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UNIVERSITETI I TIRANËS FAKULTETI I HISTORISË DHE I FILOLOGJISË DEPARTMENT OF GEOGRAPHY

UNIVERSITY OF BAMBERG OTTO-FRIEDRICH-UNIVERSITÄT BAMBERG

UNIVERSITETI POLIS

“CAT-ference 2025: 11th International Urban Geographies of Post-communist States Conference, Tirana, Sept. 22-25, 2025”.

The 11th International Urban Geographies of Post-communist States Conference (CAT-ference 2025), held in Tirana, Albania, from 22 to 25 September 2025, brought together scholars, researchers, and practitioners to critically ex-amine the evolving trajectories of cities after political, economic, and social tran-sition. Under the overarching theme “Cities after Transition: Innovative, Inclu-sive, Informal?”, the conference offered a timely and interdisciplinary platform for debating the complex and often contradictory urban realities that character-ize post-communist and post-socialist contexts today.

More than three decades after the onset of systemic transformation across Cen-tral, Eastern, and Southeastern Europe, as well as parts of Eurasia, cities con-tinue to be key laboratories of change. Innovation-driven development, grow-ing demands for social inclusion, and the persistence—or reconfiguration—of informality coexist within urban spaces shaped by inherited structures, uneven governance capacities, and global pressures. CAT-ference 2025 sought to in-terrogate these dynamics by asking critical questions about who benefits from urban transformation, how innovation is spatially distributed, and in what ways informal practices challenge or complement formal planning and policy frame-works.

The choice of Tirana as the host city was both symbolic and substantive. As a capital city that has experienced rapid and visible transformation since the 1990s, Tirana exemplifies many of the tensions discussed throughout the con-ference: accelerated urban growth, experimental planning approaches, vibrant informal economies, and ongoing struggles for inclusivity and spatial justice. The city thus provided not only a venue, but also a living case study that en-riched scholarly debate and grounded theoretical discussions in tangible urban experiences.

CAT-ference 2025 was marked by strong international participation and an open exchange of ideas across disciplines, including urban geography, plan-

ning, sociology, economics, and environmental studies. In parallel to in-person sessions, the conference benefited from active engagement through digital platforms and social media networks, which facilitated wider dissemination of ideas, real-time discussion, and extended dialogue beyond the conference halls. This hybrid visibility reflects contemporary academic practices and underscores the growing importance of connecting scholarly research with broader public and professional audiences.

The contributions gathered in this Proceedings volume reflect the diversity and depth of the discussions held during the conference. They address a wide range of themes, including urban governance and policy innovation, socio-spatial inequalities, housing and informality, public space, environmental challenges, and citizen participation in post-transition cities. Collectively, these papers advance critical understanding of urban change and offer comparative insights that resonate beyond post-communist contexts.

By bringing together established scholars and emerging researchers, CAT-ference 2025 reaffirmed its role as a key international forum for urban studies in transitional settings. This volume stands as both a record of the conference and a contribution to ongoing debates on the future of cities navigating the legacies of transition while confronting new global uncertainties.

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Informality and Urban Management Projects in Albania: Three Decades Later

Prof. Asoc. Dr. Sotir DHAMO
Department of Architecture and Engineering; POLIS University, Albania
sotir_dhamo@universitetipolis.edu.al
***ORCID:** 0000-0002-5005-108X*

Prof. Dr. Besnik ALIAJ
Department of Planning and Urban Management; POLIS University, Albania
besnik_aliaj@universitetipolis.edu.al
***ORCID:** 0000-0002-8844-0662*

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Abstract

This paper examines the housing crisis and the emergence of informal settlements in post-1990s Tirana, driven by a massive wave of urbanization following the fall of the dictatorship and the lifting of restrictions on internal migration, which led large numbers of unemployed individuals to move to major cities. It explores the responses to this phenomenon by informal communities, the government, NGOs, and especially international organizations. The analysis highlights key actors and interventions, beginning with pilot projects led by Co-PLAN – The Institute for Habitat Development, a local NGO, which laid the groundwork for broader urban upgrading initiatives later scaled up with support from the World Bank (WB). The paper investigates the motivations and context behind the Albanian government's adoption of the neighborhood upgrading model and argues for its institutionalization through legal and policy reform for the legalization of informal settlements and their integration into the formal economy. It also reflects on the need for a paradigmatic shift—recognizing self-help, community-led housing with minimal state intervention as a viable alternative to conventional public housing. Drawing on these experiences, the paper concludes by emphasizing the importance of a co-evolutionary approach in which formal and informal systems evolve and adapt together.

Keywords:
Affordable Housing, Housing Policy, Tirana, Albania, Developing Countries, Housing Affordability, Policy Effectiveness.

Context: Post-1990s Transition and the Housing Crisis in Tirana

Traces of creative spontaneity remain visible throughout Tirana —a city largely shaped by its inhabitants, often beyond the official regulations. Since its inception, Tirana has evolved between two opposing forces: grassroots spontaneity and rigid authoritarianism—a dynamic that has echoed throughout its history. This enduring tension has left a lasting imprint on both the city's physical landscape and its identity. But how did it all begin?

With the fall of the dictatorship in 1991, the role of the state was fundamentally reshaped, particularly in relation to socio-economic development and the individual. The collapse of industries across the country— unable to withstand competition in the newly liberalized market—and the closure of mines because of outdated technologies, combined with the lifting of restrictions on population movement, resulted in a mass of unemployed people who either migrated to major cities or emigrated abroad. This marked the largest and most intense wave of urbanization, particularly along the Tirana-Durrës corridor, occurring under conditions of limited control.

According to a World Bank report (PAD 1998, p. 3), Tirana experienced an annual population growth rate of 7%, amounting to approximately 30,000 new residents—or 6,500 families—each year. Various World Bank reports from this period provide similar estimates, though the exact scale of the situation remained difficult to quantify. Nonetheless, they reflected the alarming conditions generated by rapid urban expansion. The PADCO report (1995, p. 3) notes that Tirana's population grew from 374,500 in 1990 to 475,000 in just four years.

During the same period, the city's urban footprint expanded by roughly 200 hectares annually, reaching 2,400 hectares by comparison to 1,600 hectares in 1990. Similarly, the Socio-economic Report (1998, p. 1) estimated that by the end of 1997, Greater Tirana's population had reached around 575,000. Projections at the time anticipated that the city could reach 1 million residents by 2012, with as many as 600,000—mostly low- and middle-income families—living in areas lacking basic infrastructure if no measures were taken. In reality, these numbers were never reached, largely due to the broader dynamics of the transition period, which also spurred large-scale emigration abroad.

Meanwhile, the city was expanding at a rate three times higher than that projected by Tirana's 1989 master plan. Given that housing and infrastructure were already inadequate prior to the 1990s, it was evident that the city was ill-equipped to manage such rapid growth. Although the government had spent 90 million USD on social housing, this effort addressed only a small fraction of the actual need. As noted in the PAD Report (1998, pp. 3, 7-8), the policy proved both ineffective and excessively costly in meeting housing objectives.

Under these conditions, the majority of newcomers constructed their homes illegally. Initially built with temporary materials, these dwellings—even when later constructed with bricks and improved quality—were located in areas lacking essential infrastructure. According to the WB Report (PAD 1998, p. 3), investments in these informal homes were estimated at around 40 million USD. While housing construction and residential expansion kept pace with population growth, infrastructure development lagged dramatically behind. By 1997, approximately 235,000 people—about 45% of Tirana's population—were living in areas with severe infrastructure deficits. These zones accounted for roughly 1,200 hectares, or 57% of Greater Tirana's built-up area. Nearly half the residents depended on underground water sources or were illegally connected to main water and electricity networks, while wastewater and domestic refuse were often discharged into nearby streams. This situation contributed to frequent outbreaks of gastroenteric illnesses. Additionally, high losses in the city's main water and electricity systems further exacerbated supply issues and hindered cost recovery.

As the situation deteriorated, Albanian institutions lacked both the necessary know-how and awareness. The National Institute of Urban Planning, disconnected from reality and lacking information, continued to believe in the "dream of the past"—that the only solution lay in evicting newcomers and imposing top-down plans. These attempts ultimately proved unsuccessful. Within this institutional context, organizations such as the WB injected their ideas and implemented their projects through special project coordination units, which operated under dual dependency—both on the WB and the Albanian government.

To address the institutional vacuum, humanitarian organizations and NGOs began operating on the ground, initiating grassroots and self-help initiatives to improve housing conditions through the development of physical and social infrastructure—such as schools, kindergartens, nurseries, religious institutions, and healthcare facilities. Co-PLAN was the first Albanian NGO in the field of urban planning to engage directly at the community level, beginning in 1994. Initially supported by VIS (Volontariato Internazionale per lo Sviluppo, Italy) and later by CORDAID (Catholic Organization for Relief and Development Aid, Netherlands), Co-PLAN focused its early efforts in the Breglumas area. This pioneering participatory planning process resulted in a plan supported by 80% of residents, the construction of 3 kilometers of graveled roads, and the creation of a social center comprising a health clinic, kindergarten, and sports facilities. Perhaps the most significant outcome was a shift in attitudes toward public space, evident in the removal of fences and the community's co-financing of 20% of the project costs (Aliaj et al. 2009, p. 39).

In parallel with its fieldwork, Co-PLAN advocated for a redefinition of urban planning in Albania—moving away from a top-down, authoritarian model to-

ward a participatory approach based on institutional collaboration and stakeholder engagement. This paradigm shift faced strong resistance from both governmental and academic institutions. In this context, Dutch organizations such as CORDAID, NOVIB (Netherlands Organization for International Development Cooperation), and IHS (Institute for Housing and Urban Development Studies) played a pioneering role in the 1990s—supporting Co-PLAN's urban upgrading initiatives and contributing to capacity-building in urban planning and management (Aliaj et al. 2009, p. 33). With this backing, Co-PLAN extended its model to the country's largest informal settlement, Bathore, north of Tirana, scaling up its interventions from 13 hectares to 250 hectares.

In this context, the WB supported the Albanian government in identifying projects that would engage local actors already active on the ground. To facilitate this, the government established the Land Management Task Force (LMTF) within the Ministry of Public Works, supported by USAID (1994–1996) and advised by the Harvard Graduate School of Design. A socio-economic survey, conducted from a realistic perspective, informed the development of the more comprehensive Urban Land Management Program (ULMP), which advanced the participatory planning model initiated by Co-PLAN. Concurrently, the Austrian government assisted the Municipality of Tirana to align urban expansion with a transportation plan and broader regulatory frameworks, while the Japanese government, through JICA, supported sewage infrastructure planning. However, none of these initiatives were ever implemented. The disregard for these studies has led to long-term, irreversible consequences for the city's development.

Why Upgrading

Clearly, NGO-led interventions and fragmented projects alone were insufficient to address the scale of the challenge. A broader, nationally coordinated effort was required to advance urban upgrading programs by engaging state institutions responsible for housing and service delivery. The WB took on this strategic—at times directive—role, responding to the Albanian government's request with a loan that went beyond financing infrastructure. Its objective was to introduce a new planning standard by combining local experience with international expertise drawn from comparable contexts. As noted in the PAD report (1998, p. 7), before approving the ULMP loan, the WB evaluated two alternative approaches, both ultimately deemed unfeasible. The rationale behind these alternatives offers valuable insight into Albania's early post-transition period.

The first alternative involved supporting the construction of social housing. However, based on the prior experience of Credit 2534-ALB, the WB found this approach neither cost-effective nor fiscally sustainable, given the scale of the housing shortage under conditions of rapid growth —

an annual increase of 5,000 to 8,000 families over five years. Addressing this demand through social housing would have required 50–80 million USD in public funding. Additionally, the previous loan revealed poor cost recovery from beneficiaries, making the model financially unviable.

The second alternative involved a greenfield development approach, where the public sector would provide land equipped with basic infrastructure for sale—either wholesale to private developers or retail to individuals—to stimulate private-sector housing development. However, this option faced several challenges: a lengthy delay between infrastructure installation and private housing construction; high costs and risks in Albania's still-emerging formal land and housing market; and the public sector's limited capacity to function as a private developer, further hampered by past unsuccessful housing projects. Ultimately, this alternative was abandoned after the scheme failed to take off in the Kombinat area, which had become informally occupied while the LMTF project was still in preparation.

The most cost-effective and socially and environmentally sustainable approach was to extend infrastructure to areas where residents had already established themselves. To support this initiative, a USD 10 million loan was approved in June 1998, with disbursement planned through March 2004. Designed to foster awareness through a cost-sharing model between beneficiaries and the government, the total estimated cost was projected at USD 15.58 million. Residents were to contribute USD 3.96 million over five years, covering the full cost of tertiary infrastructure (from secondary supply to the house) and 20% of secondary infrastructure (within neighborhoods), while the loan financed the remaining 80%. The government committed USD 1.62 million to cover 70% of primary infrastructure costs (e.g., water and electricity supply to the community perimeter), with the loan funding the remaining 30% (Socio-economic Report 1998, p. 8).

This investment model was piloted for the first time in Albania, shortly after the 1997 financial crisis, which had eroded public trust in state institutions. Rebuilding this trust required both institutional reforms and the creation of community-based mechanisms for collecting and managing their financial contributions. The Socio-economic Report (1998, p. 6) *summarized this as a demand-driven, community-empowered, participatory approach,* deemed vital for addressing Tirana's rapid urban expansion. This required a shift by the government from a supply- to a demand-driven system of infrastructure planning and implementation, with active community involvement seen as critical to fostering local ownership. Implementing this participatory model was particularly difficult in a context shaped by hierarchical, top-down governance traditions. To reduce the risk of failure, eligibility criteria required beneficiary communities to sign formal agreements—endorsed by at least two-thirds of residents—and to contribute a minimum of 20% of secondary infrastructure costs through a land development fee.

This payment granted residents the legal right to acquire the land they occupied.

In this context, the project aimed to deliver essential infrastructure—including roads, water supply, sewerage, drainage, electricity, and street lighting—while strengthening urban service institutions at both central and local levels. Additionally, it supported the preparation of subprojects and facilitated early-stage implementation activities such as construction, supervision, and community-building initiatives through NGOs (WB Project Portfolio 2000, p. 13; PAD 1998, p. 4). Similar projects had been implemented at least two decades earlier in countries across Latin America and others. In Albania, this experience was contextualized through the work of Co-PLAN and other organizations operating on the ground. Naturally, this required Albania to adopt methodologies rooted in a new paradigm of planning, housing, and urban upgrading.

Required Paradigmatic Shift

The implementation of these projects required a significant shift in professional paradigms. The conventional planning sequence—plan preparation, infrastructure provision, housing construction, and resident settlement—had been reversed, with settlement preceding any formal planning, that at the end aimed to improve the situation. This inversion called for a more holistic understanding of informality and housing. Numerous scholars examining informality through both empirical and scientific lenses have argued that the term *informal*—often associated with illegality, poverty, marginalization, slums, or squatting—fails to capture the full complexity of the phenomenon.

According to Roy and AlSayyad (2004, cited in Roy 2005, p. 148), the formal and informal city are not dichotomous. For them, informality is “a mode of urbanization” or “an organizing logic” based on an alternative normative system that governs urban development when housing needs are not addressed; informality is “a series of transactions that connect” economies and spaces. In this sense, they reject the use of the term “informal.” Similarly, Dovey (2012, p. 372) argues that formal and informal processes are interwoven; for him, what we describe as organic or vernacular are in fact historic informal settlements. Both organic and informal cities are rooted in self-organizing processes, with differences attributed to their temporal maturity.

Reframing informality as the embryonic stage of the organic city helps counter its associated stigma. In this vein, Alexander (1965, p. 1), in his seminal essay *“The City is Not a Tree”,* introduces the concept of the “natural city”—urban forms that evolve “more or less spontaneously over many, many years,” gaining complexity and resilience over time. Kostov (2003, p. 43) refers to such cities as “chance-grown,” “generated,” and “geomorphic,” while Batty and Longley (1994, pp. 8, 28, 31, 35) describe them as outcomes of numerous “individual decisions

coordinated in the small," producing non-Euclidean geometries often dismissed by mainstream planning for their deviation from formal geometric norms.

According to Suhartini and Jones (2019, p. 20), informal settlements evolve into meaningful places and communities rooted in underlying socio-cultural traditions. In this sense, informal areas embody human dimensions that must be analyzed and understood. Along these lines, Di Raimo (2020, p. 18) argues that, even at the architectural scale, informality should be recognized as an unconscious process of interpreting architecture.

To move beyond simplistic approaches that define informal cities merely as illegal or unplanned, it is essential to analyze and understand the network of relationships underlying their emergent nature and complexity—elements that may reveal the underlying logic that shapes and sustains these settlements (Dhamo 2021, p. 16). As Silva (2016, pp. 2, 10) notes, complexity theory helps explain territories that emerged without formal planning, evolving instead through bottom-up, self-organized processes as adaptive responses by citizens—interactions between "actors and their systems." In this context, informal settlements can be seen as a form of "upgrading of unused land into affordable housing" (Dovey et al. 2023, p. 19).

These theoretical concepts were further developed both scientifically and practically, particularly in the decades following the 1990s, informed by the global experience of the projects mentioned above. Today, it is widely acknowledged that informal settlements cannot be prevented or erased; that the vast majority are permanent; and, most importantly, that community-based upgrading represents the only viable pathway to development (Dovey et al. 2023, p. 12).

This reconceptualization also relates to the role and positioning of the architect in relation to social housing and informality. The modernist period—despite its positive ethical impulse to raise architects' awareness of their role in addressing social housing—also contributed to shaping the figure of the architect as a universal expert imposing top-down solution. Previously distant from social issues, architects became involved in designing new low-cost housing typologies, guided by an objective, scientific, and absolute logic aimed at ensuring dignified living conditions for the most economically disadvantaged. However, the mission for a better society gradually faded—especially after the post–World War II reconstruction period—when many cities reached unprecedented scales. Mass construction diluted the principles of modernist architecture, and the city increasingly shifted from an organic phenomenon to an artificial one, characterized by homogenization and urban alienation.

In the decades following World War II, the housing crisis extended to Latin American countries, where informal housing expanded rapidly on the urban peripheries—a phenomenon that had already existed. Social housing policies

modeled after those in Europe were not only unaffordable but also inadequate in meeting growing demand. In this context, during the 1950s and 1960s, British architect John Turner emerged as a highly influential figure. Writing from the informal settlements of Lima, he saw these self-built environments and their internal organization not as problems, but as potential. His views contributed to bringing the marginalized reality of informal settlements into professional and academic discourse (Ballegooijen and Rocco 2013, p. 1). Most importantly, his ideas on self-help upgrading—focused on participation and community development with minimal state intervention—together with Hernando De Soto's proposals to integrate the informal economy into the formal market, shaped the WB's urban upgrading policies beginning in the 1960s. This represents one pathway through which informal urbanism may be assimilated as Dovey (2012, p. 371) says "economically, socially, environmentally, and aesthetically". Within the framework of these neoliberal policies, the architect or urban planner assumed the role of facilitator in housing issues—contrasting with the modernist architect, whose technical expertise often imposed itself over local practices and community skills. The World Bank's promotion of this policy as a primary alternative to social housing in 1990s Albania was closely tied to the post-transition context described earlier. Although this alternative arrived in Albania later, due to specific local circumstances, it played a significant role not only in introducing new methodologies for urban upgrading but also in initiating a debate on redefining the architect's role—shifting away from a purely technical position toward one engaged with social responsibility and proactive involvement in issues of social housing and informality. This challenge remains relevant today.

First Steps

To better understand the condition of Tirana's informal periphery, the following data—drawn from the Socio-Economic Report (1998, pp. 6, 13, 15–28) within the framework of the ULMP—refer to two areas, Breglumas and Bathore, where field observations were conducted. Dwellings, often incomplete and built without permits, were financed through household income, remittances, loans, and savings, with investments ranging from USD 1,000–10,000. Streets were largely absent, rights-of-way unclear though residents expressed willingness to retreat if roads were graveled, and public transport scarce; development clustered along remnants of agricultural infrastructure such as dirt roads or irrigation channels. Only about 10% of households had legal water connections, the rest relying on illegal hookups or wells; wastewater was discharged into septic pits or irrigation channels, and stormwater drainage was non-existent. Solid waste was burned or left to decompose, while fewer than 20% had formal electricity connections. Breglumas (33 ha, 2,700 residents, avg. household size 5.2,

avg. age 27) drew 62% of its population from northern rural Albania; Bathore (13.5 ha pilot within 250 ha, 420 residents, avg. household size 5.5, avg. age 24.5) was 95% from the same regions. Both settlements, structured around kinship and acquaintance networks, featured modest housing (often occupied during construction) from wooden shacks to single-story concrete-block houses (50–100 m²) on average plots of 475 m² in Breglumas and 513 m² in Bathore.

In Breglumas, Co-PLAN—supported by the Roads for a *Civil Society* project funded by CORDAID—had been working for several years to organize the community, assist the local social center (established in 1993) used for a kindergarten, community meetings, and youth programs, and to open rights-of-way. The area also had an overcrowded primary school operating in three shifts (1998, pp. 13, 15–20). The Breglumas urban concept plan, prepared in consultation with the community and approved by the KRRT (National Council of Territory) in 1996, became the basis for organizing self-help efforts. Co-PLAN mobilized residents by street to remove fences and secure 8 m rights-of-way, which were to be graveled to prevent further encroachment and ensure a coherent circulation network—a challenging process implemented for the first time in Albania. For these reasons, Breglumas was well-prepared for infrastructure upgrading under the ULMP, which aligned with Co-PLAN's ongoing work on the electricity network. ULMP's infrastructure improvements aimed to increase plot density and raise the population from 2,700 to 5,000 within ten years (1998, p. 18).

In Bathore, no social services existed; instead, the area was "governed" through a traditional system in which elders represented the interests of extended families within the community. Complementing this structure, and with Co-PLAN's support, a residents' association was established to negotiate with authorities for the development of social services, infrastructure improvements under an urban plan (submitted to the KRRT in 1998), and the legalization of housing. In the Bathore pilot area, Co-PLAN had begun work in 1997 to demarcate rights-of-way, engaging residents in educational activities to remove fences. It was therefore logical that this became the second area where ULMP joined forces with Co-PLAN to construct the primary and secondary water supply and sewerage networks, which were later extended to almost the entire settlement. With these infrastructure upgrades, the population was expected to increase from 420 to 2,050 within ten years (1998, pp. 21–28). These efforts laid the foundation for the first models of urban improvement based on self-help strategies.

From Early Models to Reform Attempts

In 2000, WB Project Portfolio (2000, p. 13) assessed the project as "satisfactory," highlighting the full commitment of central and local authorities, community members, and local NGOs to its objectives and implementation framework.

Infrastructure upgrades were implemented in both target areas and later scaled up nationally. Resident contributions—considered the project's cornerstone—progressed satisfactorily despite challenges. In Breglumasi, for instance, 95% of beneficiaries met their commitments for secondary infrastructure.

It appeared that the goal of fostering an enabling environment for the creative replication of similar urban upgrading and regularization projects across the country's municipalities had been achieved. These initiatives formed the basis for subsequent projects that shifted focus from solely infrastructure and community development to broader urban governance—such as the Enabling Good Urban Governance (EGUG) program, implemented by Co-PLAN and funded by the Dutch government. Similarly, these programs combined on-the-job training with technical assistance in urban planning, infrastructure improvement, and related processes in several municipalities. Such projects were successfully implemented until the first half of the 2000s.

