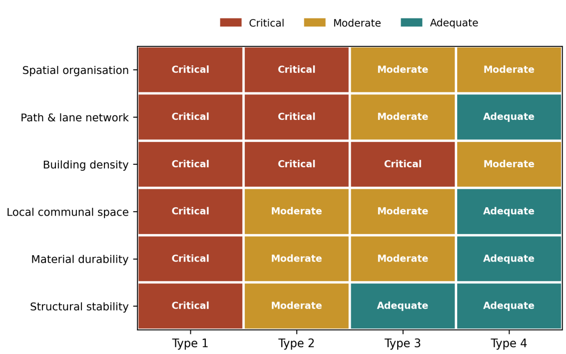

Figure 13: Heatmap of the indicator–type matrix (critical, moderate, adequate).

On the basis of the indicator–type matrix and the global weights, an intervention-priority index was computed for each type (Fig. 14). Type 1 (compact spontaneous) records the highest priority at 0.86 and Type 4 (upgrading) the lowest at 0.34, with Types 2 and 3 at 0.68 and 0.50, respectively. The index provides a defensible, evidence-based ordering for allocating limited resources across types and zones.

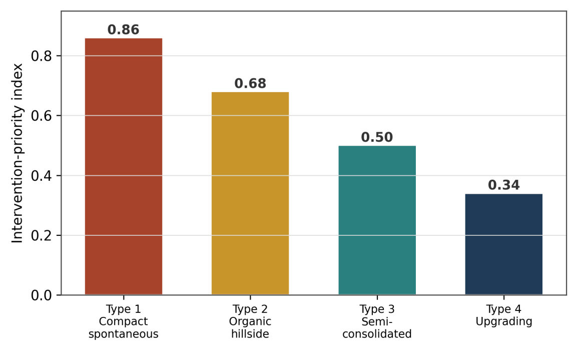

Figure 14: Intervention-priority index of the four types.

RESULTS AND CONCLUSION

TThe morphological analysis indicates that the four types are not discrete, static classes but stages of a single continuum of physical transformation that begins with compact, temporary shelter and ends with organized, durable housing. This evolutionary reading aligns with the evolutionary morphology of urban form (Marshall, 2009) and with the notion of “forms of informality” as incremental adaptations (Kamalipour, 2016), and it supplies a dynamic framework in place of a static classification. It also resonates with the observation that consolidated informal settlements can nonetheless undergo renewed decline—so-called "slumification"—when consolidation is not supported (Ward et al., 2021).

Three substantive findings deserve emphasis. First, among the three clusters, space carries the strongest discriminating role registering the highest aggregate weight and the strongest path coefficient (β = 0.52) followed by form and then materials. This corrects readings that privilege materials or form alone and foregrounds spatial organization, access network, and density as the primary levers of differentiation and intervention. Second, the convergence of independent methods fuzzy Delphi consensus, AHP weighting, and PLS validation triangulates the indicator set and lends robustness to the framework beyond any single technique. Third, the negative density–stability relationship gives an empirical anchor to the intuition that the densest, most spontaneous fabrics are simultaneously the least safe, which justifies their elevated intervention priority. Methodologically, the study demonstrates the value of coupling qualitative expert judgement with quantitative weighting and validation in informal-settlement research, where official data are scarce and standardized estimates are unavoidable. The context-grounded derivation of indicators rather than the import of external checklists responds to the long-standing call for context-sensitive, incremental upgrading (Payne, 2005; Turner, 1976) and to configurational readings of settlement space (Hillier & Hanson, 1984). The study makes five theoretical contributions. First, it operationalizes the shift from a pathological to a typological reading of informal settlements, treating them as a system of types with internal logics rather than a homogeneous, problem-only mass. Second, it stabilizes the three-cluster language of form, space, and materials as a transferable vocabulary for the physical analysis of informal fabrics. Third, it demonstrates the interdependence of these clusters and the primacy of space, correcting purely materials- or form-centered readings. Fourth, it formulates the "continuum of physical transformation" hypothesis, interpreting the four types as stages of a continuous evolutionary process rather than discrete, static categories, in line with evolutionary urban morphology (Marshall, 2009) and forms-of-informality thinking (Kamalipour, 2016). Fifth, it evidences the efficacy of integrating fuzzy Delphi, analytic network weighting, and PLS validation in informal-settlement studies, where the convergence of independent methods secures the credibility of the findings. Practically, the framework supplies a decision aid that identifies a settlement's type and prescribes a matching intervention strategy. Rather than issuing a single prescription for the whole fabric, it enables differentiated, targeted intervention and thereby guards against the dissipation of limited resources. The priority index offers a transparent basis for sequencing action stabilizing the most critical, densest fabrics first, guiding the consolidating middle, and lightly supporting the self-improving edge. Set against earlier typological work, the framework advances the field in two respects. Where the Delhi classification of slum clusters (Ishtiyaq & Kumar, 2011) and comparable descriptive schemes group settlements by location, tenure, or gross physical condition, the present typology is derived from weighted, validated architectural indicators and is explicitly tied to a graded intervention logic. And where morphological readings of informality establish that informal fabrics possess an internal spatial order (Kamalipour, 2016; Kamalipour & Dovey, 2019), the present study converts that qualitative insight into a measured, weighted structure in which space is shown to carry the dominant discriminating role. The result is a typology that is at once descriptive and prescriptive: it names the types, measures their differences, and specifies what to do about them. The convergence of the four types onto a single continuum of transformation, rather than a set of unrelated categories, is the feature that most distinguishes this scheme from static classifications and that best equips it to anticipate both consolidation and renewed decline.

