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Operationalizing Creative Diversity as a Multi-scale Diagnostic Framework for Urban Resilience

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INTRODUCTION

Background & Theoretical Gap

Urban resilience scholarship recognizes that systems must not merely recover from disturbances but develop the capacity to transform toward sustainable trajectories (Folke et al., 2010; Davoudi et al., 2013). Heritage sites, when underutilized, represent both a challenge and an opportunity for adaptive urban transformation (Bullen & Love, 2011). However, existing evaluation tools suffer from fundamental limitations: environmental certifications (LEED/BREEAM) inadequately address socio-cultural dimensions, while heritage frameworks (ICOMOS) lack standardized performance measurement (Foster & Kreinin, 2020). This fragmentation leaves heritage adaptive reuse vulnerable to political bias and economic short-termism (Chen et al., 2018).

Creative Diversity as Integrative Principle

While functional redundancy (Elmqvist et al., 2003) and response diversity (Biggs et al., 2015) address component interchangeability within single domains, Creative Diversity (Colucci, 2022) extends this principle across ecological, social-psychological, and institutional domains simultaneously. This cross-domain integration enables synergies that single-domain approaches cannot capture: a single intervention (e.g., a productive greenhouse) can simultaneously deliver ecological, social, and economic resilience outcomes. The concept is operationalized through three spatial domains: Space for Nature, Space for Community, and Space for Function.

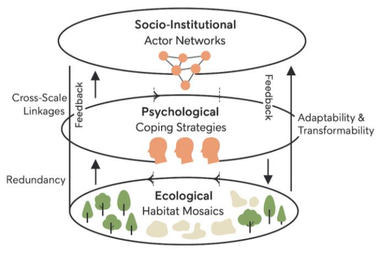


Figure 1. Multilayer Schematic

Figure 2. Lecco location Map

Research Aims

(1) Develop a Six-Dimensional Assessment Framework integrating four internationally validated reference systems for evaluating adaptive urban transformation in heritage contexts.

(2) Apply the framework to Villa Guzzi (Lecco, Italy) across regional and site scales to diagnose baseline deficiencies and identify strategic transformation gaps.

METHOD

Six-Dimensional Assessment Framework

The three Creative Diversity spaces are crossed with two resilience capacities (adaptive and transformative) to generate a 3×2 matrix of six measurable assessment dimensions:

Creative Diversity Space	Adaptive Capacity	Transformative Capacity
Space for Nature	D1: Ecological Connectivity	D2: Environmental Performance
Space for Community	D3: Social Inclusivity	D4: Cultural Identity
Space for Function	D5: Functional Flexibility	D6: Economic Viability

Multi-Reference Evaluation Methodology

To address the challenge of assessment subjectivity in heritage adaptive reuse (Chen et al., 2018), the framework employs methodological triangulation (Denzin, 1978). Each dimension is grounded in at least two internationally validated reference systems, ensuring cross-validation and compensatory coverage (Jick, 1979; Patton, 2002):

LEED/BREEAM → Environmental performance (D1, D2)
Universal Design + SDG 10 → Social inclusivity (D3)
EU CLIC + ICOMOS → Heritage & cultural identity (D4, D6)
ISO 59020 + AdaptSTAR → Functional flexibility & circularity (D5)

Figure 3. Multi-Reference Integration Logic

Assessment Approach: Each dimension is scored 0-5.0 using a rubric-anchored qualitative scoring method. Scores are determined through spatial evidence analysis (satellite imagery, site survey photographs, GIS-based spatial diagrams) mapped against predefined rubric criteria with quantified thresholds (e.g., D2: "<40% permeable surface; ornamental vegetation only" = score 1-2). This approach prioritizes transparent, evidence-traceable assessment over subjective expert judgment.

Multi-Scale Application

The framework is applied across two nested spatial scales, each using quantitative scoring (0-5.0):

Regional Scale (Acquate neighborhood): Spatial analysis of ten diagrams covering green-blue infrastructure, transportation, demographics, and commercial networks.
Site Scale (Villa Guzzi demonstration zone): Building surveys, landscape analysis, and heritage assessment to establish the baseline condition for pre-intervention evaluation.

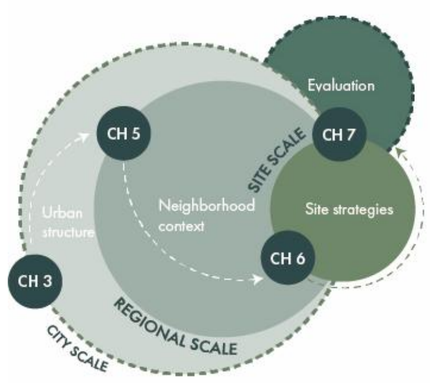


Figure 4. Multi-Scale Framework

RESULTS

Regional Baseline Assessment (Acquate Neighborhood)

Spatial analysis through ten spatial diagrams revealed systematic deficiencies across all three resilience domains: fragmented green space (45% vegetation as isolated patches, zero habitat corridors), severe accessibility barriers (40% of area beyond transit access, steep terrain excluding 36% of vulnerable residents), and functional homogeneity (85% residential dominance, <5% economic self-sufficiency).