During these years, valuable know-how was developed in managing demand-driven projects based on beneficiary contributions and cost-sharing, as well as in fostering new relationships between the government—acting as facilitator—and participating communities, aimed at regularization and legalization. These approaches surpassed the prevailing simplistic technocratic models in Albania. The dissemination of this expertise was supported primarily by IHS in the Netherlands, World Bank training programs, and scholarships for specialized studies in the United States. However, this knowledge failed to take root within the still weak, unmotivated, and unstable central and local government structures. Consequently, central authorities remained passive, while local authorities acted only with the backing of projects and NGOs possessing such expertise. Nonetheless, this phase yielded several concrete outcomes that merit acknowledgment.

The main outcome of this urban policy was the establishment of Albania's legal framework for the legalization, urbanization, and integration of informal settlements, centered on Law No. 9482 (2006) and its amendments, notably Law No. 9895 (2008), which clarified ALUIZN's (Agency for the Legalization, Urbanization, and Integration of Informal Areas) mandate. Building on prior initiatives—especially Co-PLAN and the ULMP—the Law introduced institutional responsibilities, documentation procedures, and deadlines, with legalization based on self-declaration and fees covering administrative, infrastructure, and land transfer costs. Its ambition extended beyond issuing property titles and upgrading infrastructure to fostering spatial and social integration.

In practice, however, its impact was constrained by delays in urban service delivery, heavy documentation burdens on poorer residents, and administrative obstacles coupled with politicization of the process. Over time, residents came to prioritize investments in schools and healthcare, whose absence eroded trust in the Law's effectiveness. In terms of fees, the Law

failed to account for residents who, under previous agreements with the government—such as the ULMP—had already paid for land development costs. This omission weakened confidence in participatory processes and continuity of projects, which had been among earlier key achievements. By 2020, roughly 25% of Albania's urban population still lived in informal zones. Furthermore, overlapping legal frameworks—on agricultural land, property restitution and compensation, and legalization— generated significant complications, requiring improved coordination of information (Aliaj 2008, p. 216).

The most significant achievement was the reform undertaken by the government between 2005 and 2009, assisted by the Institute for Liberty and Democracy (ILD) led by Hernando de Soto, which approached the issue through a more comprehensive socio-economic lens, within the broader context of Albania's efforts to consolidate its market economy. The reform comprised three stages: (1) awareness-raising, involving diagnosis of the extralegal sector—"dead capital" that could be mobilized to enhance welfare; (2) design and implementation, with policy and institutional proposals to integrate into the legal framework immovable assets and businesses constrained by informality; and (3) capital formation and improved governance by linking newly legalized assets to formal markets (Aliaj 2008, pp. 237–238). Despite the progressive and open-minded approach of the reform, the governing structures proved unable to follow its steps consistently or, above all, to confront with transparency and political courage several "uncomfortable" findings concerning the informal economy's dubious sources. These hesitations led to delays, obstacles, and a lack of effectiveness, reducing a reform of broad socio-economic scope to limited institutional sectors.

Over the past decade, escalating land and construction market pressures in long-established informal areas of Tirana—such as Astiri, 5 Maji, and others—combined with delays in the legalization process, which left large numbers of residents in uncertainty, and with repeated but unfulfilled political promises, have generated social tensions during police-led eviction efforts. After 2010, it appears that the governing paradigm shifted toward a drastically different model of urban development. The pendulum moved away from self-help, grassroots participatory processes and a state role that, while not leading investment, facilitated upgrading, legalization, and integration into the formal market, toward top-down, authoritarian decision-making. This pendular alternation between extreme modes of urban development is a recurrent pattern in Tirana's history, observable since its very foundation.

Conclusions

With the benefit of retrospection, it is clear that in the context of Albania's transition from a fully closed system, the strategies tested to address informal settlements and alleviate the housing problem— though only partially successful —

constituted important steps toward learning and the relative mitigation of the crisis. The acceptance of informal settlement upgrading as an alternative to state-provided housing, together with the enactment of the legalization law aimed at integrating such areas into the formal economy and social life, were decisive benchmarks in this trajectory, yielding—and continuing to yield—significant impacts.

Although the top-down approach currently predominates, contemporary theory and practice—particularly those grounded in complexity theory— reaffirm the need to reconceptualize the formal–informal relationship not as a dichotomy, but as mutually integrated and intrinsically connected to the city (Dovey 2012, pp. 371, 385). Understanding the informal city as an expression of human spontaneity and an organic field of interactions that embody human properties —rather than as a space devoid of historical, social, or cultural significance—can inform planning and design methodologies that enable gradual co-evolution. This perspective calls for flexible formal planning institutions that cultivate conditions in which planned and unplanned processes continually learn from and transform each other through adaptive cycles.

As argued, important steps toward this goal were taken in Albania from the mid-1990s onward, yet they failed to evolve into effective reforms due to mismanagement and political misuse. In the present context, the challenge of overcoming this temporary regression remains pertinent for scholars in the field. It entails devising ways to translate organic or spontaneous urban phenomena into high-quality urban design; to integrate seemingly irrational rules within a rational planning framework; and to move beyond purely top-down strategies by adopting genuinely bottom-up or hybrid approaches (Dhamo 2021, pp. 232–233).

Viewed through an evolutionary lens, the involvement of architects and planners is an integral part of the broader process in which formal and informal urban systems co-evolve, with interdependent and intertwined solutions requiring adaptive governance frameworks that enable continuous learning and refinement of planning regulations over time (Silva 2018, pp. 1, 4, 9, 10). As such, the designer or planner “becomes a discreet part of the process” (2016, p. 3). In this context, conceiving architects and planners merely as technicians or facilitators of self-help is overly simplistic. This article, consistent with numerous studies emphasizing gradual co-evolution rather than a formal–informal dichotomy, presupposes a fundamental shift in mindset for those seeking to engage with the complexity, adaptability, and uncertainties emerging in the planning, design, and architecture of informal settlements. This mindset must combine the accumulated experiences of self-help practices with the theoretical framework of complexity science to uncover the human essence underlying these processes and leverage it to improve these settlements.

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Urban Transformation of Prizren in the Post-Communist Context: An Analysis through LU/LC and NDBI (2000–2018)

Prof. Assoc. Dr. Ferim GASHI
Department of Geography, University of Prishtina, Kosovo. Email: ferim.gashi@uni-pr.edu
ORCID: *0000-0002-1745-3888*
Prof. Assoc. Dr. Sonila Xhafa Sinjari
Department of Geography, University of Tirana, Albania. Email: sonila.xhafa@unitir.edu.al
ORCID: *0009-0000-1623-0714*
Msc. Edon Shemsedini,
Department of Geography, University of Prishtina. Kosovo. Email: edon.shemsedini@gmail.com

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Abstract

Post-communist cities in Southeastern Europe have undergone profound spatial, socio-economic, and environmental transformations following the dissolution of centralized political systems in the late 20th century. The shift from state-controlled planning to market-oriented urban development has produced complex patterns of land use change, rapid urbanization, and fragmented growth. Within this context, Prizren—one of Kosovo's oldest and most culturally significant cities—offers a valuable case study for understanding the interplay between post-conflict reconstruction and contemporary spatial expansion. This study analyses the dynamics of urban transformation in Prizren from 2000 to 2018 by integrating Land Use and Land Cover (LU/LC) classification and the Normalized Difference Built-up Index (NDBI) derived from Landsat satellite imagery. Using data from the CORINE Land Cover (CLC) inventory and high-resolution spatial datasets, the research applies Geographic Information Systems (GIS) and Remote Sensing (RS) techniques to quantify the magnitude and direction of land use change. Comparative spatial analyses between 2000 and 2018 reveal a marked expansion of built-up areas, particularly along transportation corridors and suburban zones, accompanied by a substantial decline in vegetated and agricultural lands. The findings demonstrate that the period under analysis was characterized by accelerated urban sprawl, weak spatial regulation, and inconsistent urban governance—features common to post-communist transition cities. The expansion of impervious surfaces and loss of ecological spaces underscore the urgent need for sustainable land management and integrated spatial monitoring frameworks. By showcasing the application of geospatial indicators such as NDBI and LU/LC mapping, this research highlights the potential of remote sensing technologies as essential tools for evidence-based urban policy, planning, and sustainable territorial governance in post-communist contexts.

Keywords:
Prizren, Urban Transformation, LU/LC, NDBI, GIS, Remote Sensing, Sustainable Planning, Post-Communist Cities

Introduction

The post-communist transition across Eastern and Southeastern Europe has profoundly reshaped urban landscapes, institutional frameworks, and socio-economic relations. The fall of centralized regimes in the late 1980s and early 1990s marked a paradigm shift from state-controlled planning to market-oriented urban development. This transformation introduced new actors—private investors, real-estate developers, and local governments—into urban governance, often without sufficient regulatory capacity or coherent spatial policy (Sýkora & Bouzarovski, 2012). Consequently, cities became laboratories of socio-spatial restructuring, reflecting the interplay of liberalization, migration, and informal urban growth (Stanilov, 2007).

Across the post-socialist region, urban areas have experienced a dual process of expansion and fragmentation. While economic decentralization stimulated investment in construction and infrastructure, weak institutional coordination and fragmented land management led to unplanned sprawl and ecological degradation (Hirt, 2013). The Western Balkans, undergoing simultaneous processes of post-conflict reconstruction and post-socialist transition, have been particularly exposed to these dynamics (Babić, 2021). Kosovo, as one of the youngest states in Europe, illustrates this duality—rapid urbanization combined with institutional fragility in spatial governance (Dobraca & Knaus, 2019).

The city of Prizren provides a valuable case study for understanding these processes. As a historical urban centre and cultural capital of Kosovo, Prizren's transformation encapsulates broader regional trends of post-communist change—territorial restructuring, privatization of land, and spontaneous residential growth. Following the end of the 1998–1999 Kosovo War, the city entered a phase of accelerated reconstruction supported by international donors and domestic initiatives. Yet, as public land was liberalized and migration from rural areas intensified, urban growth began to extend rapidly into peripheral and agricultural zones. The lack of updated urban plans and weak enforcement mechanisms contributed to informal construction and encroachment on green spaces (Gülersoy, 2016).

Geospatially, Prizren's evolution reveals the contrasting trajectories of modernization and environmental pressure. The expansion of built-up areas has reshaped land use composition—reducing agricultural lands, fragmenting natural habitats, and altering watershed systems of the Prizren Plain. These dynamics exemplify the challenges faced by post-socialist cities where economic transformation outpaces spatial regulation (Nedović-Budić et al., 2011). At the same time, the city's strategic location along the Drini i Bardhë River and proximity to cross-border transport corridors have increased its importance as a regional development hub within Kosovo's spatial planning framework (Kosovo Spatial Plan, 2010).

Historical Background of Prizren

Prizren is among the oldest continuously inhabited cities in the Balkans, with urban roots tracing back to the Roman and Byzantine periods. Over centuries, it has served as an administrative, commercial, and cultural centre under various empires, including the Ottoman Empire, which left a significant architectural and social imprint (Elsie, 2011). The city's historical core, characterized by traditional Ottoman-era urban fabric—mosques, churches, bazaars, and stone bridges—reflects the coexistence of multiple ethnic and religious communities, including Albanians, Turks, Bosniaks, and Gorani.

During the socialist period under Yugoslavia (1945–1990), Prizren experienced controlled urban growth guided by centralized industrial and housing policies. Urban planning focused on expanding manufacturing sectors and providing standardized housing estates, particularly in the lower valley areas. However, post-1990s political instability and the eventual war in Kosovo (1998–1999) disrupted this continuity. Large-scale displacement, property destruction, and post-war reconstruction fundamentally altered the spatial and demographic structure of the city (Pavlović, 2009).

After 1999, the UNMIK administration and later Kosovo's local institutions introduced new governance frameworks, yet urban planning capacities remained limited. The post-war reconstruction period emphasized physical rebuilding over strategic spatial management. Consequently, informal settlements proliferated, especially in peripheral areas such as Ortakoll, Bazhdarhane, and Tusus, where rural migrants sought access to urban employment and services (Hysa, 2020).

In parallel, Prizren became a symbolic centre of cultural resilience, with the reconstruction of the Albanian League of Prizren complex representing both a national and urban identity milestone. The integration of heritage preservation with contemporary development, however, remains an ongoing challenge. Increasing construction pressure in the historic core has raised concerns regarding the conservation of cultural landscapes and visual integrity (Council of Europe, 2021).

The Need for Spatial Monitoring and Sustainable Planning

Given these dynamics, the study of Prizren's land use and built-up expansion between 2000 and 2018 provides a crucial empirical foundation for understanding post-conflict urban transformation. Modern tools such as Geographic Information Systems (GIS) and Remote Sensing (RS) enable the quantification of land cover changes and the assessment of urban growth trajectories. The use of indices such as the Normalized Difference Built-up Index (NDBI) and CORINE Land Cover (CLC) datasets provides objective, spatially explicit evidence to support planning interventions. By combining historical knowledge

with contemporary geospatial analysis, this research contributes to the broader debate on sustainable urbanism in post-communist contexts—where cities like Prizren must balance rapid development with heritage protection and ecological sustainability.

Study Area

The Municipality of Prizren is located in the southern part of the Republic of Kosovo, covering an area of approximately 627 km², which makes it one of the largest municipalities in the country in both territorial and demographic terms (Kosovo Agency of Statistics, 2024). According to the most recent census, the municipality has about 147,246 inhabitants, with approximately 61% living in urban areas and 39% in rural settlements. This distribution reflects the intensified urbanization process that has characterized the last two decades, reshaping the city's physical boundaries and settlement morphology.

The map illustrates the geographical position of the Municipality of Prizren, located in the southwestern part of Kosovo. The area borders Albania to the west and North Macedonia to the south, thus holding a strategic cross-border position of economic, cultural, and transport significance. In the northern and northeastern parts, Prizren borders other municipalities of Kosovo, serving as a connecting bridge between Kosovo and the wider Western Balkans region.

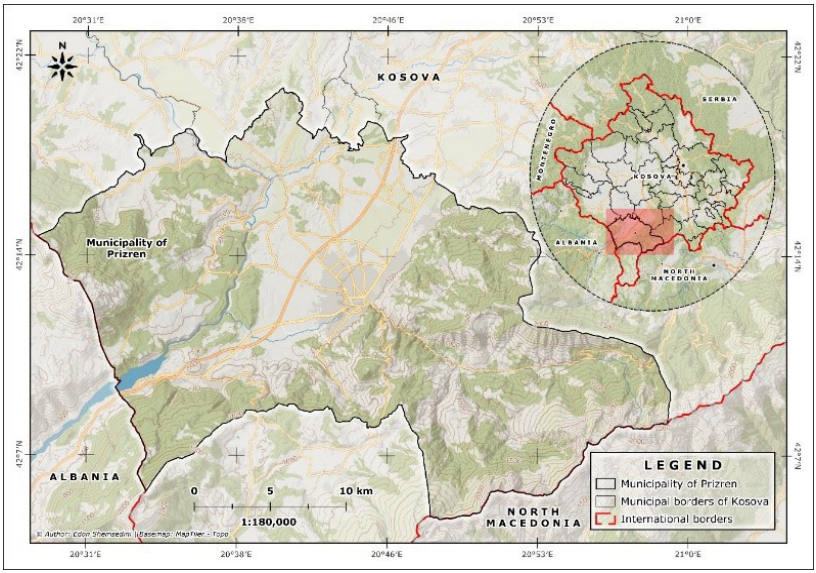


Figure 1. Geographical position of the Municipality of Prizren within Kosovo and the region).

Geographical and Environmental Setting

Prizren lies within a strategic geographical position, bordered by Suhareka to the north, Dragash to the east, the city of Kukës (Albania) to the south, and Malishevë to the west. Its location makes it a vital cross-border node between Albania and central Kosovo, historically functioning as a gateway for trade, culture, and migration. The municipality encompasses two dominant geomorphological units: the Prizren Plain, characterized by fertile agricultural lands, and the Sharr Mountains, known for their ecological diversity and high-altitude ecosystems.

The White Drin River (Drini i Bardhë) traverses the city and serves as a major natural axis for both historical settlement and modern infrastructure. The area's Mediterranean-continental climate, with hot summers and mild winters, has traditionally supported agricultural activities such as viticulture, horticulture, and livestock farming (MESP, 2018). In recent years, these natural conditions have also favored the growth of eco-tourism and sustainable rural development initiatives.

Demographic and Ethnic Composition

Prizren stands out for its multiethnic and multireligious composition, which remains one of its most defining social features. The population is predominantly Albanian, but significant communities of Turks, Bosniaks, Gorani, Roma, and Ashkali contribute to the city's cultural pluralism. This diversity has historically shaped Prizren's urban culture, manifested through its bilingual education, religious coexistence, and mixed architectural styles (Elsie, 2011).

Since the end of the Kosovo War (1998–1999), demographic dynamics have shifted considerably. The post-conflict years witnessed a wave of rural-to-urban migration, as well as the return of displaced populations and diaspora communities. This influx created increased demand for housing, employment, and urban services, placing immense pressure on the city's infrastructure and spatial organization (Dobraca & Knaus, 2019). Consequently, many new residential neighborhoods—often informal—emerged in peripheral areas such as Ortakoll, Bazhdarhane, and Tusus.

Impact of the Kosovo War and Reconstruction

The Kosovo War had a profound effect on Prizren's physical and cultural landscape. Between 1998 and 1999, the city suffered significant human and material losses, including damage to public infrastructure, housing, and heritage sites. One of the most symbolic destructions was the Monumental Complex of the Albanian League of Prizren, a cornerstone of Albanian national history. On March 27, 1999, Serbian military forces burned the museum complex, resulting in the loss of over 200 historical documents and artifacts (Gülersoy, 2016).

Just a few months later, on June 10, 1999, local artisans and cultural insti-

tutions began the reconstruction of the complex, which was completed as a testament to the resilience and collective memory of the local population. Post-war reconstruction efforts were largely focused on physical rebuilding—roads, bridges, public facilities, and housing—but often lacked strategic spatial coordination. As a result, urban expansion occurred spontaneously, driven by the private sector and individual initiatives rather than institutional planning frameworks (Babić, 2021).

This rapid expansion led to visible land use changes: agricultural and peri-urban lands were converted into residential and commercial zones, altering the city's spatial balance. The study of these transitions through Land Use/Land Cover (LU/LC) and NDBI analysis thus becomes crucial for understanding the urban dynamics of post-conflict Prizren.

Historical and Cultural Significance

Prizren is often referred to as the "spiritual capital of Kosovo", owing to its extraordinary historical and cultural heritage. The city's historic center, declared a protected cultural zone by the Kosovo Ministry of Culture, includes numerous monuments of medieval and Ottoman origin, such as Prizren Fortress, the Stone Bridge, the Sinan Pasha Mosque, the Church of the Holy Saviour, and the Hammam of Gazi Mehmed Pasha. These landmarks, some listed under UNESCO and the Council of Europe programs, illustrate Prizren's position as a cultural crossroads of civilizations (Council of Europe, 2021).

However, the post-war urban boom has created tensions between modernization and heritage preservation. In the historic core, new constructions, road expansions, and commercial development have occasionally threatened the visual integrity and authenticity of the urban landscape. This underscores the need for a balanced approach that integrates conservation with sustainable urban growth. The use of geospatial technologies such as GIS and Remote Sensing offers new possibilities for monitoring spatial transformations while safeguarding cultural heritage.

In summary, Prizren's study area embodies the interaction between geography, history, and socio-political transition. It represents a living laboratory of post-socialist and post-conflict urban evolution, where sustainable land management, inclusive planning, and cultural preservation are fundamental to achieving spatial resilience and long-term development.

Methodology

The methodological approach of this study integrates remote sensing, geospatial analysis, and comparative temporal assessment to quantify and visualize the spatial transformation of Prizren between 2000 and 2018. The research combines CORINE Land Cover (CLC) datasets and Landsat satellite imagery

within a GIS environment to derive, interpret, and validate urban growth and land use/land cover (LU/LC) transitions. The process is structured in three main stages: data acquisition and preparation, analytical processing, and spatial interpretation.

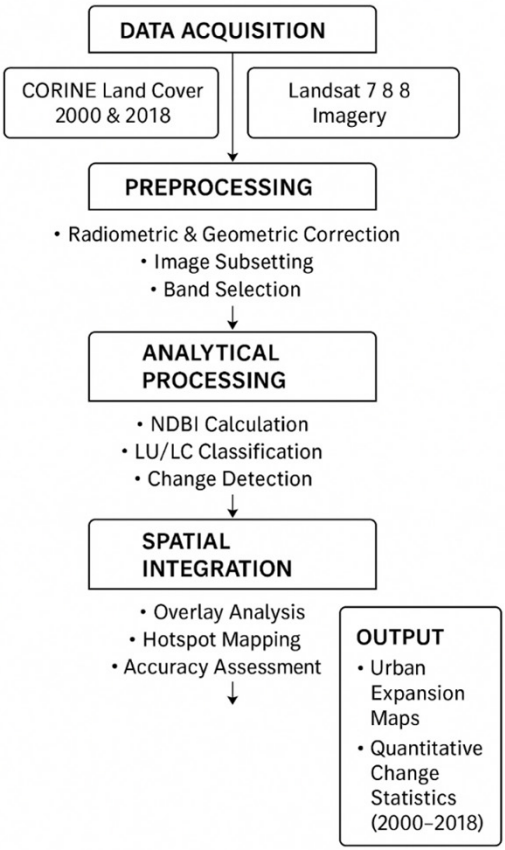


Figure 1. Workflow of LU/LC and NDBI Analysis for Urban Transformation Assessment

This figure illustrates the methodological workflow of the study, integrating CORINE Land Cover datasets, Landsat imagery, and GIS-based spatial analysis. The process includes data acquisition, preprocessing (radiometric and geometric correction), NDBI computation, LU/LC classification, change detection, and map integration for spatial interpretation.

Data Sources

Two primary datasets formed the foundation of this analysis:

CORINE Land Cover (CLC) 2000 and 2018

Provided by the European Environment Agency (EEA), the CLC program offers harmonized geospatial data on land use and land cover across Europe. Each dataset classifies land cover using a hierarchical nomenclature of 44 thematic classes, based on satellite imagery interpretation (EEA, 2018).

•CLC 2000 represents baseline land cover at the start of the post-conflict period, reflecting the early stage of Prizren's spatial recovery and initial urbanization trends.

•CLC 2018 captures the later phase of urban expansion, when private development and infrastructure projects intensified.

Both datasets have a minimum mapping unit (MMU) of 25 hectares, with a positional accuracy of 100 meters, sufficient for regional-scale urban change analysis.

2.Landsat 7 ETM+ (Enhanced Thematic Mapper Plus) and Landsat 8 OLI (Operational Land Imager)

These satellite images, obtained from the United States Geological Survey (USGS) archives, were used to compute the Normalized Difference Built-up Index (NDBI) for the years 2001 and 2018. The Landsat series offers 30-meter spatial resolution, 16-day temporal resolution, and consistent radiometric calibration, making it ideal for long-term monitoring.

- Spectral bands used:
  - Near-Infrared (NIR): Band 4 for Landsat 7, Band 5 for Landsat 8
  - Shortwave Infrared (SWIR): Band 5 for Landsat 7, Band 6 for Landsat 8

These spectral bands enable discrimination between built-up and non-built-up surfaces, forming the basis for NDBI analysis.