This study set out to develop an analytical approach for the physical typology of peripheral informal settlements and to derive weighted architectural indicators, using the periphery of Yasuj city as the case. In answer to the first question, the physical typology rests on three fundamental clusters form, space, and materials operationalized through the final weighted indicators, with space playing the most central role; four types were identified: compact spontaneous, organic hillside, semi-consolidated, and upgrading. In answer to the second question, very high density, tangled spatial organization, a weak lane network, the absence of communal space, and low material quality are the principal producers of unfavorable dwelling conditions, most acutely in Type 1 and in the northern and south-eastern zones. In answer to the third question, the weighted indicators led by spatial organization, mass and form, and the lane network are the most effective for typological differentiation and for prioritizing intervention. The conceptual essence of the study can be formulated as a doctrinal proposition: an informal settlement is a system of types each possessing an internal logic, and every architectural intervention must begin from that internal logic rather than from an externally imposed template. The doctrine rests on five pillars: reading the internal logic of each type; grounding indicators in the fabric rather than importing them; differentiating among types in prescribing intervention; intervening incrementally and stage-appropriately; and committing to spatial justice. (Tab. 8)

Table 8: Dominant intervention strategy and priority by type

Type	Dominant strategy	Priority index
Type 1: Compact spontaneous	Structural stabilization; reopen vital access routes	0.86
Type 2: Organic hillside	Slope-sensitive access, drainage, and slope stabilisation	0.68
Type 3: Semi-consolidated	Enhance communal space and lane quality; guide consolidation	0.50
Type 4: Upgrading	Fabric retention; reinforce identity; integrate with formal city	0.34

Implementing context-based strategies is expected to yield measurable improvement in the physical quality of the settlements. Fig. 15 compares the expected profile across five key metrics before and after context-based upgrading, illustrating the gains anticipated when intervention follows the type-specific logic rather than a uniform prescription. (Fig. 15)

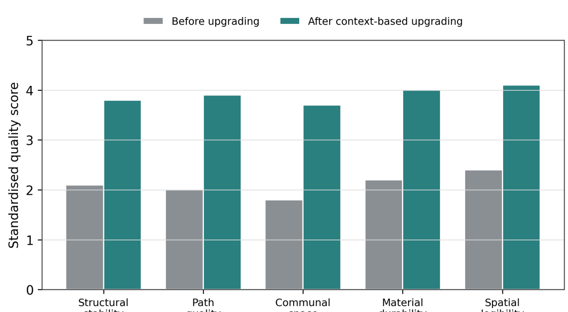

Figure 15: Expected improvement across five key metrics before and after context-based upgrading.

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