Dimension	Score	Spatial Evidence
D1: Ecological Connectivity	**1.5 / 5.0**	Isolated patches, <20% corridor connectivity
D2: Environmental Performance	**2.0 / 5.0**	<30% permeable surface, zero NBS integration
D3: Social Inclusivity	**1.0 / 5.0**	40% area beyond transit, steep slope barriers
D4: Cultural Identity	**2.5 / 5.0**	Heritage preserved but dormant, zero activation
D5: Functional Flexibility	**1.5 / 5.0**	85% residential, 2-3 use categories only
D6: Economic Viability	**1.0 / 5.0**	12 commercial establishments, <5% self-sufficient

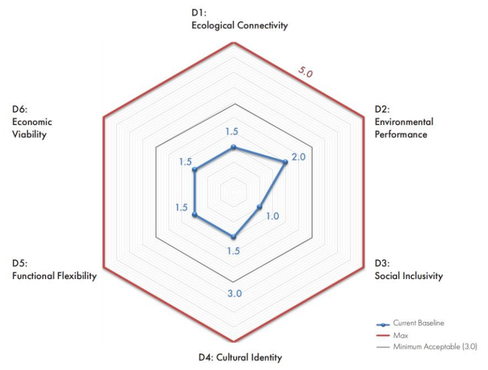


Figure 5. Regional-scale land use map

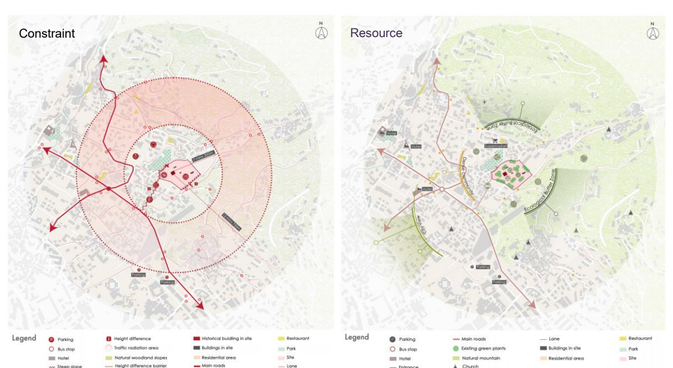
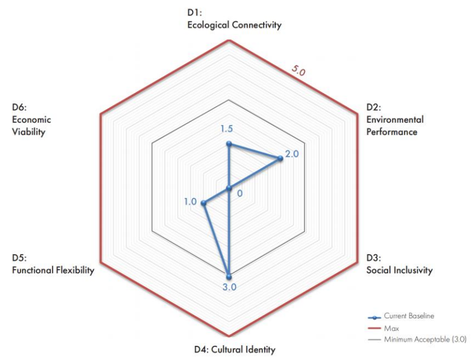


Figure 6. Site-scale constraint/resource map

Site-Scale Baseline (Villa Guzzi Demonstration Zone)

Site-level assessment confirmed more severe deficiencies than the regional level. D3 Social Inclusivity scored 0/5.0 (15% slope gradient, no barrier-free access). D6 Economic Viability scored 0/5.0 (zero revenue, full subsidy dependency). D4 Cultural Identity was the sole moderate performer at 3.0/5.0 (heritage preserved but not activated). No dimension met the minimum acceptable threshold of 3.0.

Dimension	Score	Spatial Evidence
D1: Ecological Connectivity	**1.5 / 5.0**	**Gap 1: Ecological Isolation (D1+D2 avg: 1.75)**
D2: Environmental Performance	**2.0 / 5.0**	
D3: Social Inclusivity	**0 / 5.0**	**Gap 2: Access Barriers (D3+D4 avg: 1.50)**
D4: Cultural Identity	**3.0 / 5.0**	
D5: Functional Flexibility	**1.0 / 5.0**	**Gap 3: Functional Rigidity (D5+D6 avg: 0.5)**
D6: Economic Viability	**0 / 5.0**	



Three Strategic Gaps

Cross-scale comparison reveals three interconnected gaps consistent across both spatial scales, confirming the diagnostic reliability of the framework:

Gap 1 - Ecological Isolation (D1+D2): Disconnected green fragments with no habitat corridors, untreated stormwater runoff, and minimal native vegetation at both regional and site scales.
Gap 2 - Access Barriers (D3+D4): Heritage value (Manzoni literary connection) exists but remains dormant; 15% slope gradient and absence of universal design exclude vulnerable populations.
Gap 3 - Functional Rigidity (D5+D6): The most severe gap. Fixed building layouts, zero revenue generation, and complete subsidy dependency prevent adaptive reuse and community activation.

CONCLUSION

- **Framework contribution:** Creative Diversity is translated into a six-dimensional, multi-scale diagnostic framework for resilience-oriented heritage adaptive reuse.
- **Cross-scale diagnosis:** Villa Guzzi shows recurring deficits in ecological connectivity, accessibility and cultural activation, and functional-economic adaptability; only cultural identity reaches 3.0/5.0.
- **Planning implication**: Regeneration should prioritize green-blue reconnection, barrier-free access, active community use, and flexible revenue-supporting functions, followed by post-intervention reassessment.

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