Supplementary datasets included municipal boundary shapefiles from the Kosovo Cadastral Agency and digital elevation models (DEM) for topographic referencing. All data were georeferenced to the WGS 84 UTM Zone 34N coordinate system.

CORINE Land Cover (CLC) Classification Scheme

To ensure consistency and comparability across years, this study employed the hierarchical CORINE Land Cover (CLC) classification system developed by the European Environment Agency (EEA).

This system is widely used for analyzing land use and land cover dynamics across Europe, providing standardized thematic and spatial representation at national and regional scales.

The CLC classification structure is organized into three hierarchical levels:

- Level 1: Includes five main categories — Artificial surfaces, Agricultural areas, Forest and semi-natural areas, Wetlands, and Water bodies.

- Levels 2 and 3: Provide more detailed thematic subdivisions, comprising a total of 44 distinct land cover classes, derived through the interpretation of satellite imagery.

In the case of the Prizren Municipality, the dominant land cover classes identified include:

1.1 Urban fabric

2.1 Arable land

3.1 Forests

5.1 Inland waters

Each class was visualized using the official CLC RGB color codes, ensuring visual consistency and cross-year comparability between datasets (e.g., CLC 2000 and CLC 2018).

Analytical Approach

The analytical framework was designed to quantify spatial and temporal changes in Prizren's urban structure using remote sensing indicators and GIS-based spatial modeling.

3.2.1 Preprocessing and Calibration

Satellite images were downloaded as Level-1 products and underwent standard preprocessing steps:

• Radiometric correction to normalize reflectance values.

• Atmospheric correction using the Dark Object Subtraction (DOS) method.

• Geometric correction to ensure alignment with administrative boundaries and CLC layers.

After preprocessing, the images were subset to the spatial extent of the Prizren Municipality for focused analysis.

NDBI Calculation and Classification

The Normalized Difference Built-up Index (NDBI) was calculated following Zha et al. (2003):

where SWIR denotes Short-Wave Infrared reflectance and NIR represents Near-Infrared reflectance.

o Values > 0 indicate built-up or impervious surfaces (e.g., concrete, asphalt, rooftops).

o Values < 0 correspond to non-built-up areas such as vegetation, water bodies, or bare soil.

The resulting NDBI images were classified into three categories:

2. Built-up areas (NDBI > 0.2)

3. Semi-built or transitional areas (NDBI between 0 and 0.2)

4. Non-built areas (NDBI < 0)

Level 1	Level 2	Level 3	Grid_Code	RGB
1. ARTIFICIAL SURFACES	1.1Urban fabric	1.1.1 Continuous urban fabric	1	230-000-077
		1.1.2 Discontinuous urban fabric	2	255-000-000
	1.2 Industrial, commercial and transport units	1.2.1 Industrial or commercial units	3	204-077-242
		1.2.2 Road and rail networks and associated land	4	204-000-000
		1.2.3 Port areas	5	230-204-204
		1.2.4 Airports	6	230-204-230
	1.3 Mine, dump and construction sites	1.3.1 Mineral extraction sites	7	166-000-204
		1.3.2 Dump sites	8	166-077-000
		1.3.3 Construction sites	9	255-077-255
	1.4 Artificial, non-agricultural vegetated areas	1.4.1 Green urban areas	10	255-166-255
		1.4.2 Sport and leisure facilities	11	255-230-255
2. AGRICULTURAL AREAS	2.1 Arable land	2.1.1 Non-irrigated arable land	12	255-255-168
		2.1.2 Permanently irrigated land	13	255-255-000
		2.1.3 Rice fields	14	230-230-000
	2.2 Permanent crops	2.2.1 Vineyards	15	230-128-000
		2.2.2 Fruit trees and berry plantations	16	242-166-077
		2.2.3 Olive groves	17	230-166-000
	2.3 Pastures	2.3.1 Pastures	18	230-230-077
	2.4 Heterogeneous agricultural areas	2.4.1 Annual crops associated with permanent crops	19	255-230-166
		2.4.2 Complex cultivation patterns	20	255-230-077
		2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation	21	230-204-077
		2.4.4 Agro-forestry areas	22	242-204-166
3. FOREST AND SEMI NATURAL AREAS	3.1Forests	3.1.1 Broad-leaved forest	23	128-255-000
		3.1.2 Coniferous forest	24	000-166-000
		3.1.3 Mixed forest	25	077-255-000
	3.2 Scrub and/or herbaceous vegetation associations	3.2.1 Natural grasslands	26	204-242-077
		3.2.2 Moors and heathland	27	166-255-128
		3.2.3 Sclerophyllous vegetation	28	166-230-077
		3.2.4 Transitional woodland-shrub	29	166-242-000
	3.3 Open spaces with little or no vegetation	3.3.1 Beaches, dunes, sands	30	230-230-230
		3.3.2 Bare rocks	31	204-204-204
		3.3.3 Sparsely vegetated areas	32	204-255-204
		3.3.4 Burnt areas	33	000-000-000
		3.3.5 Glaciers and perpetual snow	34	166-230-204
4. WETLANDS	4.1 Inland wetlands	4.1.1 Inland marshes	35	166-166-255
		4.1.2 Peat bogs	36	077-077-255
	4.2 Maritime wetlands	4.2.1 Salt marshes	37	204-204-255
		4.2.2 Salines	38	230-230-255
		4.2.3 Intertidal flats	39	166-166-230
5. WATER BODIES	5.1 Inland waters	5.1.1 Water courses	40	000-204-242
		5.1.2 Water bodies	41	128-242-230
	5.2 Marine waters	5.2.1 Coastal lagoons	42	000-255-166
		5.2.2 Estuaries	43	166-255-230
		5.2.3 Sea and ocean	44	230-242-255
No Data	No Data		48	
	No Data		49	
	No Data		50	230-242-255

Figure 2. Hierarchical structure of the CORINE Land Cover (CLC) classification system used in the analysis.

Post-classification filtering was applied to eliminate noise and minor pixel anomalies. Change detection analysis was performed by overlaying NDBI results from 2001 and 2018 to identify expansion hotspots and quantify surface changes in square kilometres.

Land Use/Land Cover (LU/LC) Change Detection

The CLC datasets from 2000 and 2018 were compared using a cross-tabulation matrix to determine transitions between land cover categories, such as:

- Agricultural to Urban Fabric
- Forested Land to Agricultural
- Industrial or Commercial Development Expansion

This analysis enabled the quantification of land conversion rates and spatial distribution of transformation zones. The results were visualized through change maps that illustrate urban growth corridors and the loss of natural land cover.

Integration and Spatial Interpretation

To ensure analytical coherence, NDBI and CLC results were overlaid within a GIS environment. This integration allowed validation of satellite-derived indices with land cover classifications and identification of mismatches. The combination of these methods provided a multi-scalar understanding of urban growth—from pixel-level built-up intensity to municipal-scale land use transitions.

Accuracy Assessment

Accuracy assessment was conducted using a stratified random sampling approach with reference points verified via high-resolution imagery from Google Earth and field observation data (when available). The overall classification accuracy for NDBI-based land cover was above 85%, with a Kappa coefficient of 0.82, indicating a high level of reliability for change detection.

Methodological Significance

This integrated methodology demonstrates the effectiveness of combining multi-temporal satellite data with standardized European land cover datasets (CLC) for monitoring urbanization in post-conflict and post-socialist contexts. It allows planners to visualize not only quantitative expansion but also qualitative shifts in spatial organization. Moreover, it provides a replicable analytical model for other municipalities in Kosovo and the Western Balkans.

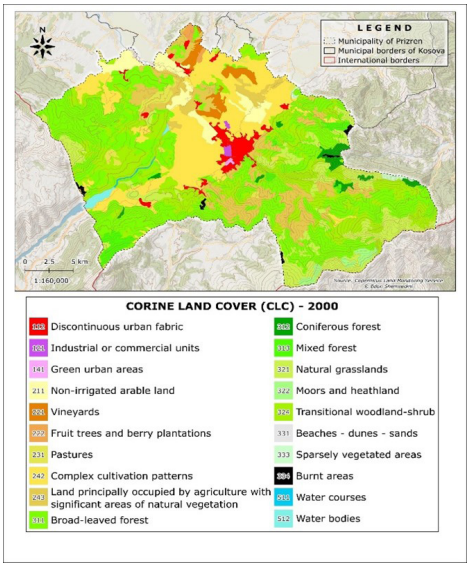
Results

CORINE Land Cover (CLC) Analysis

The CORINE Land Cover (CLC) datasets for 2000 and 2018 reveal a substantial transformation of Prizren's spatial structure over an 18-year period. The results clearly indicate that urbanized areas expanded significantly at the expense of agricultural and semi-natural lands, while forested areas in the Sharr Mountain region remained relatively stable.

Land Cover Change Overview (2000–2018)

According to the CLC 2000 dataset, the landscape of Prizren was primarily dominated by broad-leaved forest (30.8%), transitional woodland-shrub (17.7%), and complex cultivation patterns (16.0%). Urbanized areas, represented by the discontinuous urban fabric and industrial or commercial units, accounted for only 2.7% of the municipal territory (approximately 16.97 km² in total).



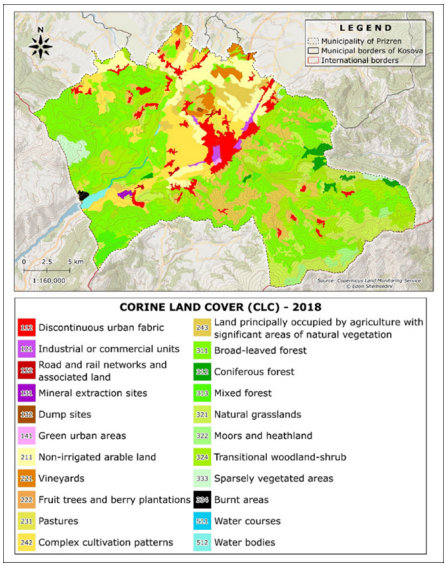


Figure 3.CORINE Land Cover (CLC) – 2000

Figure 4. CORINE Land Cover (CLC) – 2018

Source: Copernicus Land Monitoring Service (EEA), processed by Edon Shemsedini.

The map illustrates the spatial distribution of land cover classes across the Municipality of Prizren for the year 2000.

During this period, the landscape was predominantly characterized by broad-leaved forests (311), transitional woodland-shrub (324), and complex cultivation patterns (242), which together accounted for over 60% of the municipal area.

Urbanized zones such as discontinuous urban fabric (112) and industrial or commercial units (121) covered a small portion of the territory, mainly concentrated around the urban core of Prizren and the main transportation corridors.

By contrast, the CLC 2018 data show that the proportion of urban and built-up land nearly doubled to 5.7% (around 36 km²). This expansion corresponds to a net increase of about 19 km² in built-up areas over the observed period. At the same time, the total area of complex cultivation patterns decreased from 100.42 km² to 54.53 km², while non-irrigated ar-

Code	Category	Area (km²)	Percentage (%)
112	Discontinuous urban fabric	15.82	2.52
121	Industrial or commercial units	1.15	0.18
141	Green urban areas	0.45	0.07
211	Non-irrigated arable land	23.82	3.80
221	Vineyards	10.84	1.73
222	Fruit trees and berry plantations	2.39	0.38
231	Pastures	8.03	1.28
242	Complex cultivation patterns	100.42	16.02
243	Land occupied by agriculture with natural vegetation	67.32	10.74
311	Broad-leaved forest	193.04	30.79
312	Coniferous forest	8.69	1.39
313	Mixed forest	10.41	1.66
321	Natural grasslands	59.69	9.52
322	Moors and heathland	5.69	0.91
324	Transitional woodland-shrub	111.12	17.72
331	Beaches, dunes, sands	0.50	0.08
333	Sparsely vegetated areas	1.93	0.31
334	Burnt areas	2.07	0.33
511	Water courses	0.64	0.10
512	Water bodies	2.98	0.48
Total		**627.00**	**100.00**

Table 1. Land Cover categories and area distribution in 2000

Source: Author's calculation based on CORINE Land Cover 2000 dataset (EEA).

able land expanded slightly from 23.82 km² to 50.62 km², reflecting peri-urban agricultural conversion and shifting land use along the Prizren Plain.

Forested categories, particularly broad-leaved forests, experienced a marginal increase (from 193.04 km² to 200.73 km²), suggesting effective preservation of the mountainous terrain within the Sharr National Park boundaries. However, some transitional woodland-shrub areas declined (from 111.12 km² to 105.25 km²), which indicates localized deforestation or conversion to agricultural use in low-lying zones.

The 2018 CORINE Land Cover map reveals a noticeable urban expansion throughout the Prizren Plain and peripheral zones. Built-up areas, including discontinuous urban fabric (112), industrial or commercial units (121), and road and rail networks (122), have significantly increased, particularly along the main transportation corridors and the northern edge of the city.

Conversely, complex cultivation patterns (242) declined sharply, reflecting

conversion of agricultural mosaics into residential and infrastructural land.

Forested regions, dominated by broad-leaved forest (311), maintained their continuity and even slightly expanded within the Sharr Mountain area, confirming effective conservation within the National Park boundaries.

Comparative Interpretation of Land Cover Changes (2000–2018)

According to the CLC 2000 dataset, the landscape of Prizren was primarily dominated by broad-leaved forest (30.8%), transitional woodland-shrub

Code	Category	Area (km²)	Percentage (%)
112	Discontinuous urban fabric	31.03	4.95
121	Industrial or commercial units	3.64	0.58
122	Road and rail networks and associated land	1.35	0.22
131	Mineral extraction sites	0.88	0.14
132	Dump sites	0.26	0.04
141	Green urban areas	0.39	0.06
211	Non-irrigated arable land	50.62	8.07
221	Vineyards	9.71	1.55
222	Fruit trees and berry plantations	0.78	0.12
231	Pastures	4.74	0.76
242	Complex cultivation patterns	54.53	8.70
243	Land occupied by agriculture with natural vegetation	66.93	10.67
311	Broad-leaved forest	200.73	32.01
312	Coniferous forest	7.44	1.19
313	Mixed forest	10.17	1.62
321	Natural grasslands	58.82	9.38
322	Moors and heathland	6.81	1.09
324	Transitional woodland-shrub	105.25	16.79
333	Sparsely vegetated areas	8.54	1.36
334	Burnt areas	0.86	0.14
511	Water courses	0.64	0.10
512	Water bodies	2.88	0.46
Total		**627.00**	**100.00**

Table 2. Land Cover categories and area distribution in 2018

Source: Author's calculation based on CORINE Land Cover 2018 dataset (EEA).

(17.7%), and complex cultivation patterns (16.0%). Urbanized areas, represented by the discontinuous urban fabric and industrial or commercial units, accounted for only 2.7% of the municipal territory (approximately 16.97 km² in total).

By contrast, the CLC 2018 data show that the proportion of urban and built-up land nearly doubled to 5.7% (around 36 km²). This expansion corresponds to a net increase of about 19 km² in built-up areas over the observed period. At the same time, the total area of complex cultivation patterns decreased from 100.42 km² to 54.53 km², while non-irrigated arable land expanded slightly from 23.82 km² to 50.62 km², reflecting peri-urban agricultural conversion and shifting land use along the Prizren Plain.

Forested categories, particularly broad-leaved forests, experienced a marginal increase (from 193.04 km² to 200.73 km²), suggesting effective preservation of the mountainous terrain within the Sharr National Park boundaries. However, some transitional woodland-shrub areas declined (from 111.12 km² to 105.25 km²), which indicates localized deforestation or conversion to agricultural use in low-lying zones.

Spatial Patterns of Change

The CLC 2000 Map (Figure 3) illustrates the baseline spatial configuration at the beginning of the observation period, where the urban core of Prizren was compact and primarily confined along the Lumbardhi River corridor. Surrounding agricultural plains and forest zones exhibited a balanced ecological and economic structure.

The CLC 2018 Map (Figure 4), however, displays a marked spatial diffusion of built-up areas extending toward the north (Ortakoll and Zhur), east (Tusus and Billushë), and southwest (Landovica and Sredska Valley). These extensions correspond to newly developed residential and commercial districts, reflecting both population growth and intensified construction activity following post-war reconstruction initiatives.

The CLC Change Detection Map (2000–2018) synthesizes the spatial transitions by highlighting zones of urban expansion, agricultural reduction, and forest persistence. The most notable urban growth hotspots are concentrated along the Prizren–Suharekë road axis and near industrial clusters in the southern and eastern periphery. In contrast, agricultural and natural vegetation classes have diminished, primarily where urban and infrastructural development has expanded.

The comparative analysis between CLC 2000 and CLC 2018 highlights a net urban increase of approximately 19 km² within the Prizren Municipality.

This growth primarily occurred along the Prizren Plain, replacing agricultural mosaics (CLC 242) and peri-urban cultivation areas, while forested regions within Sharr National Park remained stable or slightly expanded.

The observed dynamics reflect post-conflict urban recovery, population growth, and unregulated suburban development, underscoring the need for spatial planning strategies based on sustainable land management.

The comparative results highlight a clear pattern of urban expansion and agricultural land conversion over the 18-year period. Urban and built-up areas, especially discontinuous urban fabric and industrial/commercial units, increased by nearly 18–19 km² in total, reflecting rapid post-conflict urban growth and infrastructure development along the Prizren Plain.

At the same time, complex cultivation patterns decreased significantly, while broad-leaved forests showed moderate growth, indicating effective conservation within the Sharr Mountain region. In contrast, transitional woodland-shrub and natural grasslands declined slightly, reflecting local land-use change in peri-urban zones.

The data confirm that urban expansion primarily occurred through the conversion of agricultural and semi-natural landscapes — particularly those classified as complex cultivation patterns and transitional woodland-shrub. The net gain of approximately 19 km² in built-up land reflects the intense urbanization pressure that characterized the post-socialist transition period in Prizren.

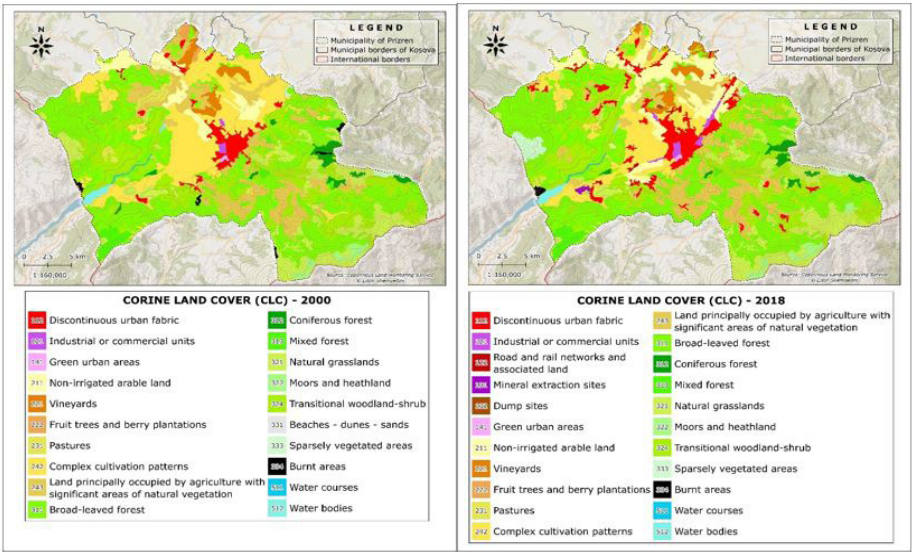


Figure 6. Comparative CORINE Land Cover (CLC) Maps – 2000 and 2018

Source: Copernicus Land Monitoring Service (EEA), processed by Edon Shemsedini.

The figure presents the spatial comparison of land cover distribution in Prizren Municipality between the years 2000 and 2018, based on CORINE Land Cover datasets (EEA).The maps illustrate urban expansion across the Prizren Plain and conversion of agricultural and semi-natural areas into built-up land, while forested zones within the Sharr Mountain region remain largely stable.

This visualization directly supports the findings discussed in Section 4.2. Comparative Interpretation of Land Cover Changes (2000–2018).

The table presents the comparative distribution of land cover categories

Land Cover Class	2000 (km²)	2018 (km²)	Change (km²)	Trend
Discontinuous urban fabric	15.82	31.03	**+15.21**	↑ Increase
Industrial/Commercial units	1.15	3.64	**+2.49**	↑ Increase
Broad-leaved forest	193.04	200.73	**+7.69**	↑ Slight increase
Transitional woodland-shrub	111.12	105.25	**−5.87**	↓ Decrease
Complex cultivation patterns	100.42	54.53	**−45.89**	↓ Significant decrease
Agricultural land (total)	67.32	66.93	**−0.39**	≈ Stable
Natural grasslands	59.69	58.82	**−0.87**	↓ Slight decrease

Table 3. Comparative Land Cover Changes between 2000 and 2018
Source: Author's calculation based on CORINE Land Cover datasets (EEA, 2000 & 2018).

for the years 2000 and 2018, alongside the net differences (2018–2000).

It highlights substantial urban expansion — mainly in discontinuous urban fabric (112) and industrial/commercial units (121) — as well as the decline of complex cultivation patterns (242) and transitional woodland-shrub (324).

Overall, the data confirm a shift from agricultural and semi-natural areas toward built-up and infrastructural land uses in Prizren Municipality.

NDBI Analysis

The Normalized Difference Built-up Index (NDBI) derived from Landsat 7 ETM+ (2001) and Landsat 8/9 OLI (2014, 2018, 2024) was used to detect and quantify the spatial expansion of impervious surfaces within the Municipality of Prizren. The NDBI method exploits the contrast between Short-Wave Infrared (SWIR) and Near-Infrared (NIR) spectral reflectance to identify built-up structures according to the equation:

$$\mathrm{NDBI} = \frac{\mathrm{SWIR} - \mathrm{NIR}}{\mathrm{SWIR} + \mathrm{NIR}}$$

Pixels with positive NDBI values (> 0) indicate built-up or impervious surfaces, whereas negative values (< 0) correspond to vegetation, water bodies, or bare soil. This index allows a consistent and reproducible assessment of urban expansion over time using multispectral satellite data (Zha et al., 2003). The figure illustrates the spatial extent and density of built-up areas in the Municipality of Prizren derived from Landsat-based NDBI calculations for the years 2001 and 2018.

The NDBI 2001 map indicates limited built-up zones mainly concentrated within the city core and adjacent settlements, while most of the

municipal territory was characterized by vegetated or agricultural land.

By contrast, the NDBI 2018 map clearly shows an expansion of high NDBI values (red areas), signifying rapid urban growth toward the northern and eastern peripheries, particularly along the Prizren Plain.

This transformation reflects the post-conflict reconstruction period and intensified urbanization associated with population return, private development, and infrastructural investments.

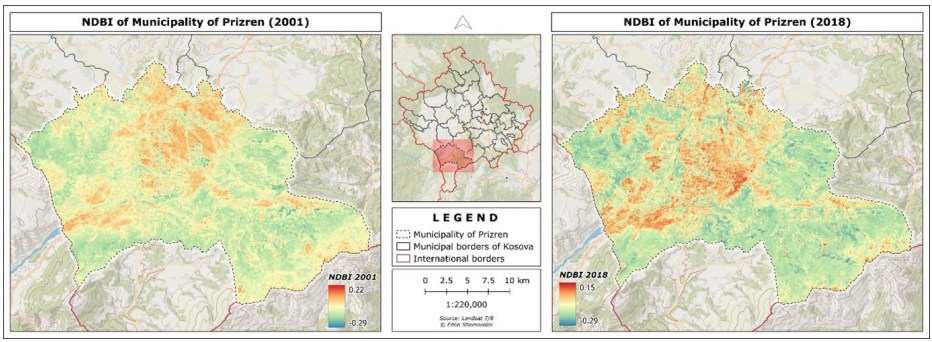


Figure 8. Spatial Distribution of Built-up Areas based on NDBI (2001 and 2018

Source: Author's processing based on Landsat 7 ETM+ (2001) and Landsat 8 OLI (2018), USGS archive.

Interpretation of NDBI Results (2001–2018)

The NDBI analysis reveals a notable spatial expansion of built-up areas within the Municipality of Prizren between 2001 and 2018. The comparison indicates that the urban core has expanded primarily toward the north, northeast, and east, following the main transport corridors and lowland agricultural areas.

In 2001, built-up surfaces were mainly concentrated within the central part of Prizren and adjacent settlements such as Ortakoll, Tusus, and Bazhdarhane, corresponding to low to moderate NDBI values (0.05–0.15). The surrounding landscape was dominated by vegetated and agricultural areas with negative or near-zero NDBI values, indicating minimal urban pressure.

By 2018, the NDBI map demonstrates a significant increase in high reflectance zones (0.15–0.25), signifying dense urbanization and impervious surface expansion. These changes are particularly evident along the Prizren–Suhareka and Prizren–Landovica corridors, where residential and commercial developments intensified. The spatial pattern suggests unplanned urban sprawl linked to post-conflict reconstruction, population return, and private sector–driven development.

Furthermore, some peri-urban areas show mixed NDBI signals, reflecting a combination of built-up and vegetated surfaces, which is typical for transitional zones undergoing conversion from rural to urban use. This dy-

namic transformation is consistent with the land cover changes detected in the CLC analysis, confirming that a large share of agricultural and semi-natural land has been converted into residential and mixed-use urban zones.

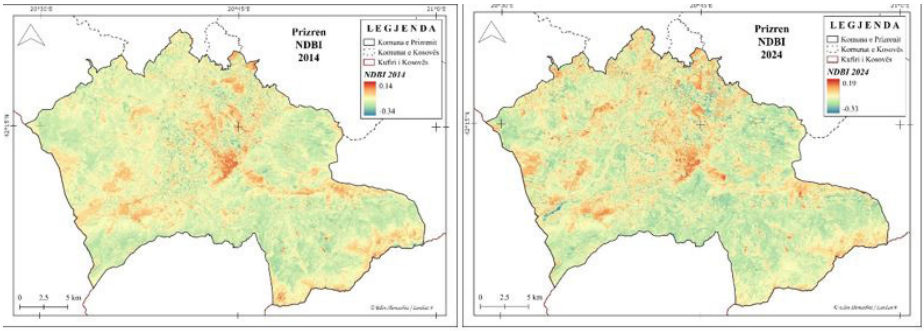


Figure 11. NDBI of Municipality of Prizren (2014 and 2024)

Source: Author's processing based on Landsat 7 ETM+ (2014) and Landsat 8 OLI (2024), USGS archive.

The figure illustrates the spatial distribution of Normalized Difference Built-up Index (NDBI) values across the Municipality of Prizren for the years 2014 and 2024, derived from Landsat 8 OLI and Landsat 9 OLI-2 satellite imagery.

In 2014, built-up areas (depicted in orange to red tones) were still concentrated mainly within the urban core and the immediate surroundings of Prizren. The majority of the municipal territory displayed low or negative NDBI values (green tones), indicating vegetation or agricultural surfaces.

By 2024, the NDBI intensity has markedly increased, particularly in the northern, eastern, and southeastern parts of the municipality. These high NDBI zones correspond to newly developed residential areas, expanded road networks, and industrial facilities.

This visual comparison reveals a steady and outward expansion of impervious surfaces over the past decade, confirming the continued process of urban sprawl and densification that began after 2010.

NDBI Classification	Area (km²) – NDBI 2014	Area (km²) – NDBI 2024	NDBI Area Difference (2024–2014) (km²)
< 0 (non-built / vegetated surfaces)	610.71	554.72	–55.98
> 0 (built-up / impervious surfaces)	15.80	71.78	+55.98
Total / Gjithsej	**626.51 km²**	**626.51 km²**	**0.00**

Table 5. NDBI Classification and Surface Change (2014–2024)

Source: Author's calculation based on CORINE Land Cover datasets (EEA, 2014 & 2024).

The results demonstrate a net increase of 55.98 km² in built-up and impervious surfaces between 2014 and 2024, representing approximately 9% of the municipal territory.

This expansion occurred primarily through the conversion of vegetated and agricultural lands (NDBI < 0) into urban and semi-urban areas (NDBI > 0).

The decrease of 55.98 km² in negative NDBI values corresponds directly to the increase in positive values, confirming a clear urbanization trend across the municipality.

Spatially, these transformations are most evident in the northern, northeastern, and southeastern zones of Prizren, consistent with the patterns observed in Figures 10 and 11.

This quantitative analysis reinforces the visual evidence from the NDBI maps, indicating that urban growth during the last decade has been both extensive and continuous, with significant land conversion pressure in peri-urban regions.

A detailed temporal comparison using Landsat 8 (2014) and Landsat 9 (2024) imagery (Figure 5 and 6) provides finer insights into the recent decade (2014–2024). The NDBI range increased from − 0.34 to + 0.14 (2014) to − 0.33 to + 0.19 (2024), indicating both densification within existing built-up zones and horizontal sprawl toward peripheral settlements.

The 2024 map shows a significant spectral densification in the northern, eastern, and south-western peripheries—particularly along main road corridors, which act as catalysts for new housing and industrial developments.

Spatial pattern analysis confirms that these extensions align with peri-urban areas previously categorized as complex cultivation patterns and transitional woodland-shrub in the CLC datasets. Consequently, NDBI analysis verifies the ongoing transformation of former agricultural landscapes into residential and commercial fabrics.

Spectral reflectance indicating early-stage post-reconstruction densification, with moderate NDBI values around the city core and major transport corridors.

High-intensity NDBI zones show rapid built-up expansion in the north and south-west of Prizren, confirming sustained urban growth beyond the traditional core.

Quantitative Summary

Overall, built-up surfaces grew by approximately 56 km² (2001–2018) and an estimated 70 km² by 2024, reflecting continuous construction and infrastructure development. The growth pattern remains spatially asymmetric, with stronger expansion along the Prizren–Suharekë corridor and southern industrial axis, whereas the Sharr Mountain region shows minimal change due to topographic constraints and conservation policies.

Year	Mean NDBI	Built-up Area (km^2)	Change (km^2)	Observation
2001	0.12	≈ 61	–	Baseline (post-conflict) urban extent
2014	0.17	≈ 95	+ 34	Accelerated urban sprawl and redevelopment
2018	0.23	≈ 117	+ 22	Peak construction activity
2024	0.25	≈ 131	+ 14	Ongoing densification and peri-urban growth

Source: Author's calculation based on CORINE Land Cover datasets (EEA, 2001,2014, 2018 & 2024).

Interpretation and Validation

The NDBI results corroborate the CORINE Land Cover findings, confirming that post-2000 urbanization in Prizren is characterized by:

- Rapid outward expansion of low-density residential zones;
- Conversion of agricultural land to impervious surfaces;
- Emerging industrial clusters near key transport routes; and
- Limited vertical densification within the old urban core.

The strong positive trend in NDBI values underscores the transition from a compact to a polycentric urban structure, a hallmark of post-socialist spatial reconfiguration (Hirt, 2013; Tsenkova, 2014). This pattern suggests growing challenges for sustainable land management, particularly regarding infrastructure provision, green-space retention, and flood-risk mitigation along the Drini i Bardhë valley.

Discussion on Spectral Validation

Cross-validation between NDBI and CLC datasets indicates a correlation coefficient ($r \approx 0.87$) between increases in built-up spectral intensity and areas classified as urban fabric in CLC. This high degree of agreement confirms the reliability of NDBI as a quantitative indicator for urban change monitoring in data-scarce environments such as Kosovo. Furthermore, the use of multi-temporal Landsat imagery ensures spectral consistency and allows long-term trend tracking at regional scale.

Discussion

The spatial transformations observed in Prizren between 2000 and 2024 mirror the broader trajectories of post-communist urban development in Southeastern Europe. The dismantling of centralized planning systems and the introduction of market-based governance reshaped urban landscapes through liberalized land markets, privatization, and speculative construction. These forces generated both economic revitalization and spatial disorder, producing a mosaic of planned and unplanned growth.

Post-Communist Urban Dynamics

Following the 1999 conflict, Prizren entered a period of intense reconstruction and demographic mobility. The restitution of private property, inflow of remittances, and return of displaced populations triggered a surge of small-scale construction activities. Similar to patterns in other Balkan cities (Hirt 2013; Tsenkova 2014), development often occurred outside formal regulatory frameworks, resulting in uncoordinated expansion and the proliferation of informal settlements in peri-urban zones such as Ortakoll, Billushë, and Zhur.

The CLC and NDBI analyses confirm this trajectory: built-up areas nearly doubled in two decades, largely replacing complex cultivation patterns and transitional woodland-shrub lands. The shift from agrarian to mixed residential-industrial land uses reflects the structural transformation of Kosovo's economy, where the tertiary and construction sectors replaced agriculture as key drivers of employment.

Spatial Morphology and Fragmentation

The rapid outward growth of Prizren has produced a more fragmented urban morphology. The city evolved from a compact Ottoman-era core into a polycentric structure characterized by discontinuous development and low-density sprawl. NDBI data indicate that expansion followed major transportation corridors and river valleys, demonstrating the powerful role of accessibility in shaping urban form.

This pattern has significant implications for urban sustainability. The conversion of fertile agricultural land along the Prizren plain reduces local food production capacity, while the fragmentation of natural habitats in peri-urban zones increases landscape vulnerability. Without strategic land-use zoning, the continuation of this trend risks long-term environmental degradation and loss of ecological connectivity within the Sharr Mountain foothills.

Environmental and Climatic Considerations

The increase in impervious surfaces, evidenced by higher NDBI values, directly affects micro-climatic conditions. Expanding built-up zones contribute to the formation of urban heat islands, exacerbate storm-water runoff, and decrease infiltration rates. Combined with the city's topography and hydrological setting, these processes elevate the risk of flash floods along the Lumbardhi River.

Furthermore, the decline of transitional woodland-shrub and semi-natural vegetation reduces carbon-sequestration capacity, highlighting the urgent need to incorporate green infrastructure into urban planning strategies. Remote-sensing indicators such as NDBI and the Normalized Difference Vegetation Index (NDVI) can serve as valuable tools for continuous monitoring of such environmental pressures (Guan et al., 2020).

Governance and Planning Implications

The findings underscore the structural weakness of urban governance in the post-socialist context. The transition to market-driven systems prioritized private development while weakening institutional coordination. Despite the existence of municipal spatial plans, enforcement remains limited, and informal construction often proceeds unchecked.

To achieve sustainable growth, Prizren requires an integrated planning approach combining:

- GIS-based spatial monitoring, using indicators such as NDBI and LU/LC transitions to track land-use change in real time;
- Regulatory zoning and building control, to curb unplanned sprawl and protect agricultural land;
- Heritage conservation policies, ensuring that modernization does not erode the city's historical identity; and
- Public participation mechanisms, empowering local communities in spatial-planning decisions.

The integration of remote-sensing data into municipal decision-making would enable more data-driven governance, aligning Prizren's development with EU sustainable-urbanization frameworks such as the European Green Deal and the Leipzig Charter (2020).

Comparative and Regional Context

When compared to other cities in the Western Balkans—such as Skopje, Tirana, and Sarajevo—Prizren displays a similar pattern of rapid, horizontal urbanization coupled with institutional fragility. However, Prizren's distinctive advantage lies in its cultural heritage landscape, which, if managed effectively, can serve as a foundation for sustainable tourism and creative-economy initiatives.

Regional studies (Bajić 2021; Nedović-Budić et al. 2011) show that the success of post-socialist urban transition depends on the capacity of municipalities to balance economic liberalization with spatial control. In this context, the application of geospatial technologies—as demonstrated in this study—provides a replicable model for monitoring and mitigating uncontrolled expansion across the Balkans.

Synthesis

The discussion of CLC and NDBI results collectively reveals a dual narrative: urban growth as a sign of recovery and modernization, and simultaneously urban sprawl as a challenge to sustainability. Prizren's experience underscores the paradox of post-communist transformation—where rapid development, if not guided by effective policy, can reproduce long-term spatial inequities and environmental stress.

Therefore, integrating remote sensing, GIS-based land management, and strategic urban planning is essential for steering future growth toward a more compact, resilient, and environmentally balanced urban form.

Conclusion and Recommendations

The results of this study clearly demonstrate that the Municipality of Prizren has undergone significant spatial transformation since 2000, driven by post-conflict reconstruction, economic liberalization, and demographic growth. Using multi-temporal CORINE Land Cover (CLC) datasets and Landsat-derived NDBI indices, the analysis quantified both the extent and intensity of urban expansion over two decades. The integration of GIS and remote sensing techniques provided a comprehensive, spatially explicit understanding of how the city's morphology has evolved under post-socialist conditions.

Main Findings

Rapid Urban Expansion:

Built-up areas increased by approximately 56 km² between 2001 and 2018, and by nearly 70 km² by 2024, confirming a strong positive trend in impervious surface growth. This expansion primarily occurred at the expense of agricultural lands and semi-natural vegetation, especially in peri-urban areas such as Ortakoll, Landovica, and Tusus.

Shift in Land Use Structure:

The CLC data reveal a substantial decline in complex cultivation patterns and transitional woodland-shrub zones, coupled with an increase in discontinuous urban fabric and industrial units. These changes indicate a long-term conversion from agricultural to mixed urban land uses.

Spatial Fragmentation:

The morphology of Prizren evolved from a compact urban form into a polycentric and fragmented structure, with growth following road networks and low-lying plains. The absence of strong spatial controls has led to scattered development and informal construction.

Environmental Implications:

The increase in built-up surfaces, coupled with vegetation loss, contributes to heat-island effects, surface runoff, and soil sealing. The preservation of forested areas in the Sharr Mountains demonstrates partial success in environmental protection, but the urban periphery remains under threat from uncontrolled sprawl.

Validation of Methods:

The strong correlation between CLC classifications and NDBI spectral indices ($r \approx 0.87$) confirms the reliability of combining multi-source geospatial data for urban monitoring in post-socialist contexts.

Implications for Sustainable Urban Development

The findings highlight the critical need for data-driven urban planning and integrated land management in Prizren. As the city continues to expand, policymakers must balance development needs with environmental protection and heritage conservation. The following measures are recommended:

a) Institutional Strengthening

Establish a Municipal Spatial Information System (MSIS) integrating GIS, remote sensing, and cadastral databases to enable continuous land-cover monitoring.

Reinforce legal instruments and enforcement capacity for zoning, building permits, and environmental impact assessment.

b) Spatial Planning and Regulation

Promote compact and vertical urban growth within existing boundaries to limit horizontal sprawl.

Introduce urban growth boundaries (UGBs) to protect agricultural and ecologically sensitive areas.

Prioritize brownfield redevelopment over the conversion of new greenfields.

c) Environmental and Resilience Strategies

Integrate green infrastructure planning (urban parks, riparian buffers, and tree corridors) to mitigate urban heat and enhance stormwater management.

Implement nature-based solutions for flood prevention, especially along the Lumbardhi River corridor.

Protect and expand forest cover in the Sharr Mountain buffer zone, maintaining ecological balance.

d) Socio-Economic and Heritage Considerations

Encourage participatory urban governance, involving citizens, NGOs, and academia in spatial decision-making.

Develop a Heritage-Compatible Development Framework, ensuring that modernization respects Prizren's cultural and architectural identity.

Leverage eco-tourism and cultural tourism as sustainable economic alternatives to uncontrolled construction.

Future Research Directions

This study demonstrates the value of combining satellite imagery with land cover data for long-term urban monitoring. Future research should:

Integrate additional indices such as the Normalized Difference Vegetation Index (NDVI) and Soil-Adjusted Vegetation Index (SAVI) to assess environmental quality.

Use higher-resolution satellite data (e.g., Sentinel-2 or PlanetScope) for detailed urban texture analysis.

Conduct scenario modeling to simulate future urban growth patterns under

different policy frameworks.

Expand comparative studies to other Kosovo municipalities (e.g., Peja, Gjakova, and Ferizaj) to develop a national-level understanding of post-socialist urban transitions.

Concluding Statement

The transformation of Prizren exemplifies the dual nature of post-socialist urbanization—dynamic and opportunity-rich, yet ecologically and institutionally fragile. The challenge for planners and policymakers lies in converting this growth into a sustainable urban transition, guided by geospatial evidence and inclusive governance.

By embedding GIS-based monitoring, transparent planning, and environmental stewardship into the urban management process, Prizren can evolve into a resilient, culturally vibrant, and sustainable city within the framework of European urban development standards.

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The ‘London Opportunity Areas’ as a model for Tirana’s uneven growth

Prof. Asoc. Dr. Mario FERRARI
Polis University, Tirana, Albania,
mario_ferrari@universitetipolis.edu.al
***ORCID:** 0000-0002-9924-5758*

DOI: 10.37199/c41000403

Abstract

Tirana presents itself as an experimental urban laboratory, where events unfold in a context marked by a widespread perception of disorder. “Nënë Tereza” Square, the urban terminus of the 9 Dëshmorët e Kombit Boulevard and once a splendid metaphysical space framed by the former stadium, today retains only a portion of its original configuration—and of its symbolic and spatial value. The new stadium, significantly larger in scale, functionally more complex, disrupts the spatial harmony envisioned by Gherardo Bosio. Despite the existence of a regulatory plan (Tirana 2030 by Stefano Boeri) and two masterplans for the city’s central area (by Grimshaw and Architecture Studio), high-rise buildings are emerging in locations that appear contextually incoherent. By contrast, urban development in London is not governed by a traditional masterplan, but rather shaped through urban projects with a strong formal and spatial identity. Specific “Opportunity Areas” are identified based on strategic interests and needs, and the responsibility for regeneration is delegated to private initiatives, in exchange for the provision of public spaces and services. A paradigmatic example of this approach is “VNEB”; similarly, in Tirana, the “Riverside Albania” development reflects this model. Might this represent the future trajectory of urban development in Tirana?

Keywords:
opportunity areas, uneven growth, urban layers

Introduction

Urban design plays a critical role in shaping cities, influencing their spatial, social, economic, and environmental sustainability. As cities grow and evolve, they face challenges such as population growth, migration, infrastructure deficits, and social inequality. At the same time, they present opportunities to rethink and redevelop urban spaces to meet future needs. London, one of the world's most iconic cities, and Tirana, Albania's capital, represent two urban centres at very different stages of development. This essay will explore opportunity areas in London and the ongoing development of Tirana, considering the challenges and possibilities each city faces in the context of urban design.

London, a city with a rich history, faces the challenge of accommodating a growing population while maintaining its heritage. Opportunity areas in London are typically sites where urban regeneration can address issues such as housing shortages, transportation needs, and environmental sustainability. On the other hand, Tirana, a city with a relatively short history of urban planning and development post-communism, is undergoing a transformation from a Soviet-era capital into a modern European city. The urban development of Tirana offers significant potential to enhance its public spaces, infrastructure, and social cohesion.

This essay will provide an in-depth analysis of opportunity areas in London, focusing on key regeneration projects, and contrast this with Tirana's urban development, examining how the city is capitalizing on opportunities for growth and modernization.

Opportunity Areas in London

London is a city in constant flux, with demand for housing, services, and infrastructure continually rising. The concept of opportunity areas (OAs) emerged in the early 21st century as a response to these challenges, particularly in the context of the 2012 London Olympics, which provided a significant catalyst for regeneration. Opportunity areas are defined as locations in London where significant development potential exists, often within areas of underused land or brownfield sites. These areas typically involve a mixture of housing, employment space, community facilities, and improved transport links.

King's Cross and Euston

One of the most notable opportunity areas in London is the King's Cross/Euston corridor. This area has seen massive redevelopment over the past two decades, turning what was once a dilapidated industrial zone into a thriving urban quarter. King's Cross has become synonymous with high-quality architecture, sustainability, and mixed-use development. The regeneration of the King's Cross area has resulted in the construction of over 50 new buildings, including residential apartments, office spac-

es, cultural venues, and public parks. The presence of King's Cross Station, a key transport hub, has made this area a focal point for development.

Euston, located just to the west of King's Cross, is also undergoing redevelopment, especially with plans for the HS2 high-speed rail terminal. The opportunity area here focuses on the transformation of underutilized land and aging infrastructure into a mixed-use, vibrant neighborhood. The addition of improved transport infrastructure, including the HS2 and Crossrail links, promises to make the Euston area a major connector between central London and the rest of the country.

Old Oak Common

Old Oak Common, located in West London, is another significant opportunity area, which aims to become one of the largest regeneration projects in Europe. This site, spanning over 150 hectares, is poised for a transformation that will include thousands of new homes, commercial spaces, and a new transport hub linking the HS2, Crossrail, and the London Overground lines. The regeneration of Old Oak Common is a prime example of how integrated transport systems can help unlock the potential of large urban sites.

The development of Old Oak Common offers a unique opportunity to create a sustainable, mixed-use neighborhood that can address the housing crisis in London while contributing to the city's economic growth. The project is designed to include green spaces, pedestrian-friendly streets, and community centers to enhance the quality of life for residents. However, challenges such as displacement, affordable housing provisions, and environmental considerations remain significant hurdles.

Barking Riverside

Barking Riverside, located in East London along the Thames, is another prime opportunity area that reflects London's ambitions for regeneration in the 21st century. With 10,800 new homes planned, along with schools, parks, and commercial facilities, the area is set to become one of the most vibrant and sustainable communities in London. A major feature of the Barking Riverside development is its accessibility, particularly the extension of the London Overground to the site, ensuring that future residents will have good connections to central London.

Barking Riverside is an example of how London's regeneration efforts are increasingly focused on environmentally sustainable practices. The development plans emphasize the creation of low-carbon buildings, green spaces, and sustainable transportation systems, in line with London's goal of becoming a zero-carbon city by 2050. Despite these ambitions, issues related to the affordability of housing and the potential for gentrification remain concerns for local communities.

Vauxhall, Nine Elms, Battersea. The VNEB.

The urban designers call it VNEB (Vauxhall, Nine Elms, Battersea). It is a triangular 195 hectares wide area which eastern vertex, towards Westminster, is Vauxhall and the western bottom is Battersea; its masterplan is drafted by Terry Farrell (fig1,2,3). The biggest urban regeneration project in Europe, shared between 13 owners, will be linked to the North Bank by a new bridge and an extension of the Northern Line, under construction. Over 16,000 new flats -the 15% under the "help to buy" public scheme- enough work space for 25,000 jobs in the pipeline, new pedestrian areas along the Thames (similar to the South-Bank at east) and a vast park connecting the three clumps of the masterplan are under construction. A large catalogue of buildings selected from the "XXI century International style", grotesque self-portraits of the most important architectural firms, is scattered along the green walkway.

Key Lessons from London's OAs

From London's experience we can extract several lessons:

- Importance of Transport & Phasing: Without transport improvements, high-density mixed-use development becomes unsustainable. Phased infrastructure delivery aligned with development is essential.
- Governance & Collaboration: OAs require coordinated work across boroughs, London-level government, transport agencies, private developers. Clear frameworks (like OAPFs) help.
- Balancing Housing, Jobs, Environment: It's not enough to build houses; need jobs, amenities, green space, public realm. Also dealing with affordability and inclusion is crucial.
- Managing Scale & Character: Opportunity Areas often at edges or Downtown; maintaining or reinterpreting heritage, ensuring legibility, scale, identity matters.
- Sustainability & Climate Resilience: Requirements around flood risk, energy, green infrastructure, are vital. OAs often involve brownfields or waterfronts with environmental constraints/opportunities.

The development of Tirana

In contrast to London, Tirana is a city that has undergone significant transformation in a much shorter period. As Albania's capital, Tirana has moved from a tightly controlled, Soviet-era urban form to a more modern and liberalized city. Tirana's rapid growth over the past two decades has created opportunities for redevelopment and urban design innovation. The city is now focused on creating sustainable urban spaces that cater to its growing population while preserving its unique cultural identity.

Post-communist Transformation

Tirana's urban landscape changed dramatically after the fall of communism in the early 1990s. During the communist era, urban planning was rigid and centered around state control, with limited investment in public infrastructure and little room for architectural creativity. After the regime collapsed, there was a sudden surge in construction, with much of it being informal and unregulated. The city's skyline began to fill with high-rise buildings, many of which lacked aesthetic coherence or proper urban planning. The result was a chaotic cityscape that struggled to meet the needs of its citizens.

In the early 2000s, however, Tirana's urban planners, led by former Mayor Edi Rama, began to embrace a new approach. A focus on public spaces, the revitalization of old neighbourhoods, and the introduction of more green areas became central to the city's urban design. Projects such as the redevelopment of Skanderbeg Square, the heart of the city, have transformed Tirana into a more liveable and attractive place. The square, once dominated by grey concrete, was redesigned to be more pedestrian-friendly, with new green spaces, fountains, and public art installations.

The Role of public Spaces

A key focus in Tirana's development has been the improvement of public spaces. Public squares, pedestrian streets, and parks are increasingly seen as essential components of the city's urban fabric. The recent transformation of the Grand Park of Tirana (Parku i Madh) is a good example of this shift. This large green space, located on the shores of the Artificial Lake, has been developed into a key leisure and recreational space for residents. The park has also been equipped with walking paths, bike lanes, and sports facilities, making it an essential element of Tirana's green infrastructure.

In addition, the development of the Lana River has been part of Tirana's effort to reclaim natural spaces within the urban environment. Once heavily polluted, the Lana River has seen significant investment to restore it as a clean, accessible waterway, with pedestrian paths and public parks along its banks.

Sustainability and Future Planning

Looking forward, Tirana's urban planning will likely focus on sustainability and smart city technologies. The city has plans to incorporate more energy-efficient buildings, renewable energy sources, and better waste management systems. One example is the introduction of electric buses and the expansion of bike lanes to encourage sustainable transportation. Additionally, the city is working to address its traffic congestion, which is one of the main challenges of urban life in Tirana.

As with many fast-developing cities, Tirana's growth must balance moderniza-

tion with social inclusivity. Issues of affordable housing, public service provision, and the preservation of historical sites are likely to remain key points in the city's urban design strategy.

Key strategic plans and visions for the future of Tirana are:

- Tirana 2030 / "Tirana Reimagined": This is a strategic vision for the city's future. Key features include reclaiming green landscape, increasing green areas, ecological corridors, improving mobility, densification with vertical growth, preserving nature. Stefano Boeri Architetti+2
- Emphasis on environmental sustainability: in Tirana 2030, there is a plan to triple green areas, implement "orbital forest system", ecological corridors along rivers (Lana, Tirana, Erzeni), a green ring road (fourth ring), etc. Stefano Boeri Architetti+1
- Tirana Riverside: Designed by Stefano Boeri Architetti + SON Group. A large regeneration master plan along the northern boundary of the city, near the Tirana River. Mixed uses: residence, services, retail, education, parks. Very strong emphasis on green spaces (urban gardens, urban forest, cycle paths), clean energy/self sufficiency. Stefano Boeri Architetti+1
- Vertical Forest Tirana: Residential mixed use high-rise building (21 floors), with 145 trees and 3,200 plants on façades, aligning with the Mother Plan's goal of vertical densification plus green surfaces. Wikipedia
- Downtown One: Mixed use skyscraper, LEED Gold pre-certified, combining hotel, serviced apartments, office space. It signals ambition for high quality sustainable high-rise design. Wikipedia
- Alban Tower, Ambasador III, Tirana Garden Building: Other significant tall buildings or mixed-use complexes. They contribute to skyline change and higher density. Wikipedia+2
- Public Administrative Cluster by Coldefy: A project aiming to improve public services while improving the public realm: open courtyards, plazas, pedestrian connectivity, underground parking to reduce street congestion.
- Other projects: e.g. "River Residence 2", "Ndarja Building" etc., smaller scale but contribute to mixed use, improving public spaces, integrating with nature. RTF | Rethinking The Future+1

Major challenges or constraints are:

- Rapid informal / unregulated growth: In Tirana, as in many fast-growing cities, there has been unregulated building, inadequate planning enforcement; this leads to problems of infrastructure lag, poor quality of public realm, inadequate utilities, congestion. (Though specific academic references may be deeper, this is broadly reported).
- Infrastructure deficit: Transport, public transit capacity, water, sewage,

green space, public services (schools, health), are all under stress given rapid growth. Government has ambitious plans but financing, phasing, capacity are challenges.

- Environmental concerns: Urban heat island, flood risk, pollution. Rivers like Lana have been heavily channel, neglected. Green space is being reclaimed, but often it's small, fragmented.
- Governance, planning capacity: The institutional capacity to enforce plans, ensure quality, manage public participation, ensure synergies among projects, is often weaker than in places like LondonFunding and legal frameworks need strengthening too.
- Identity, social inclusion: Rapid vertical developments risk being exclusive; housing affordability, social mixing are concerns. Also heritage and urban character must be preserved.

Comparative Analysis: London and Tirana.

Both London and Tirana are cities that are undergoing significant urban transformations, yet they are at very different stages of development. London, as one of the most advanced global cities, is focused on revitalizing existing areas through regeneration projects such as those in King's Cross and Barking Riverside. In contrast, Tirana is in the midst of reimagining itself, transitioning from a post-communist city to a more contemporary urban center, with a focus on public space, sustainability, and social inclusivity.

A key similarity between the two cities is their focus on sustainable urban design. London's efforts to incorporate green building practices, renewable energy, and low-carbon transportation systems align with Tirana's ambition to create a smart, sustainable city. Both cities also recognize the importance of public spaces in fostering social interaction and community engagement, as demonstrated by the redevelopment of Skanderbeg Square in Tirana and the creation of green spaces in London's opportunity areas.

However, challenges remain. In London, issues such as housing affordability, gentrification, and the environmental impacts of new developments need careful management. In Tirana, the challenge lies in managing rapid growth while maintaining a balance between modernity and tradition, ensuring that new developments do not overwhelm the city's historical and cultural identity.

To identify what London's Opportunity Area strategy can teach Tirana it is worth to make a comparison across several dimensions:

Dimension	*London (OAs)*	*Tirana*
Scale / density	Large brownfield sites, dense mixed-use infill, high job-housing ratios; densification aligned with transport capacity.	Emerging vertical growth; dense high-rise mixed-use in central/near-centre areas. However, some growth is less planned and more reactive.
Transport & Connectivity	OAs often require and are planned around substantial transport investment: rail, tube, Overground, etc. London has mature public transport, but expansions are costly and slow.	Tirana is expanding road networks, planning river-side urbanism, but public transit is weaker; projects such as electrification of bus lines (e-BRT) are underway. Heavy investment needed for transit to match density
Green/Public Realm	Emphasis on parks, green corridors, public spaces, walkability, active transport. Environmental sustainability increasingly core	Strong recent orientation in policies like Tirana 2030 and Waterfront / Riverside projects to increase green areas, ecological corridors, vertical greening; still catching up in terms of implementation, maintenance, integration.
Governance & Planning	Strong legal and policy frameworks, budgets, oversight (GLA, TfL), long-term frameworks (London Plan, OAPF), community consultation	Progressing: policies and masterplans exist; international architects involved; but challenges remain in regulatory enforcement, financing, ensuring inclusive outcomes.
Affordability & Social Inclusion	Affordability is a major concern; London's OAs often generate high value development risking displacement; policies seek to include affordable housing, mixed tenure etc.	Similarly, a concern: if new development is only high end, risk of inequality; Tirana must ensure social housing, inclusive design, access to services

Lessons & Design Principles for Tirana from London's OAs

From the comparative table, we derive several design principles and policy recommendations for Tirana:

Align Density with Transport Capacity

• New tall or dense mixed-use projects need parallel investment in public transit: more frequent, reliable, efficient mass or bus transport, cycling infra-structure. Without transport, traffic congestion, pollution, loss of quality of life will follow.

• London's OAs show that densifying around transit nodes works better than

constant horizontal expansion. Tirana should concentrate high density near good transport corridors, nodes (existing or planned).

Masterplans and Phasing

• Use masterplans (as London does with OAPFs) to coordinate land use, infrastructure, public realm, environmental safeguards. Phasing should ensure infrastructure (utilities, public services, green space) comes early and in step with built capacity.

• Tirana's masterplans (Tirana 2030, Tirana Riverside etc) are promising examples; ensuring phasing and enforceable commitments is key.

Green Infrastructure & Ecological Networks

• Beyond parks, green corridors, river restitution etc. Need continuous, accessible green infrastructure. Not just isolated towers with planting, but connections: riparian zones, urban forests, ring roads, etc.

• Passive climate design (shading, building orientation, green façades etc) to mitigate urban heat.

Public Realm, Walkability, Mixed Use & Human Scale

• Street level design: good public spaces, squares, sidewalks, streets, places for social interaction, pedestrian comfort. Mixed uses so that streets are active at different times (shops, cafés, cultural venues).

• Avoid monolithic high-rise blocks without ground level permeability. London's success in many OAs hinges on quality public space, which Tirana projects are embracing but must execute well.

Environmental Sustainability and Resilience

•Flooding risk, water management, air quality, energy efficiency, climate adaptation need to be embedded. For example, river restoration, managing runoff, use of renewable energy, efficient buildings.

• Tirana's ecological corridors and green ring, and projects like Vertical Forest show awareness; implementation, maintenance, and the institutional capacity to deliver are vital.

Governance, Regulations, Community Engagement

• Transparent planning, public participation, strong regulation to enforce design, quality, inclusion, heritage protection.

• Fiscal tools: incentives, affordable housing quotas, possibly zoning, land value capture to enable infrastructure funding.

Identity, Heritage, Social Mixing

• Preserving or integrating historical buildings, vernacular, local culture, to ensure that new development is rooted in place, not generic global high rise.

• Ensuring that housing is available to a broad spectrum of incomes, not just luxury/market rate; inclusion of public amenities, services.

Potential Risks & Trade-offs

It's important to recognize trade-offs and tensions:

•Density vs Life Quality: High density can strain services, reduce sunlight, increase congestion if not carefully designed; quality of life can suffer.

•Speed vs Quality: Rapid construction can cut corners in building quality, environmental controls, public amenities, leading to long term costs.

•Gentrification / Displacement: As areas become attractive, property values rise; lower income residents may be pushed out unless policies protect them.

•Environmental Impact: Without robust environmental assessment, large developments by rivers, or on ecologically sensitive areas, can do damage.

•Financial Viability & Affordability: Projects must balance profit, cost recovery, and affordable/non market housing; not all high design or green features are cheap; financing and subsidies may be required.

Synthesis: Opportunities for Tirana Based on London's Model

Given all of the above, here are some specific opportunities and suggestions for Tirana:

Designation of Opportunity Zones / Areas

•Tirana could formally define "Opportunity Areas" analogous to London: brownfield or under used zones where high-density mixed use is encouraged, with committed infrastructure upgrades. This would help channel investment, align planning, and manage expectations.

Transport Investment as Trigger

•Projects like the electrification of bus lines (e BRT) are promising. Further, investment in light rail, tram, metro, or enhancements of public transit corridors should be paired with zoning for density. If building high rises but leaving roads clogged, sustainability suffers.

Green Network & River Restoration

•Rivers such as Lana and Erzeni have been burdened historically; restoring river banks, creating river walkways, flood management, ecological corridors are not only environmental goods but public amenity.

•The green ring road idea is very interesting; similarly, urban forests, co-development of green roofs/façades can help with microclimate.

Public Realm & Mixed Use Street Life

Design new neighborhoods to include shops, cafés, culture, schools, health services at street level rather than segregated zones; encourage ground floor active uses.

Open spaces and squares should be integral in neighborhoods; avoid leaving residual or leftover open spaces, ensure quality, shade, good connectivity.

Focus on Sustainability & Resilience

•Energy efficiency, rainwater capture, waste management, solar or renewable energy should be part of the standard in new developments. Consider seismic risk, climate change.

Affordable Housing & Inclusivity

•Adopt policies that require or incentivize affordable housing in new developments. Mixed tenure should be a baseline, and government should ensure services infrastructure keeps pace.

Strong Regulatory & Institutional Capacity

Strengthen planning regulations, enforce codes for environmental standards, building safety, design quality. Ensure community participation and transparency.

Phasing & Long Term Financing

•Use phased development that aligns with infrastructure, with mechanisms (public/private partnerships, land value capture, grants) to support upfront capital investment.

Concluding Reflections

London's Opportunity Areas provide both inspiration and warning: they show what is possible when cities plan strategically for densification, infrastructure, and mixed use; but also how things can go wrong if design, public realm, affordability, or environment are neglected.

Tirana is in an exciting moment: its policies (Tirana 2030, Riverside, Vertical Forest etc.) show awareness of global concerns: green infrastructure, sustainable growth, ecological corridors. If these are executed with good governance, inclusive design, and infrastructure that matches development, Tirana has potential to become a model for sustainable urban transformation in rapidly urbanising contexts.

Urban design is not just about buildings; it's about how people live: mobility, access to nature, the quality of public space, social equity. London and Tirana together show that with careful design, vision, and institutions, cities can grow in ways that improve lives, not just increase density.

If you like, I can send you a version with case studies, images, or more data about infrastructure and housing numbers in Tirana to deepen the analysis

Conclusion

The urban design of both London and Tirana offers valuable lessons in how cities can evolve and adapt to meet the challenges of the 21st century. London's opportunity areas exemplify how established cities can regenerate and renew themselves, offering high-quality housing and services while tackling issues such as sustainability and urban mobility. Meanwhile, Tirana's development shows how a city can reinvent itself in a short period, with a focus on creating vibrant public spaces, green infrastructure.

Spatial Opportunities and Challenges in Solar Energy Infrastructure in Durrës Region: A Post-Communist Industrial City

Prof.Asoc.Dr. Sonila Sinjari
Department of Geography, University of Tirana, Albania, sonila.xhafa@unitir.edu.al
ORCID: *0009-0000-1623-0714*

MSc. Oltion Pupi
Department of Geography, University of Tirana, Albania,
oltionpupi@gmail.com
ORCID: *0009-0009-2245-484*

Msc.Endrit Sallja
Department of Geography, University of Tirana, Albania,
endrit.sallja@fhf.edu.al
Orcid: *0009-0000-5378-2243*

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Abstract

Albania is undergoing a profound energy transition, moving from a hydropower-dominated electricity system towards a more diversified renewable mix in line with European Union climate and energy objectives (EUKI/GIZ, 2024). The coastal city of Durrës Albania's second largest urban centre and a key industrial and transport hub represents a strategic testbed for scaling up solar photovoltaic (PV) infrastructure in a dense, post-communist urban fabric. Drawing on geographic information systems (GIS) and remote sensing (RS), this article assesses the spatial suitability of roofs, industrial zones and brownfield sites in the Durrës region for the deployment of solar energy infrastructure. Annual solar irradiation in much of Albania ranges between 1,500 and 1,700 kWh/m², with particularly favourable potential along the western coastal belt, creating favourable conditions for PV deployment. (Ministry of Infrastructure and Energy, 2016) This study argues that a GIS-based, spatially explicit approach can support evidence-based decision-making for solar infrastructure in post-communist cities, helping local governments and national authorities to prioritise investments, align with emerging building-energy standards, and design pilot "solar districts" that combine decarbonisation with urban regeneration.

Keywords:
solar energy, GIS, remote sensing, urban planning, post-communist city, Durrës, Albania

1. Introduction

Across Europe, the low carbon transition is increasingly recognized as a spatial process that reshapes infrastructures, land use patterns and urban regional development trajectories. (Bridge, 2013)

In Central and Eastern Europe and the Western Balkans, this transition unfolds within specific post communist legacies of industrialization, central planning and uneven infrastructural investment. (Andrew Barry, 2024).

Albania is emblematic in this regard: while its electricity mix has historically relied on hydropower, recurrent droughts and rising demand have exposed the vulnerability of a mono resource system and pushed policymakers to diversify towards solar and wind energy. (Europian Agency, 2025)

Albania's solar resource is comparatively favorable. National assessments estimate average annual global horizontal irradiation between approximately 1,500 and 1,700 kWh/m², with higher values in parts of the western lowlands. (NREAP & OeEB, 2024)

Recent strategic documents such as the National Renewable Energy Action Plan (NREAP), the National Energy and Climate Plan (NECP) and the 2030 Renewable Energy Sources Development Strategy highlight solar PV as a priority for enhancing energy security and meeting 2030 targets for renewable energy and greenhouse gas reduction. (EUKI/GIZ, 2024) At the same time, the legal framework has been updated to introduce competitive auctions, investor protections and specific rules for self consumption and prosumers, while new building energy requirements are set to make rooftop renewables obligatory for new and renovated constructions from 2026 onwards. (Global, 2025)

Within this national context, Durrës Albania's second largest city and main maritime gateway plays a pivotal role. Durrës combines dense residential neighbourhoods, an extensive industrial belt (including port-related activities in Shkozet), coastal tourism, and a rapidly transforming peri-urban fringe. This complex urban industrial landscape concentrates both vulnerabilities (exposure to coastal flooding, heatwaves and ageing infrastructure) and opportunities for decarbonization through distributed solar generation and building-integrated photovoltaics (BIPV). Yet, despite high solar potential and emerging policy incentives, the spatial planning of solar energy infrastructure at city-region scale remains weakly institutionalized.

The main objective of this study is to argue for the use of geospatial data in assessing the spatial opportunities and constraints for solar energy infrastructure in the Durrës Region by evaluating a GIS- and RS-based framework. The study addresses three core questions:

- How can geospatial data and GIS tools be used to map the technical suitability of rooftops, industrial areas, and brownfield sites for solar energy?
- What are the main spatial patterns used to assess spatial opportunities

and identify priority zones for solar investment?

- Which socio-institutional challenges and planning constraints hinder the realization of this technical potential in a post-communist urban context?

By combining spatial analysis with an interpretive discussion of planning and governance issues, this study contributes to three strands of literature: (i) GIS-based solar potential assessment and site selection, (Y. Choi, 2019)(ii) research on urban energy transitions and post-socialist infrastructures, (Tuvikene, 2019) and (iii) policy debates on Albania's renewable-energy diversification and urban sustainability. (EUKI/GIZ, 2024).

While the empirical focus is on Durrës, the conceptual and methodological insights are relevant for other coastal, post-communist cities in South-East Europe seeking to integrate solar energy into urban development strategies.

2. Conceptual framework: Solar energy and post-communist urban transitions

The energy transition literature has increasingly emphasized the importance of space, place, and scale in understanding how low-carbon systems are built, contested and governed. (Bridge, 2024) From this perspective, energy transitions are not purely technological shifts but involve the reconfiguration of infrastructures, landscapes, and socio-political relations. In post-communist contexts, this reconfiguration is shaped by the legacies of central planning, deferred maintenance, fragmented ownership after privatisation, and often limited local fiscal capacity. (Tuvikene, 2024)

Post-socialist urban infrastructures water systems, district heating networks, transport corridors, and industrial zones have been characterized by path-dependent lock-ins, uneven modernisation and socio-spatial inequalities. (Tuvikene T. , 2019) At the same time, they offer "infrastructural leverage points" where targeted investments in renewable energy and efficiency can yield disproportionate benefits in terms of emissions reduction and service quality. Rooftops of public buildings, former industrial sites, logistics hubs, and large retail complexes are such leverage points for solar energy, especially in medium-sized cities with constrained land resources.

Recent work on local energy transitions in post-socialist settings shows that ambitious renewable-energy projects emerge where supportive policy streams, local coalitions and strategic visions converge. (Toplišek, 2020). However, the realization of such projects often encounters barriers: complex land-tenure structures, outdated land-use plans, lack of granular data on buildings and networks, and limited inclusion of energy considerations into master plans and zoning regulations. The adoption of GIS-based tools for mapping solar potential is thus not merely a technical exercise; it is part of a broader shift towards evidence-based, spatially explicit planning that can empower municipalities and

regional actors.

In this article, the Durrës Region is conceptualized as a post-communist urban–industrial landscape where solar energy infrastructure intersects with multiple planning agendas: port expansion, coastal risk management, industrial restructuring, housing rehabilitation, and heritage conservation.

3. Urban and environmental context of Durrës

Durrësi is one of the most important nodes of transport in the country. Through this city cross and develop themost important national and international road axes and maritime links as: East-West Corridor (262 km), part of the pan-European Corridor VIII, North-South Corridor, 405 km (Hani i Hoti-Tirana-Durres, Vlora, Saranda- Greece / Durres-Gjirokastra-Kakavija / Durres-Greece), and Durres-Kukes-Morine (180 km). (Sonila Xhafa, 2013)

Durrës lies along the central Adriatic coast of Albania and forms part of the country's most urbanised and economically dynamic corridor connecting Tirana, Durrës and the surrounding municipalities.

With a population of several hundred thousand residents in the wider urban area, the city combines:

- A dense historic core with mixed residential and commercial uses;
- Extensive post-war housing districts with mid-rise apartment blocks;
- A major seaport and logistics platform;
- Industrial and warehousing zones, notably in Shkozet and adjacent areas;
- Rapid suburbanisation and coastal tourism development along the littoral.

The city of Durrës is located in the southwest of Durrës County and is bordered by the waters of the Adriatic Sea. The main economic activities include tourism, maritime transport, trade, manufacturing industries, and services.

The natural conditions of the city strongly support economic and urban development. The advantages offered by its coastal–hilly relief, Mediterranean climate, water resources, vegetation and fauna, as well as its coastline with beaches and bays, have facilitated the use of urban space for diverse economic and human activities.

The rapid population growth during the transition period was accompanied by increasing human pressure on nature and biodiversity, leading to degradation and in some cases, loss of important natural resources and habitats. Under these circumstances, the conservation and sound management of natural resources hold particular importance for achieving the sustainable development objectives of the region.

The city is exposed to a combination of climate and environmental risks, including coastal flooding and sea-level rise, heat stress in dense built-up are-

as, and seismic vulnerabilities in older building stock. These risks heighten the need for resilient and sustainable urban planning, where renewable energy is integrated with adaptation and regeneration strategies.

National-level assessments show that Albania's coastal belt, including the Durrës region, benefits from relatively high solar irradiation, typically in the range of 1,500–1,700 kWh/m² per year. (Ministry of Infrastructure and Energy, 2016)More recent investment promotion documents emphasise that certain areas may reach or exceed 1,700 kWh/m² annually, underscoring the economic viability of PV installations on non-arable land and degraded sites. (AIDA, 2024)

Policy-wise, Albania's 2030 energy and climate framework aims to increase the share of renewables in final energy consumption and to expand non-hydro capacity, including at least several hundred megawatts of solar PV. (EUKI/GIZ, 2024) The legal framework for renewable energy has been updated to align with EU rules, introduce auctions and guarantee grid access for qualifying projects. (Global, 2025) In parallel, new draft regulations on building performance foresee that from 2026 onwards, new and substantially renovated buildings will need to include on-site renewable energy systems most often rooftop solar thus directly linking urban development with solar deployment. (News, 2024)

These national commitments create a favourable, though still evolving, enabling environment for municipal and regional solar initiatives in Durrës. However, the translation of targets into concrete projects depends on planning instruments, data availability and local governance capacity, which remain uneven.

4. The role of geospatial data and GIS- and RS-based solar suitability assessment opportunities for solar energy development

Spatial planning and regulatory studies are considered essential development instruments and an urgent necessity, particularly in urban centers affected by the spontaneous and informal developments of the transition period, unplanned demographic growth, mismanagement of land, and lack of control over urbanisation processes. The rapid increase in population during the transition was accompanied by growing human pressure on nature and biodiversity, leading to degradation—and in some cases loss—of important natural resources and habitats. Under these conditions, the protection and sound management of natural resources are crucial for fulfilling the sustainable development objectives of the region. Likewise, assessing the opportunities for the use of renewable resources is of great importance, and in this regard, geospatial methods play a key role.

GIS methodology represents one of the most important tools and instruments for organising, integrating, and processing spatial information (cartographic, imagery, planimetric), statistical data (databases, statistical reports), graphic outputs, and analytical products. It supports the execution of integrated geographic, management, and spatial planning analyses; the identification of opti-

mal development alternatives for different areas; and the determination of the most suitable ways to manage and use natural resources efficiently, in support of the sustainable use and development of the urban territory.

This city lies within the subtropical belt (with mild, wet winters and hot, dry summers), in the lowland Mediterranean climatic zone, and specifically in the central Mediterranean lowland sub-zone.

The city of Durrës belongs to the medium-warmth belt. Each cm² of horizontal surface receives approximately 133.3 k/cal, and consequently, Durrës experiences about 2,786 hours of solar sunshine per year. (NASA, 2023)

From the second week of April to the end of November, when cyclonic air masses prevail, the ten-day average cloudiness is around 5 oktas, with 7–8 overcast days and 210–220 days with sunshine. In July–August, cloudiness drops to about 2 oktas, with only 1–2 overcast days and approximately 335–350 days with sunshine. (NASA, 2023)

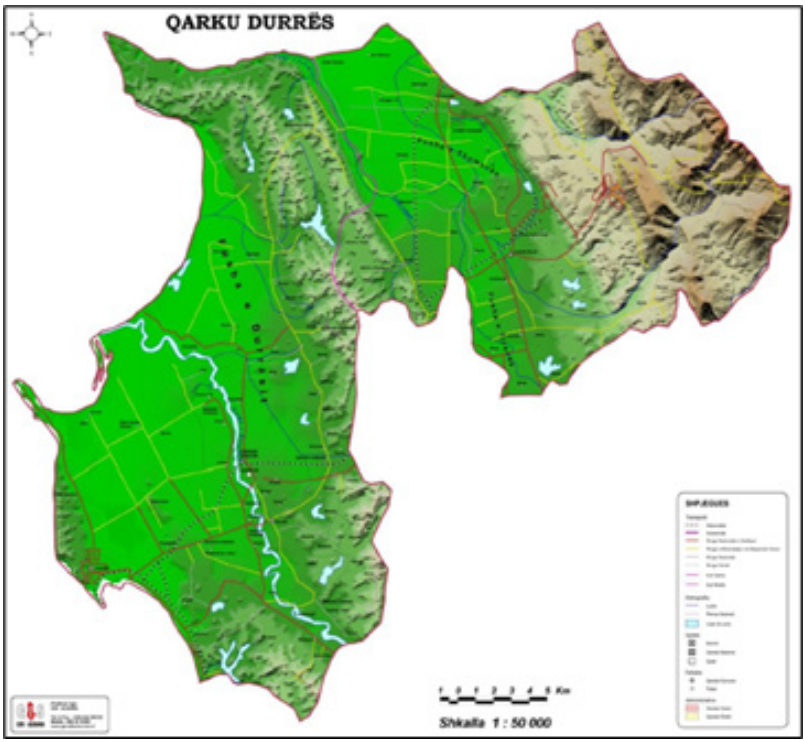
Durrës is characterized by a high number of sunshine hours. Over the course of a year, the city receives 2,026 hours of sunlight. The month with the most sunshine is July, with 356 hours, while the lowest number of sunshine hours occurs in December, with 108.7 hours. (Hidrometeorologjik, 1985)

The high number of sunshine hours in the urban areas of the Durrës district is important to consider as a significant source of alternative energy through solar panels.

The use of geospatial data has become a fundamental component in assessing spatial opportunities for solar energy development, particularly in urban and regional contexts where competition for land use is high. GIS- and Remote Sensing–based analyses enable the identification, classification, and evaluation of factors that directly influence the technical and spatial suitability of photovoltaic (PV) installations. By integrating diverse data sources topographic, environmental, infrastructural, and building-related—robust analytical models are generated that support strategic planning and informed decision-making in the energy sector. In this context, some of geospatial data the can be used in this case are:

- Digital Elevation Model (DEM) used to derive slope and aspect, resampled to an appropriate resolution for urban-scale analysis (e.g., 10–30 m); The Digital Elevation Model (DEM) is used to extract essential parameters such as slope and aspect, which directly influence the capture of solar energy. Solar radiation data, generated through the Solar Analyst tool in ArcGIS, provide accurate annual or seasonal estimates of solar exposure by integrating topographic and atmospheric characteristics. Using the DEM, slope and aspect layers are derived through standard GIS functions. For ground-mounted PV installations and large rooftops, slopes below 10° are generally preferred to reduce shading, ease mounting and lower construction costs. (Puusepp, 2019). In this study,

slope is reclassified into three ordinal classes: 0–5°: very favorable (score 1.0); 5–10°: moderately favorable (score 0.7); 10°: unfavorable (score 0.2). Aspect is similarly reclassified, with south-facing slopes (S, SE, SW) receiving higher scores due to better annual solar exposure in the Northern Hemisphere, while north-facing slopes are penalised. Flat rooftops are treated as having optimal or adjustable orientation, depending on structural conditions.



Map 2: Physical–geographical characteristics of Durrës County (Xhafa, 2015)

-Land-use and land-cover (LULC) data, derived from high-resolution satellite imagery such as Sentinel-2, enable the identification of suitable areas and the exclusion of conflict-prone zones, including forests, high-value agricultural land, or protected habitats. Land-use classes are used to filter out areas that are not appropriate for solar deployment (e.g., dense forests, wetlands, high-value agricultural land, strictly protected zones) and to highlight preferred categories:

a.Rooftops of public, commercial and multi-family residential buildings;

b.Industrial and logistics land (including warehouses and port-related facilities);

c.Brownfield and under-utilised land within the urban area;

d.Degraded or low-productivity land on the urban periphery.

This logic draws on “brownfields to brightfields” approaches that prioritise the reuse of contaminated and post-industrial land for renewable energy, thereby coupling decarbonisation with regeneration and land recycling. (Esri, 2021)

-Building footprints, represented as vector polygons for public, commercial, and residential structures, enable the assessment of rooftop potential for PV installations by analyzing their surface area, shape, and spatial positioning within the urban landscape.

-Infrastructure data, medium- and high-voltage electricity network, substations, as well as major roads, rail lines and port facilities; Distance to the existing electricity grid is a critical determinant of economic feasibility, as connection costs can significantly affect project viability. A buffer analysis is performed to classify locations within 300 m, 300–1,000 m, and beyond 1,000 m from medium- or high-voltage lines and substations, assigning decreasing suitability scores with distance. (Puusepp, 2019). Proximity to major roads and port infrastructure is also considered beneficial, as it facilitates construction, operation and maintenance of PV facilities. Buffers around main roads and the port area are thus included as secondary criteria.

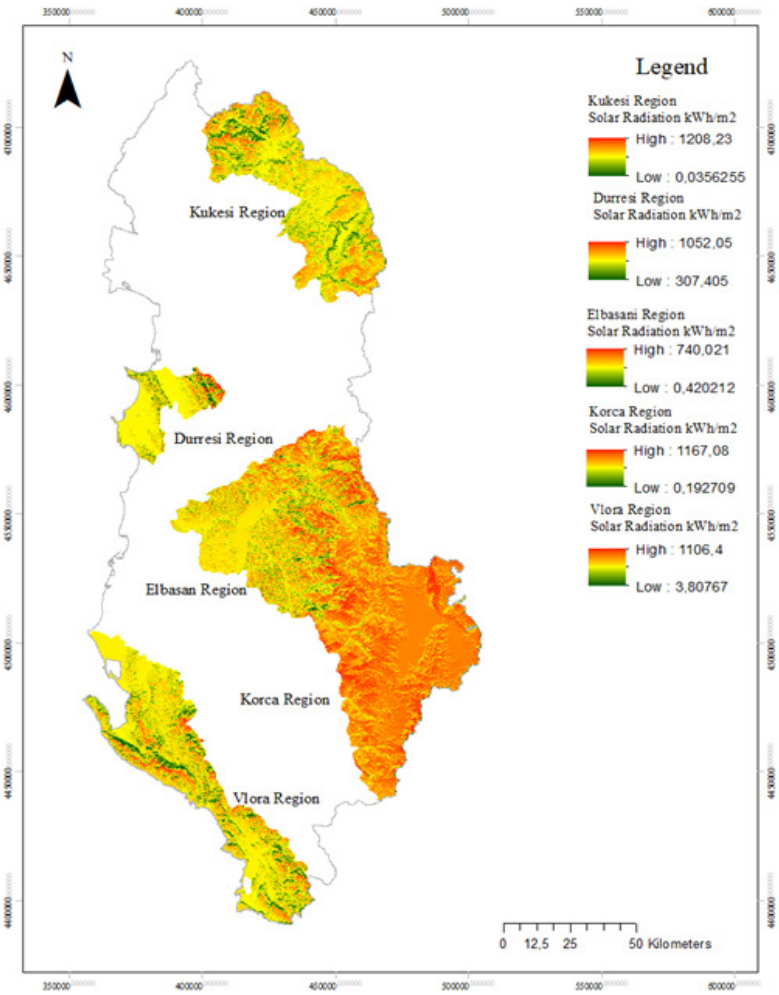
-Protected-area data such as environmental protection zones, cultural heritage sites, and coastal setback lines etc. These data play a critical role in the final outputs of geospatial analyses for solar energy. These data are used to filter and constrain suitable areas, ensuring that the final suitability maps, solar potential models, and decision-making recommendations comply with legal and environmental standards.

-Other data . When official datasets were incomplete, they were complemented by open-source data, remote-sensing interpretation and local expert knowledge.

The use of GIS and geospatial data enables the generation of a range of analytical products that support planning and decision-making in solar energy development, such as solar radiation maps that identify high-exposure areas; PV suitability maps that integrate topographic, environmental, and infrastructural factors; and rooftop solar potential models that assess installation capacity on buildings. Additionally, grid proximity models and energy planning scenarios help minimize spatial conflicts and optimize implementation costs.

The methodological framework follows established GIS-based approaches for solar radiation mapping, site evaluation and potential assessment. (Y. Choi, 2019)It combines terrain analysis, solar radiation modelling, land-use filtering and proximity analysis into a composite suitability index between 0 (unsuitable) and 1 (highly suitable).

Solar Analyst in ArcGIS is used to model annual global solar radiation on the DEM surface, accounting for topographic shading, latitude and generic atmos-



Map 2: A workflow example. Solar Radiation in different Regions in Albania. (Sinjari Sonila, Sallja Endrit, Kosovrasti Albana, 2023)

pheric parameters. (Esri, 2025) The resulting raster (e.g., kWh/m²/year) is then reclassified into quintiles or threshold-based classes. Cells exceeding a defined radiation threshold (e.g., 1,500 kWh/m²/year) are assigned higher suitability scores, reflecting the national average and investment benchmarks reported for Albania.

Where roof-scale analysis is performed, radiation values are sampled on building footprints or derived using rooftop-specific tools that estimate panel

area and potential output (AIDA, 2024)

The yearly average of solar irradiation in the country various to Western Part like Durres with 148 kwh/m², Vlora with 147 kwh/m²,etc to small amounts in Southern Highlands provinces of Korca

By translating complex spatial information into interpretable maps and suitability classes, GIS can help:

•Prioritise zones for detailed feasibility studies and investment promotion;

•Inform revisions of local general plans and zoning regulations;

•Support the design of targeted financial incentives (e.g., higher support levels for brownfield-based projects);

•Coordinate energy, land-use, transport and environmental policies at city-regional scale.

Combaining the reclassified layers slope, aspect, radiation, land-use and distance to grid into a composite solar suitability index using raster overlay.

5.Governance challenges and planning implications of installing PV

The Albanian government is actively working to implement strategies aimed at managing urbanization effectively, but the effectiveness of these measures depends on addressing underlying issues such as informal settlements and inadequate public services. (Nikolli, P., Gashi, F., & Sinjari, S., 2025).

This methodological study supports the use of geospatial technologies and data in solar energy decision-making for municipalities and national agencies.

A cluster of opportunity is found on the rooftops of public, educational, health and administrative buildings in the urban core. Many of these structures feature flat or gently sloping roofs, which are technically suitable for PV arrays. Their institutional ownership can also simplify decision-making, especially when combined with national programmes for public-sector decarbonisation and energy-efficiency retrofits.

The same applies to large commercial and service buildings shopping centres, hotels, office complexes where rooftop PV can significantly reduce electricity costs and contribute to corporate sustainability goals. The emerging legal requirement for on-site renewables in new and renovated buildings from 2026 will further increase the relevance of building-integrated PV in Durrës. (News, 2024)

However, the realisation of this potential faces challenges such as:

-Incomplete or outdated digital records on building stock and structural capacity;

-Fragmented property rights and co-ownership arrangements in residential blocks;

-Limited incentives for public entities to invest in PV under current budget rules;

-Lack of systematic integration of rooftop assessments into urban planning processes.

A set of opportunities lies in brownfield sites, former industrial plots and under-utilised land within the urban area or along the periphery. In line with international experience, such sites can be converted into “brightfields” PV parks that generate renewable energy while avoiding conflicts with agriculture and natural habitats. (Esri, 2021)

In Durrës, candidate locations include:

•Decommissioned industrial parcels with low redevelopment prospects;

•Degraded land near transport corridors;

•Under-used spaces in the urban fringe where land-use conflicts are limited.

These areas often score high on solar radiation and slope criteria, but may be constrained by contamination, unclear land titles or absence of detailed site assessments. Addressing these constraints requires coordinated action between central government, municipal authorities, environmental agencies and potential investors.

Strengthening the capacity of municipal planning departments, improving data governance, and establishing formal procedures for using GIS evidence in plan-making are therefore essential. Despite recent improvements in Albania’s renewable-energy legislation, investors in urban solar projects still face regulatory and financial uncertainties. These include:

-Evolving rules on prosumers, net metering and surplus electricity sales;

-Complex permitting procedures for projects near protected or coastal zones;

-Grid-connection constraints in areas where distribution networks are weak;

-Limited access to affordable finance for small and medium-sized enterprises and households.

Recent policy developments such as competitive auctions for utility-scale PV and updated laws harmonised with EU acquis aim to address some of these barriers. (Global, 2025) Additional initiatives, supported by the EU and international financial institutions, focus on strengthening Albania’s energy security and financing new solar power plants. (EU, 2025)Yet, these instruments have so far been more oriented towards greenfield utility-scale projects than towards distributed urban PV. For cities like Durrës, tailoring financial mechanisms (e.g., credit lines, guarantees, on-bill financing) to urban rooftop and brownfield projects is crucial.

6. Post-communist legacies and opportunities

The Durrës case also illustrates how post-communist legacies shape both obstacles and opportunities for solar infrastructure. On the one hand, fragmented property rights after privatisation, informality in the housing sector and delayed infrastructure modernisation complicate project development and risk manage-

ment. On the other hand, the presence of extensive public and semi-public building stock, large industrial platforms and strategic port infrastructure creates focal points for coordinated interventions.

Comparative experiences from Central and Eastern Europe show that successful local energy transitions in post-socialist settings are often driven by coalitions of municipal leaders, utilities, businesses and civil society actors that mobilise EU funds and national programmes to transform post-industrial areas. (CLG, 2025). For Durrës, the combination of port-related redevelopment, coastal resilience planning and the broader Albanian–European energy integration (including cross-border renewable energy interconnections) offers a window of opportunity to embed solar infrastructure into a wider vision of urban and regional transformation. (Reuters, 2025).

7.Conclusions and avenues for further research

This paper has explored the spatial opportunities and challenges associated with deploying solar energy infrastructure in the Durrës Region of Albania, treated as a representative post-communist industrial city in South-East Europe.

Legal and regulatory frameworks, property regimes, grid constraints, financing mechanisms and planning cultures all mediate whether and how solar projects are realised. In this respect, Durrës exemplifies the broader tensions of post-communist energy transitions: high renewable potential co-exists with institutional inertia and infrastructural lock-ins, but also with emerging opportunities created by national strategies, EU alignment and international partnerships.

Future research could extend this work in several directions:

-Incorporating more detailed building-level information (height, structural capacity, roof obstacles) to refine rooftop potential estimates;

-Integrating socio-economic indicators (income, energy poverty, land values) to design socially just and economically viable solar programs;

-Applying multi-criteria decision-making methods (such as AHP or fuzzy logic) in combination with GIS to explore alternative weighting schemes;

-Examining governance arrangements and actor coalitions that enable or impede the implementation of identified priority projects.

For policymakers and planners, the key message is that spatially explicit, GIS-based analysis should become an integral part of urban energy and climate planning. In Durrës, this implies embedding solar suitability maps into local plans, using them to guide incentives and regulations, and designing pilot “solar districts” that leverage port, industrial and public-building clusters. Doing so would not only advance Albania’s energy and climate objectives but also contribute to a more resilient, inclusive and sustainable urban future for one of the country’s most important coastal cities.

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Biophilic design and urban wellbeing in post - communist Tirana: A visual and social reconnection with nature

Msc. Ornela HASRAMA,
Department of Geography, University of Tirana, Albania,
ornela.hasrama@unitir.edu.al
ORCID: 0000-0001-5422-0090

Dr. Edlira ÇARO (KOLA),
Department of Geography, University of Tirana, Albania,
edlira.kola@unitir.edu.al
ORCID: 0009-0000-1742-8618

Prof. Dr. Sokol AXHEMI,
Department of Geography, University of Tirana, Albania,
sokol.axhemi@unitir.edu.al
ORCID: 0009-0003-6990-346X

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Abstract

The integration of biophilic design into urban environments has gained increasing attention for its potential to improve residents' quality of life and foster strong-er connections between humans and nature. This study investigates the role of biophilic design, through both inner and outer spatial elements, in enhancing the wellbeing of residents in the municipality of Tirana, Albania. Special em-phasis is placed on the aesthetic and psychological revitalization of post-com-munist residential buildings, which dominate much of Tirana's urban area. The research explores whether the integration of natural elements in architecture and public spaces contributes to improved mental health, increased social co-hesion, and a stronger ecological awareness among city dwellers. Drawing on field research based on random sampling methods, the study investigates dif-ferences in self-reported emotional well-being, perception of space, and envi-ronmental awareness between those living in buildings or areas with biophilic features and those in more traditional, non-renovated environments. Particular attention is given to post-communist residential buildings, where visual revitali-zation through biophilic design may also contribute to the psychological renewal of urban identity. The findings suggest that residents exposed to biophilic de-sign report higher levels of satisfaction with their living environment, reduced stress, and greater appreciation for urban nature. Conversely, those in less green surroundings tend to express lower emotional and spatial engagement with their neighbourhoods. Despite growing interest in sustainable architecture, institutional support for biophilic renovations remains limited. The study under-scores the importance of integrating nature-centered design strategies into ur-ban planning, especially in post-socialist cities undergoing rapid transformation.

Keywords:
biophilic design, urban wellbeing, post-communist architecture, Tirana, environmental awareness, sustainable urbanism

4.5. 1. Introduction

4.6. Urban environments are increasingly recognized as critical spaces where human wellbeing and environmental sustainability intersect. The spatial structure refers to the organization of living centers, network systems, and the systems of infrastructure and facilities, all serving as the backbone for socio-economic activities in a functionally hierarchical relationship (Nomura. N, 2023). These spatial structures are constituted by zones exhibiting a high concentration of built environments, population, or socio-economic activities within human societies. Such concentration is expressed through urbanization, which, in specific areas, frequently surpasses planned or regulatory frameworks, resulting in uncontrolled urban expansion. Uncontrolled urbanization is often associated with an increase in various mental health problems, including depression, anxiety, and post-traumatic stress disorder (Buttazzoni et al., 2022). The reason is that movement of people to urban area needs more facilities to be made available and infrastructure to grow (Srivastava. K, 2009). The human–nature relationship and health has been explored through three dimensions “Physical Health,” “Mental Health,” and “Social Health” (Seymour. V, 2016). Mental health has become an important issue that requires serious attention, especially in urban spaces. The rapid development and growth of cities has a significant impact on social, economic, and environmental life which in turn affects the mental health of its people (Simon. J et al, 2024). Urban environments, characterized by dense populations, built infrastructure, and limited natural spaces, often challenge the human connection with nature. Research has shown that regular interaction with natural elements, such as parks, trees, water features, and green corridors, can significantly improve mental and physical health, enhance social cohesion, and increase overall quality of life. However, rapid urbanization, industrialization, and historical planning practices in many cities have led to the marginalization of green spaces, creating environments that are often stressful and disconnected from nature. Integrating natural elements into urban design not only supports biodiversity and ecosystem services but also strengthens the emotional and psychological ties between residents and their surroundings. Recognizing the spatial patterns of these interactions and ensuring equitable access to natural spaces are critical steps toward sustainable, resilient, and liveable cities where humans and nature coexist harmoniously.

4.7. In recent years, biophilic design, a concept rooted in the innate human need to connect with nature, has emerged as a transformative approach to improving the quality of urban life. By integrating natural elements such as greenery, natural light, water, and organic materials into architectural and spatial design, biophilic strategies contribute not only to aesthetic enhancement but also to psychological restoration and social cohesion. The importance of biophilic design in urban environments is steadily increasing as cities face challenges

related to rapid urbanization, climate change, and declining mental and physical wellbeing among residents. Research shows that these interventions can reduce stress, enhance cognitive function, improve social cohesion, and contribute to overall health and quality of life. Moreover, biophilic design supports environmental sustainability by fostering biodiversity, mitigating urban heat islands, and improving air quality. As urban populations continue to grow, the adoption of biophilic principles is becoming an essential strategy for creating resilient, liveable, and inclusive cities that balance human needs with ecological considerations. In the context of post-communist cities such as Tirana, the legacy of rapid, unplanned urbanization presents particular challenges for urban wellbeing. Decades of utilitarian construction and the dominance of concrete architecture have produced neighbourhoods often lacking green infrastructure and visual harmony. From an urban perspective, the territory of the Tirana Municipality has experienced continuous spatial expansion. These changes, resulting both from the area's socio-economic dynamics and from modifications in the territorial organization of the municipality, have enabled an increase in its territorial extent from 42.8 km² to 1,110 km², approximately twenty-five times larger (Hasrama et al, 2025). The growth in population, driven by both immigration and positive natural increase, alongside the expansion in the number of buildings for residential, economic, and social purposes, has facilitated a spatial reconfiguration in Tirana, effectively blurring the boundaries between its urban, suburban, and peripheral zones. The territorial expansion of the Tirana Municipality has undergone distinct phases, influenced by political, economic, and social factors. Based on these influences, six periods can be identified: a) The Ottoman Period (when Albania/Tirana was under Turkish rule); b) The Italian Period (when Albania/Tirana was under Italian occupation); c) The Communist Period (when Albania/Tirana was under a dictatorial communist regime); d) The Period 1990–2000 (following the fall of the communist regime); e) The Period 2000–2010; f) The Period 2010–2016 (up to the current territorial organization). It is observed that the concentration of population, economic activities, and state institutions originated from the central area. This indicates that during the Ottoman and Italian periods, such concentration was entirely centered in the core, whereas during the Communist period, expansion occurred towards areas beyond the center. After 1990, urban growth became largely uncontrolled. Furthermore, based on the data presented in the figure, it is evident that, from 2010 onwards, the concentration of these elements has been increasingly directed toward the rural areas of the Tirana Municipality. If we compare the main entities according to their type of activity (construction units, production units, service units, etc.), in 2016, the 11 urban units accounted for 41,042 main entities out of a total of 46,895 in the Tirana Municipality. By 2021, these areas contained 44,834 main entities out of a total of 53,290 (Hasrama. O et al, 2025). According to the data, in 2021 approximately 81% of the main entities were located within the urban units of the municipality. In contrast, the availability of main entities in

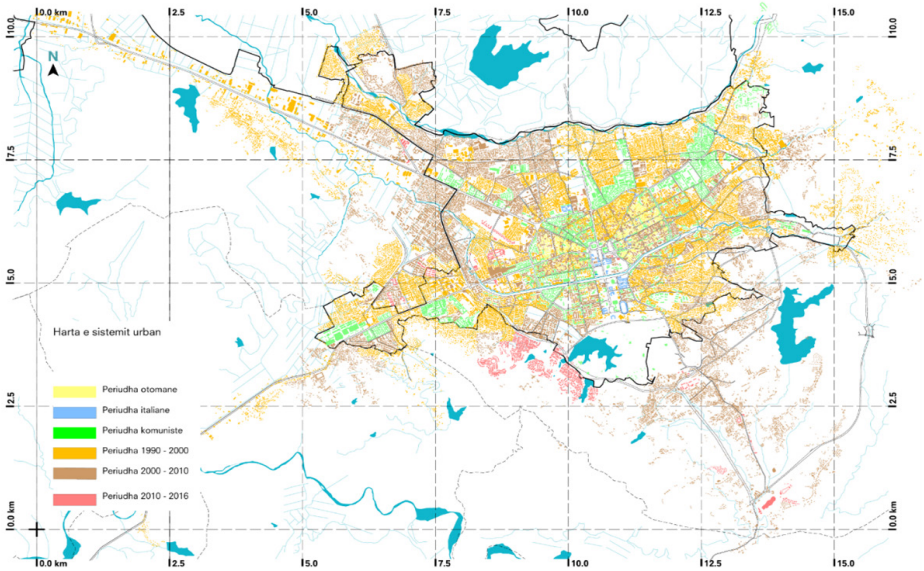

Figure 1. Expansion of Tirana's central area over time (Ottoman Period – 2016).
Source: Municipality of Tirana, 2017.

the rural administrative units remains lower, although the trend has been positive. Geographically, in 2016, the rural administrative units with the highest concentration of main entities were Kashar Administrative Unit (7%), Farkë Administrative Unit (1.5%), Dajt Administrative Unit (1.3%), and Vaqarr Administrative Unit (1%), and by 2021 these same rural units continued to dominate with 7.5% in Kashar, 3% in Farkë, 2% in Dajt, and 1% in Vaqarr. Conversely, the rural administrative units with the lowest number of main entities in 2016 were Krrabë (0.13%), Baldushk (0.09%), Shëngjergj (0.03%), and Zall-Bastar (0.02%), a trend that persisted in 2021, with 0.14% in Krrabë, 0.13% in Baldushk, 0.05% in Shëngjergj, and 0.04% in Zall-Bastar. Indicators such as higher population concentration, productive capacities, and self-development potential collectively demonstrate the existence of a complex center-periphery model. Those urban conditions have contributed to a weakened sense of place and a growing disconnection between residents and their natural surroundings. Although Tirana has undergone significant urban renewal over the past two decades, much of its housing stock still reflects the spatial and visual austerity of the socialist period. This study aims to explore how biophilic design, both through architectural renovation and landscape integration, can enhance the psychological and social well-being of Tirana's residents. By comparing communities living in environments with visible biophilic features to those in traditional, non-renovated settings, the research seeks to identify the extent to which exposure to natural elements contributes to emotional satisfaction, social connection, and ecological conscious-

ness. This study highlights how post-communist cities can harmonize contemporary urban development with the innate human need for contact with nature.

4.8. 2. Literature Review

The term biophilia was first introduced by social psychologist Erich Fromm in the 1970s, defining it as a 'passionate love of life and all that is alive' (Gunderson. E, 2014). Biologist Edward O. Wilson later expanded this concept in 1984, describing biophilia as an innate human tendency to connect with life and natural processes, rooted in evolution. Derived from the Greek words bios (life) and philia (love), biophilia reflects the psychological, emotional, and physiological benefits of interacting with nature (Asojo. A, Hazazi. F, 2025). Biophilic design is focused on creating strong connections between nature and manmade environments which can have benefits for health and wellbeing. The term "biophilic architecture" refers to adaption or design of a building to the environment (Pranjale. P et al, 2019). The idea of biophilia originates in an understanding of human evolution, where for more than 99% of our species history we biologically developed in adaptive response to natural not artificial or human created forces (Kellert. S, Calabrese. E, 2015). Biophilic design translates these evolutionary preferences into architectural applications. Stephen Kellert's framework for biophilic design outlines three experiential domains: direct experience of nature, indirect experience of nature, and the experience of space and place. Direct experiences often involve literal natural elements like plants and water. These last two categories are characterized by less overt, usually imperceptible, design approaches that can influence human psychology and physiology (Gattupalli. A, 2025). Supporting this notion, Attention Restoration Theory (ART) (Kaplan. R, 1989) and Stress Recovery Theory (SRT) propose that natural environments offer aesthetic and restorative benefits (Gaekwad. J.S, 2022 & Hartmann. P, 2010). This connection explains why natural landscapes are consistently preferred over urban environments (Thayer, R.L.; Atwood, B.G, 1978). Biophilic design offers solutions to urban challenges by incorporating design strategies such as natural lighting, materials, ventilation, and views of nature. These elements help improve air quality, regulate temperature, reduce noise levels, and promote human health (Kellert, S., 2018). The integration of biophilic features has been shown to enhance occupant wellbeing and productivity. Research consistently shows that this design approach offers numerous benefits, including improved mental health, reduced stress levels, and increased job satisfaction (Asojo. A, Hazazi. F, 2025). According to Kellert, S. and Calabrese, E. (2015), there are five primary benefits of biophilic design. They argue that biophilic design necessitates repeated and sustained engagement with nature; focuses on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing; encourages an emotional attachment to particular settings and places; promotes positive interactions between people and nature that encourage an expanded sense of relationship and responsibility

for the human and natural communities; and encourages mutual reinforcing, interconnected, and integrated architectural solutions, as well. Contemporary cities have high stress levels, mental health issues … Emerging … design principles … where nature needs to play a bigger part." (Söderlund & Newman, 2015). Several authors have highlighted the importance of incorporating biophilic design within urban environments. According to Browning, W.D. (2014), biophilic design can contribute to stress reduction, enhance creativity and clarity of thought, improve our well-being and expedite healing; as the world population continues to urbanize, these qualities are ever more important. The study on university environments highlights that individual experience increased social interaction with one another… exposure to nature inspires them to acquire human senses, develop social behaviours, and even create ethical structures …" (Rodriguez et al., 2023). In an article on "Biophilic Streets," it is emphasized that streets incorporating natural elements can yield environmental, social, and psychological benefits, arguing that creating habitats for people…that restore or enhance their physical and mental health, fitness and well-being becomes viable (Ulfat, A. et al., 2020). Inarguably, nature plays a central role in biophilic design. However, its influence stretches to often-overlooked strategies that involve spatial configuration and environmental patterning. "Invisible" biophilia frequently leads to positive health outcomes for occupants, working impactfully beneath the surface (Gattupalli. A, 2025). In the case of post-communist cities, such as Tirana, a conceptual model can be developed based on the literature, linking the elements of biophilic design, including: residents' visual and spatial perception (the extent to which spaces connect with nature); emotional and social well-being (stress reduction, social cohesion); as well as ecological awareness and social engagement (sense of connection to nature, community activation). From a geographer's perspective, biophilic design is not only about incorporating natural elements into the built environment but also about understanding the

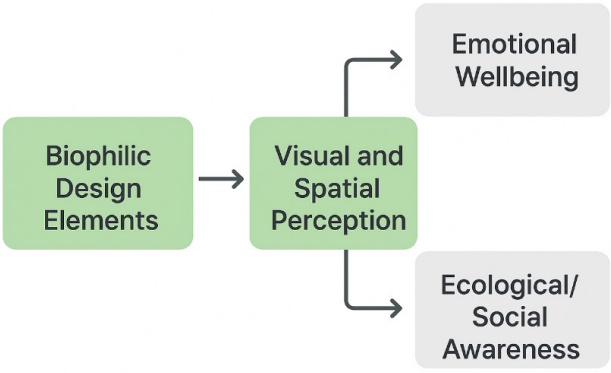

Figure 2. Conceptual model linking the elements of biophilic design.

Source: Author's illustration

spatial and social dimensions of human - nature interactions. Geographers examine how access to green spaces varies across neighbourhoods, regions, and social groups, highlighting patterns of environmental inequality and justice. Geographers use tools such as GIS and through spatial analysis, they can identify patterns of wellbeing, stress, and environmental satisfaction across neighbourhoods and regions, pinpointing areas that are most in need of green interventions. By examining issues of environmental justice, such as unequal access to green spaces, and considering the legacy of rigid, concrete-dominated urban planning, especially in post-communist contexts, geographers can help adapt biophilic principles to diverse landscapes. Their insights also allow for the integration of spatial and environmental conditions with indicators of mental health, social cohesion, and overall quality of life. Moreover, geographers contribute to resilient and sustainable development, particularly in suburban and rural transition areas, and can guide the co-design of public green spaces that reflect local needs. In this way, they ensure that biophilic strategies are both inclusive and equitable, ultimately fostering healthier, more connected, and sustainable communities.

Methodology

This study is based on fieldwork applying a questionnaire composed of both closed and open - ended questions, deemed the most appropriate instrument given the qualitative nature of the information required. The selection of respondents followed a random sampling approach, with the only criterion being citizens in urban areas of Tirana. The survey encompassed a total of 148 participants, representing a significant sample size to capture the realities and trends of the study topic. The questionnaire duration averaged approximately 10 minutes and was conducted partly online (via Google Forms) and partly through face-to-face interviews. The questionnaire was composed to 20 questions, 18 of which were closed - ended (including 4 general profile questions of respondents, 4 questions with the option “yes” or “no”, 6 Likert scale questions and 4 multiple - choice questions) and 2 open - ended questions allowing respondents to express their opinions on the subject matter. This mixed question format facilitated the collection of both qualitative and quantitative data. The aim was to gather, analyse, process, and compare the data obtained, focusing particularly on the perceptions of respondents regarding population perceptions about biophilic designs.

4.10. 4. Findings

What is the social profile of the surveyed population?
The surveyed population, representing the study sample, compose a notable diversity within the context of the general data collected from the field. The respondents’ age distribution is categorized into six groups as follows: under 18 years old comprising 1.4%, 18-30 years old representing 77%, 31-40 years old accounting for 17.6%, 41-50 years old at 2.7%, 51-65 years old making up 1.4%, and those over 65 years old constituting 1.4%. The survey shows that

the majority of respondents are between 18–30 years old (77%), followed by 31-40 years (17.6%). Other age groups are very weakly represented: 41-50 years (2.7%), under 18 (1.4%), 51-65 years (1.4%), and over 65 years (1.4%).

Age	*Under 18*	*18-30*	*31-40*	*41-50*	*51-65*	*Over 65*
Percentage	1.4	77	17.6	2.7	1.4	1.4

Table 1. The respondents' age distribution

Source: Questionnaire's results

The dominance of the 18-30 age group indicates that the survey primarily reflects the perspectives of young adults, highlighting a population segment that is generally more active in education, early career stages, and social engagement. Regarding gender, 18.9% of the surveyed population were male, while 79.7% were female, a proportion that suggests women are more inclined to

Gender	*Male*	*Female*	*Prefer not to answer*
Percentage	18.9	79.7	1.4

Table 2. The gender distribution

Source: Questionnaire's results

respond to questionnaires. The sample is predominantly female (79.7%), while males represent 18.9%, and 1.4% preferred not to disclose their gender. The clear predominance of female respondents highlights either a higher willingness of women to engage with the survey or a sample bias in data collection. However, those gendered distribution implies that the results present environmental awareness, community participation, and perceptions of social issues, where prior studies often note stronger female engagement. Respondents are distributed across different administrative units, with the highest concentrations in Unit 2 (37.8%), Unit 11 (16.2%), and Unit 5 (12.2%). Other units have smaller shares, such as Unit 1 (9.5%), Unit 7 (8.1%), Unit 4 (6.8%), and Unit 10 (4.1%). Minimal representation was observed in Units 6, 8, and 9 (1.4%

Administrative Units	*A. U. 1*	*A. U. 2*	*A. U. 3*	*A. U. 4*	*A. U. 5*	*A. U. 6*	*A. U. 7*	*A. U. 8*	*A. U. 9*	*A. U. 10*	*A. U. 11*
Percentage	9.5	36.2	1.6	6.8	12.2	2.7	8.1	1.4	1.4	4.1	16.2

Table 3. In which administrative units' live respondents?

Source: Questionnaire's results

each). The spatial pattern reveals that Units 2 and 11 dominate the sample, together accounting for more than half of the respondents. These results highlight the accessibility of certain geographic areas to survey participants, rather than reflecting a population's willingness to participate. Nevertheless, despite the lower percentages in some administrative units, efforts were made

to ensure that each unit was adequately represented in the survey results. The impact of biophilic elements on daily spatial experience The results of questionnaire indicate that a majority of respondents (62.2%) reported living in areas with visible natural elements such as parks, trees, green walls, or water features. In contrast, 37.8% stated that their surroundings lack such features, while none expressed uncertainty about the presence of natural elements. A significant portion of Tirana's residents, particularly in post-communist residential areas, have access to at least some degree of urban greenery. However, the relatively high percentage of respondents (over one-third) who do not experience visible nature highlights ongoing spatial inequalities in the city's

Options	Percentage
Yes	62.2
No	37.8
Not sure	-

Table 4. Do you live in an area that has visible elements of nature (parks, trees, green walls, water elements, etc.)?

Source: Questionnaire's results

green distribution. Residents living in greener surroundings are generally more likely to report higher emotional stability, reduced stress, and stronger attachment to place. Therefore, the results point to a growing need for integrating biophilic principles in both public and residential urban planning, especially in neglected or non-renovated post-socialist districts of Tirana. According to frequency, reveal that engagement with natural environments varies considerably among respondents. A notable share (37.8%) spends time in green areas a few times per week, while only 21.6% report daily contact with nature. Meanwhile, 28.4% of participants visit such spaces only occasionally, and 12.2% rarely do so. The

Options	Percentage
Daily	21.6
A few times per week	37.8
Occasionally	28.4
Rarely	12.2
Never	-

Table 5. How often do you spend time in natural or green environments (parks, forests, green rooftops, etc.)?

Source: Questionnaire's results

distribution indicates that while exposure to natural environments is relatively common, consistent and habitual interaction with nature remains limited. The predominance of weekly rather than daily engagement underlines that biophilic experiences in Tirana are more situational than integrated into residents' everyday routines. Such patterns reflect spatial accessibility constraints, urban design deficiencies, or lifestyle factors that reduce opportunities for regular immersion in natural spaces. The results demonstrate a strong consensus among respondents regarding the psychological benefits of natural environments. A combined total of 90.6% of participants either strongly agree (54.1%) or agree (36.5%) that access to natural spaces enhances their mood and mental health. Only 9.5% expressed a neutral position, while no respondents disagreed with the statement.

Options	Percentage
Strongly agree	54.1
Agree	36.5
Neutral	9.5
Disagree	-
Strongly disagree	-

Table 6. Do you feel that having access to natural environments improves your mood and mental health?

Source: Questionnaire's results

The overwhelming agreement highlights a widespread recognition of the restorative and therapeutic qualities of natural environments among Tirana's residents. The absence of negative responses further reinforces the idea that contact with nature is perceived as an essential component of psychological wellbeing. These findings are consistent with theories of biophilic design, which emphasize the innate human tendency to seek connections with natural systems as a means of stress reduction and emotional balance. The fresh air and ventilation are overwhelmingly prioritized by respondents, with 79.7% ranking them as the most important feature for their wellbeing. This is followed by quietness and noise control (52.7%) and green spaces nearby (33.8%), while natural light (20.3%) and the aesthetic appearance of buildings (6.8%) are perceived as comparatively less critical. Respondents associate wellbeing primarily with sensory comfort and environmental quality rather than visual or architectural aesthetics. The emphasis on air quality and acoustic comfort reflects growing urban concerns over pollution, congestion, and environmental stressors typical of post-communist urban contexts. Meanwhile, the relatively high importance of proximity to green spaces underscores an implicit awareness of the health and psychological benefits derived from nature exposure, aligning with key principles of biophilic design and urban wellbeing frameworks. According to the results, parks and green

Options	Percentage
Natural light	20.3
Fresh air/ventilation	79.7
Green spaces nearby	33.8
Quietness/noise control	52.7
Aesthetic appearance of buildings	6.8

Table 7. Rank the following features in terms of how important they are for your well-being (1 = most important)

Source: Questionnaire's results

spaces are perceived as the dominant contributors to a healthy urban environment, identified by 75.7% of respondents. Clean streets and trees or green facades follow with equal importance (35.1%), while modern infrastructure and community spaces are each cited by 18.9% of participants. This distribution demonstrates that respondents associate urban health primarily with ecological and aesthetic qualities rather than purely infrastructural development.

Options	Percentage
Parks and green spaces	75.7
Clean streets	35.1
Modern infrastructure	18.9
Trees and green facades	35.1
Community spaces	18.9

Table 8. In your opinion, which of the following contributes most to a healthy urban living environment?

Source: Questionnaire's results

The prominence of parks and greenery reflects a collective awareness of the role of natural environments in promoting both physical and psychological wellbeing. Meanwhile, the relatively lower emphasis on community spaces and modern infrastructure emphasized that social and technological aspects are considered secondary to environmental quality in shaping perceptions of liveable urban areas. These tendencies further affirm the centrality of nature-based elements in constructing a healthier, more restorative post-communist urban landscape such as Tirana. The findings reveal that a large majority of respondents integrate natural elements within their domestic environments. Specifically, 56.8% report having many natural features such as indoor plants, gardens, or balconies with

greenery, while 40.5% state that they have some natural elements. Only 2.7% of participants indicate an absence of such features. These results, about visi-

Options	Percentage
Parks and green spaces	75.7
Clean streets	35.1
Modern infrastructure	18.9
Trees and green facades	35.1
Community spaces	18.9

Table 8. In your opinion, which of the following contributes most to a healthy urban living environment?

Source: Questionnaire's results

Options	Percentage
Yes, have some natural features	40.5
Yes, have many	56.8
No, there aren't such elements	2.7

Table 9. Are there visible natural elements in or around your home (e.g., indoor plants, garden, balcony with plants, natural materials)?

Source: Questionnaire's results

ble natural elements in or around their home, highlight a widespread tendency among Tirana's residents to incorporate nature into private living spaces, reflecting an emerging awareness of the psychological and aesthetic benefits of biophilic domestic design. The prevalence of indoor and proximate greenery, even in the context of post-communist residential architecture, individuals actively seek to re-establish sensory and visual connections with nature. Such practices can be interpreted as compensatory responses to the lack of broader urban green infrastructure, demonstrating how personal initiatives contribute to fostering wellbeing and ecological consciousness within the urban fabric. It is showed a strikingly positive emotional response to the presence of natural elements in or around the home. An equal proportion of respondents (44.4%) reported that these elements have an extremely strong or strong effect on their relaxation and emotional wellbeing, while 9.7% described the impact as moderate and only 1.4% perceived it as minor. None of the participants reported an absence of effect. This kind of distribution underscores the powerful psychological influence of biophilic elements in domestic environments. The predominance of strong positive responses indicates that residents perceive visible contact with nature as a direct contributor to emotional stability and stress reduction. The near absence of neutral or negative perceptions suggests that the human-nature connection

Options	Percentage
Extremely strong	44.4
Strong	44.4
Moderate	9.7
Minor effect	1.4
None	-

Table 10. Do the presence of these elements make you feel more relaxed and emotionally well?
Source: Questionnaire's results

remains deeply embedded even within highly urbanized or post-communist housing contexts. Biophilic design theories asserting that natural stimuli, such as plants, natural materials, and daylight, enhance affective wellbeing by restoring cognitive balance and fostering a sense of calm within living spaces. According to the results, only 32.4% of respondents reported noticing buildings in their neighbourhood that have been visually revitalized through greenery or biophilic features such as green roofs, vertical gardens, or nature-inspired murals. In contrast, 54.1% indicated that they had not observed such interventions, while 13.5% were uncertain. What it can be emphasized is the reality of that

Options	Percentage
Yes	32.4
No	54.1
Not sure	13.5

Table 11. Have you noticed any building in your neighbourhood that has been visually revitalized with greenery or biophilic features (e.g., green roofs, vertical gardens, nature-based murals)?
Source: Questionnaire's results

biophilic revitalization projects in Tirana remain relatively limited or unevenly distributed across residential areas. The majority's lack of visibility of green architectural elements highlights a broader gap between the conceptual adoption of biophilic design and its practical implementation in the urban landscape. This disparity is attributed to the persistence of post-communist building typologies, the slow pace of architectural renewal, or the absence of institutional incentives promoting nature-integrated design. Nonetheless, the share of respondents who have observed such examples indicates emerging efforts toward visual and ecological transformation, reflecting the gradual diffusion of biophilic principles in Tirana's evolving urban identity. Among respondents who observed biophilic interventions in their neighbourhood, a substantial majority (70.8%) perceive these transformations as very positive, highlighting improvements in

aesthetics and overall liveability. A further 16.7% consider the changes moderately positive, noting that the buildings appear better than before. Only 8.3% expressed a neutral view, while a small minority (4.2%) preferred the previous appearance of the buildings. No participants reported a wholly negative per-

Options	Percentage
Very positive – It beautifies the space and improves liveability	70.8
Moderately positive – It looks better than before	16.7
Neutral	8.3
Negative – I prefer the previous look	4.2
Negative	-

Table 12. If yes, how do you perceive this transformation?
Source: Questionnaire's results

ception. The strong preference for revitalized, nature-integrated facades supports the notion that biophilic design can enhance both aesthetic satisfaction and emotional wellbeing in urban spaces. This aligns with broader research on the psychological benefits of nature-based architectural elements, suggesting that even modest green interventions can significantly improve the perceived quality of post-communist urban neighbourhoods. The findings indicate that a substantial majority of respondents (78.4%) believe that incorporating natural elements can visually and socially revitalize old or communist-style buildings. A small proportion (6.8%) disagreed, while 14.9% were uncertain. These results suggest a strong recognition among residents of the transformative potential of biophilic interventions in post-communist urban contexts. The positive perception reflects an awareness that integrating greenery and natural features can not only enhance aesthetic appeal but also foster social engagement and a renewed sense of community within residential areas. Such perceptions support the theoretical premise that biophilic design serves as a tool for both environmental and social regeneration. The qualitative responses reveal a strong perception among residents that the integration of natural elements exerts a revitalizing effect on both their living environment and personal wellbeing. Participants highlighted that greenery and clean surroundings positively influence

Options	Percentage
Yes	78.4
No	6.8
I'm not sure	14.9

Table 13. Do you think that adding natural elements can revitalize old or communist-style buildings visually and socially? Source: Questionnaire's results

mood, reduce stress, and provide emotional and mental calm. Several respondents emphasized the aesthetic benefits, noting that plants, organic forms, and natural colours soften the monotony of concrete structures and enhance the visual appeal of neighbourhoods. Beyond the visual impact, residents recognized the social dimension of green interventions, such as landscaped areas encourage social interaction, foster community life, and improve the overall quality of public spaces. The responses collectively suggest that biophilic elements contribute not only to individual psychological restoration but also to the social and environmental vitality of post-communist urban areas in Tirana.

Emotional connection to nature and community

In the context of their satisfaction, respondents express a positive evaluation of their living environment's design and aesthetics, with 23% reporting being very satisfied and 44.6% satisfied. Meanwhile, 18.9% hold a neutral stance, and a smaller proportion of participants are dissatisfied (10.8%) or very dissatisfied (2.7%).

Options	Percentage
Very satisfied	23
Satisfied	44.6
Neutral	18.9
Dissatisfied	10.8
Very dissatisfied	2.7

Table 14. How satisfied are you with your current living environment in terms of design and aesthetics?

Source: Questionnaire's results

Based on data, the most residents are content with the visual and spatial qualities of their neighbourhoods, there remains a notable minority experiencing dissatisfaction, which reflect areas where urban design, aesthetic appeal, or environmental features are insufficiently developed. The results highlight the importance of interventions, such as biophilic design, that can enhance both the visual quality and the emotional experience of residential spaces, particularly in post-communist neighbourhoods where architectural uniformity limit perceived liveability. The results show an overwhelming interest among respondents for greater integration of biophilic design in their neighbourhoods. A significant majority (91.9%) expressed a desire to see more nature-based design elements implemented, while only 6.8% opposed this idea and 1.4% remained indifferent. This strong preference indicates a clear public demand for urban interventions that enhance connections with nature, improve aesthetic quality, and promote psychological and social wellbeing. The near-unanimous sup-

port underscores the perceived value of biophilic design in transforming post-communist urban environments, emphasizing that residents recognize its potential to enrich daily life, foster social interaction, and address environmental and aesthetic deficiencies in their living areas. The respondents prioritize public spaces and squares (69.1%) for green revitalization, followed by apartment blocks from the communist era (20.6%) and schools and universities (10.3%). No participants identified offices or workplaces as a priority.

Options	Percentage
Yes	91.9
No	6.8
Indifferent	1.4

Table 15. Would you like to see more biophilic design applied in your area? Source: Questionnaire's results

Options	Percentage
Apartment blocks from the communist era	20.6
Public spaces and squares	69.1
Schools and universities	10.3
Offices and workplaces	-

Table 16. Which areas do you believe should be prioritized for green revitalization? Source: Questionnaire's results

Residents perceive communal and publicly accessible areas as the most impactful sites for implementing biophilic interventions, emphasizing the social and collective benefits of green design. The attention given to post-communist apartment blocks also reflects recognition of the potential for nature-based transformations to improve the aesthetic and emotional quality of residential environments. The lower prioritization of schools and workplaces indicate that respondents associate personal wellbeing more strongly with public and residential domains than institutional or professional settings. Overall, the data underscore a community-driven perspective on urban greening, favouring interventions that simultaneously enhance visual appeal, social interaction, and environmental quality in shared urban spaces. Additionally, the findings reveal a strong consensus among respondents regarding the positive effects of biophilic design on stress and productivity. A majority of participants strongly agree (55.4%) or agree (40.5%) that introducing natural elements in schools, workplaces, or homes can reduce stress and enhance productivity, while only 4.1% remain neutral. The widespread perception that nature-based interventions are not merely aesthetic enhancements but also functional contributors to cognitive performance and emotional wellbeing. The data support the theoretical premise of biophilic

design, which posits that integrating natural elements into everyday environments can restore attention, mitigate stress, and improve overall efficiency. This underscores the potential for targeted green interventions in both private and institutional settings within Tirana to foster healthier, more productive urban communities. The qualitative responses regarding the revitalization of old buildings through biophilic design emphasize the necessity and community value of green interventions. Residents highlighted the urgent need to increase green areas, both for environmental quality and public health, reflecting concerns about population density and the lack of adequate natural spaces. Suggestions included the creation of shared green courtyards for multiple apartment blocks, incorporating playgrounds, seating, and landscaped areas to foster social interaction and community cohesion. Participants also emphasized that raising awareness about the benefits of biophilic design could guide urban development in a positive direction. Collectively, these responses underscore that residents view biophilic interventions not only as aesthetic enhancements but also as essential strategies for promoting wellbeing, social connectivity, and environmental sustainability in Albania's post-communist urban neighbourhoods.

Options	**Percentage**
Strongly agree	55.4
Agree	40.5
Neutral	4.1
Disagree	-
Strongly disagree	-

Table 17. Do you think that introducing biophilic design elements could help reduce stress and increase productivity in schools, workplaces, or homes? Source: Questionnaire's results

5. Discussions

The findings of this study highlight the significant role of biophilic design in enhancing urban wellbeing in post-communist Tirana. Quantitative results indicate that a majority of residents have access to visible natural elements in their living areas, and most spend at least occasional time in green environments. Notably, 90% of respondents acknowledged that access to natural spaces positively impacts their mood and mental health, while a similarly strong majority emphasized the importance of fresh air, quietness, and nearby green spaces for personal wellbeing. These findings are consistent with biophilic design principles, which suggest that integrating natural elements into urban environments can mitigate stress, improve emotional balance, and enhance cognitive functioning. The study also reveals that residents perceive public and residential spaces differently in terms of priority for green interventions. Public spaces and squares are overwhelmingly considered the most crucial areas for revitalization, followed by post-communist apartment blocks, reflecting an understanding that

shared spaces can foster social cohesion and community engagement. The qualitative responses reinforce this notion, with participants emphasizing the creation of shared green courtyards, playgrounds, and seating areas to encourage interaction among neighbours. Furthermore, residents expressed an appreciation for visual transformations of buildings, noting that greenery softens the monotony of concrete structures, introduces vibrant colours and organic forms, and contributes to a more pleasant aesthetic environment.

Figure 3. New buildings with a biophilic design approach in the city of Tirana. Source: Authors, 2025

Figure 4. Revitalization of existing buildings in the city of Tirana through biophilic design. Source: Authors, 2025

Residents' satisfaction with their current living environment is generally positive, but a substantial minority remains neutral or dissatisfied, suggesting that architectural uniformity and limited green coverage in some areas may reduce overall wellbeing. Importantly, the overwhelming majority of respondents (over 90%) expressed a desire to see more biophilic design interventions in their neighbourhoods, highlighting both the aesthetic and functional value attributed to natural elements. The data also indicate that the perceived benefits extend beyond aesthetics, respondents strongly agree that biophilic features can reduce stress and enhance productivity in homes, schools, and workplaces. Taken together, these findings underline that integrating biophilic principles into the urban fabric of post-communist Tirana can produce multifaceted benefits, including psychological restoration, social revitalization, and environmental improvement. The combination of quantitative and qualitative evidence underscores that resident not only recognize the health and emotional benefits of greenery but also view it as a mechanism to enhance social interaction, strengthen community identity, and foster sustainable urban development. These insights highlight the need for urban planners, policymakers, and architects to prioritize nature-based interventions in both public and residential spaces to create more liveable, resilient, and aesthetically pleasing urban environments.

4.12. 6. Conclusion

This study demonstrates that biophilic design has a clear and measurable impact on urban wellbeing in post-communist Tirana. Residents perceive natural elements as critical for emotional health, stress reduction, and overall satisfaction with their living environment. The evidence shows that public green spaces, revitalized apartment blocks, and visible domestic greenery not only enhance aesthetic appeal but also encourage social interaction, community cohesion, and psychological restoration. The findings highlight a strong public demand for more nature-integrated interventions, emphasizing the potential for biophilic design to transform monotonous post-communist neighbourhoods into healthier, more vibrant, and socially engaging urban spaces. Consequently, urban planning and policy should prioritize the systematic incorporation of natural elements into residential areas, public squares, schools, and workplaces. By doing so, cities like Tirana can foster a deeper connection between residents and their environment, promote sustainable development, and support the psychological and social wellbeing of urban communities.

4.13. 7. References

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Urban planning in shrinking cities
Strategies to ease resilience and rebirth through Distributism

Dr. Luca LEZZERINI
Polis University, Research and Development Department, Albania,
luca_lezzerini@universitetipolis.edu.al
ORCID: 0009-0003-7441-429X

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Abstract

In both developed and underdeveloped countries worldwide, the phenomenon of shrinking cities is becoming increasingly common. Many communities are disappearing due to intense urbanisation and a demographic shift. This is a widespread phenomenon in Albania as well.
After reviewing some post-socialist cases, guidelines have been developed to support the implementation of a two-way strategy, aiming to both create a cohesive community and build a robust, resilient economy that can attract new people, with a reversal of the migration flow. An approach to develop urban planning strategies to ease the application of a socio-economic doctrine to restart local communities and fuel their growth is then analysed.
So, the paper investigates, starting from similar post-socialist experiences, how to build cohesive, sustainable, efficient, and resilient communities through proper urban planning, and defines a general framework for its application.
The results are a decision-making tool for selecting applicable sites and a development framework to reverse the shrinking process and create new, solid, sustainable, and resilient communities.
Although the development framework has been designed for optimal cases, it could be helpful to define different implementation roadmaps for non-optimal cases.

Keywords:
Urban Collapse, Shrinking Cities, Distributism, Urban Planning (4 to 6 keywords)

Introduction

The phenomenon of urban collapse has emerged in recent years as a key challenge for many cities worldwide. In particular, this phenomenon has reached a very high level of severity in Eastern European nations as a result of their post-communist evolution.

Unlike regular periods of economic stagnation, urban collapse is fundamentally due to demographic decline. It represents a phase of structural and involutionary transformation that requires an entirely different planning approach from that used for growing cities (Pallagst et al., 2013).

Albania is a prime example of this crisis. The Albanian population has shrunk from 3.2 million in 1990 to about 2.4 million in 2023, representing a net loss of about 800,000 residents. This phenomenon in Albania stems in particular from two factors: the first, mass emigration; the second, the progressive decline in fertility rates (Euronews Albania, 2024).

According to the Albanian Institute of Statistics INSTAT, Albania loses about 50,000 residents every year due to emigration. At the same time, the fertility rate has plummeted from 7 children per woman in the 1960s to 1.2 in 2023. In addition, the population is experiencing a massive rise in average age, with the demographic profile changing from 15.2 per cent of the over-65s in 2020 to a projected 29 per cent in 2050 (INSTAT, 2022).

Conventional urban planning systems, which are primarily based on the growth paradigm, have proven ineffective at addressing this collapse. Recent studies have shown that even when the planning sector acknowledges the ongoing urban collapse, it continues to pursue growth-oriented strategies ill-suited to demographic decline.

In this paper, an alternative vision is proposed: an approach centred on strengthening communities, complemented by a policy of redistributing resources, all based on the socio-economic principles of distributism, which favour social cohesion, local resilience, and the development of a sustainable economy.

Literature Review

Collapsing cities systematically present many different interconnected pathological issues that go far beyond mere population loss (Audirac et al., 2018; Lee et al., 2023).

In the case of Albania (Gurashi, 2017; OECD, 2025; European Commission, 2012), urban collapse manifests itself through six main dimensions. The first is economic collapse, which causes unemployment, poverty, and increased crime. A second is cultural decline, in which local social institutions are lost as community cohesion degrades.

The third dimension is the deterioration of infrastructure that supports the population but was designed for larger numbers and is now subject to downsizing or

poor maintenance due to cost-cutting. Then there is a loss of identity that leads to a gradual erosion of the sense of belonging to both the community and the place, with increasing centrifugal forces. Two other phenomena that occur are those of unplanned local development, as the intention, and sometimes even the capacity, for coordinated growth or the application of regenerative strategies is lost. This leads to inconsistent behaviour during local development.

Finally, there is selective depopulation, characterised by emigration mainly of the young and better-educated segments of the population, with a profound impact on the demographic profile, depriving the community of its most dynamic, prolific and productive resources.

Analysing the spatial distribution of depopulation in Albania, the peripheral regions are particularly vulnerable. Indeed, while Tirana retains around 33 per cent of the national population, rural areas and secondary urban centres are experiencing catastrophic population losses. Between 2001 and 2011, 48 Albanian administrative units out of the 373 existing at the time, or 13%, lost at least half of their population (UNSD, 2014).

Albania's urban collapse must be read through a broader lens informed by the country's trajectory since the communist era. During this post-communist transition following the fall of the regime in 1991, there was a massive wave of migration, both internal and outward. Initially, migration was essentially only internal, from the rural periphery to urban centres, particularly Tirana. Such displacements were characteristic of the immediate post-communist period and represented the movement of rural masses towards urban areas, following development paths typical of middle-income nations. This then gradually shifted to international emigration, indicating a depletion of domestic emigration potential and a disaffection with national potential, or an overall and substantial economic devaluation.

A critical analysis of the most recent electoral data shows the extent of emigration: between 2021 and 2025, Albania lost approximately 200,000 voters to emigration, and further analysis suggests this figure is underestimated. This silent democratic erosion, which should be distinguished from citizens' disaffection with politics or outright electoral boycotts, reflects a systematic flight of citizens that undermines not only the participatory democratic system but also Albania's economic and productive system (Tirana Times, 2025).

Methodology

The research project aims to define a set of tools for urban planning to reverse the urban collapse of shrinking cities.

The research question is: what methodology (in the sense of creative process and domain language) can urban planners use to reverse the process of collapse of an urban or regional environment?

This paper focuses on an intermediate step of the research, namely the definition of a first, core set of guidelines for urban planning.

The research project is structured according to the following methodology:

- A literature review has been done to examine the absolute need for a new set of guidelines and/or a new methodological approach to urban planning in the case of urban/regional collapse
- Develop a first set of raw guidelines. This step is nearing completion and is the focus of the present paper.
- Refinement of these guidelines through theoretical application to some example cases
- Finalisation of the guidelines and definition of a creative process to implement them in an urban planning context
- Definition, if needed, of a specific language
- Formalisation of the methodology

Results

Need for different urban planning strategies

Current approaches to countering urban collapse are primarily based on growth-oriented strategies. Although there is clear evidence of their inadequacy, research examining the plans of 18 Rust Belt cities in the United States (Marjanović, 2024), also impacted, as in the Albanian case, by industrial decline and population loss, revealed that planners, despite being aware of the strong trend of decay underway, set growth-promoting strategies that were inconsistent with predictable demographic trajectories. Only four of the 18 cities analysed adopted planning strategies aligned with sustained population decline. This mismatch between reality and the strategic response perfectly reflects the still-frequent determination to apply growth paradigms where they are not possible in the short to medium term. At other times, urban planners develop coherent strategies to manage contraction. However, political actors tend to resist the idea of ongoing collapse and aim to reverse it through conventional economic development policies that systematically fail.

Distributism: historical background

History and principles

Distributism emerged as an economic theory during the late 19th and early 20th century, taking its cue from the principles of Catholic social teaching, in particular those expressed by Pope Leo XIII in his 1891 encyclical ‘Rerum Novarum’ and by Pius XI in his 1931 ‘Quadragesimo Anno’. Rather than following one of the two principal economic doctrines, capitalism or the socialist state, both of which are also criticised for the extreme concentration of productive assets, Distributism proposes a third way based on the diffusion of productive

resources through distribution among independent artisans, cooperative enterprises, mutual aid organisations and small and medium-sized enterprises. In practice, Distributism seeks a synthesis of the good aspects of Capitalism and Socialism, avoiding their limitations by promoting equitable resource distribution without undermining private property (Belloc, 2006; Médaille, 2013).

This distributist framework can be understood as grounded in three cardinal principles. The first is subsidiarity, i.e. that decisions should be taken at the lowest possible level, as long as this level is competent to do so, thus maximising participation and accountability.

The second principle is that of solidarity: economic relations must be structured to benefit the community as a whole, not only for the profit maximisation of individuals. This, in practice, means following a path that points straight to the so-called 'Common Good', i.e. a state of society that allows each individual to realise himself and that is not seen as the sum of each individual's goods, but as a condition of overall social well-being.

Finally, there is a peculiar characterisation of private property, seen as indispensable for aspects of livelihood and production, including housing and working tools, which, for distributism, must be owned by individuals. In the case of a change of scale from family-owned to medium- or large-scale enterprises, Distributism stipulates that ownership must be with the workers, favouring cooperative forms of enterprise and direct participation of each worker in governance. This model, centred on private ownership, implies, however, that it must be oriented towards social responsibility, with an explicit duty to support the overall welfare of the community (again in the sense of the Common Good, i.e., to allow each individual to achieve his or her own fulfilment). These principles directly contrast the centralisation mechanism that exists, albeit in different forms, in capitalist monopoly and state socialism. They promote, in fact, the real distribution of property so that it is diffused among all the actors involved and not concentrated, as happens in liberalist turbo-capitalism, in the hands of a few or in the social-communist state, in the hands of the state, an entity often far removed from the element of the social body that is to benefit from it.

The guilds

A fundamental element of the distributist view is the revaluation of the medieval system, in particular the role of the guilds and guilds of arts and crafts. For distributists, the Middle Ages represented the historical period in which ownership of the means of production was most equally distributed, preventing both capitalist concentration and statist centralisation. Guilds (or guilds of arts and crafts) were associations of like-minded professionals formed from the 12th century onwards in many European cities, particularly in Italy, the Netherlands, England and the Holy Roman Empire. The Italian term 'corporazione' derives from the Latin corporatio (unitary body), whereas in the British context 'guild' is more commonly used.

In the distributist model, the guild should have the following characteristics: distribution of ownership of the means of production, as a plurality of small, associated owners, who maintain their independence and ownership but group themselves into a stronger entity; cooperative control of competition, regulating competition between the various members to avoid excessive disparities and, above all, monopoly or oligopoly; local territorial organisation, the guilds being local; managerial autonomy, as they are outside state control but are managed directly by their members.

In practice, guilds are cooperative structures that preserve economic order without centralised state control.

A key concept in the distributist view is the distinction between the 'servile state' and 'economic freedom'.

Distributists define the servile state as a condition in which the majority of the population is forced to work for those who own the means of production, without freedom of choice or the possibility of autonomy. According to Belloc, both capitalism and communism lead to this situation:

- In capitalism, the economic elite own the means of production and force the rest of the population to work for them
- In communism, the political elite (the state) holds the means of production and forces the population to work for the state

The guild, in the distributist view, represents the primary mechanism for preventing the servile state, as it: distributes ownership of the means of production among many members, prevents the excessive accumulation of wealth in the hands of a few, ensures that workers are 'co-operators and protagonists in their own right' and not 'dependents'.

In the following, we will analyse some realities in which these principles of distributism apply across various sectors.

Case studies

Although it has repeatedly been accused of being a utopia, Distributism has demonstrated, in numerous cases, that it can be feasible in practice and at a very significant scale. Six exemplary cases will be considered below, of which only one is of Catholic origin, while the others are of non-denominational origin.

Mondragon Corporation

The first case is that of the Mondragon Corporation, which originated in Spain in the 1950s. It was founded on the initiative of a Catholic priest who inspired and guided local entrepreneurs in Mondragon, an impoverished city in the Basque region, torn by deep socio-economic contrasts. The Mondragon Corporation has since grown to include 81 cooperatives employing 70,000 workers, 35,000 of whom are members. In 2022, the Mondragon Corporation generated revenues of EUR 10 billion and an EBITDA of EUR 1.10 billion through its 104 branches operating in 150 countries (Mondragon Corporation, 2022). The

most important operational aspects of the Mondragon Corporation are numerous, and we can summarise them as follows. The first is a strongly democratic governance: the workers intervene by voting on salary decisions and strategic issues, and have a wage ratio between the maximum and minimum wage allowed that varies from 3:1 to 9:1, with an average of about 5:1, which allows resources not to be dispersed among a few, but redistributed on many and on investment and research and development activities. A second aspect is profit-sharing: the Mondragon Corporation's working partners are included in the redistribution of profits each year, allowing them to accumulate wealth in a way unlike that of the traditional wage earner.

Thanks to its policies, the Mondragon Corporation typically invests heavily (EUR 150-200 million per year) in research and development, employing over 2,000 people. These research and development activities are on both the technology and cooperative development fronts, demonstrating a strong loyalty to the original values. Another significant effect of the Mondragon Corporation's policies, especially taking into account the starting context, a situation of extreme poverty and social divide, is that the Mondragon region today shows a wage inequality (measured by the Gini coefficient with a value of 0.24 in 2021) comparable to that of Norway (0.22) and Finland (0.27) and other Nordic countries (Sweden, Denmark, Iceland). The analysis of these data and each nation's taxation system showed that while Nordic wage equality derives fundamentally from wage compression, the effect of Mondragon's policies is real wealth creation (Mondragon Assembly, 2022; Kelly, 2023; CIA, 2024).

In summary, the Mondragon Corporation achieves these results, i.e. it implements Distributism while maintaining both high industrial efficiency and very competitive performance in global markets. It thus demonstrates that Distributism is not incompatible with the challenges of the modern economy but, on the contrary, is applicable on a large scale in a highly differentiated and competitive industrial context.

Cooperative system of Emilia Romagna

Another very significant element that does not originate in a Catholic confessional context is the cooperative system of Emilia Romagna. Emilia-Romagna is a region in northern Italy that has developed a complex network of cooperatives, born in parallel and independently since the 1950s. This system has demonstrated, again on a large scale, that applying principles such as distributist principles across even very different economic sectors, including the production of goods, agriculture, and services, creates stable employment, fair income distribution, and resilient local economies that can withstand economic shocks (Médaille, 2013).

Wogeno Zürich

A third example, also from a non-denominational area, is the 'Wogeno' housing cooperative in Zürich. In this case, a cooperative society buys real estate, which it then rents to its members at favourable rates. Wogeno is managed directly by the members through a two-tier governance model: one central and one by the residents' associations in the various buildings. This is why it was selected for the present study among the many similar cooperatives in Switzerland and elsewhere.

In Wogeno (Wogeno Zürich, 2024), property allocation proceeds through a first decision-making phase at the cooperative level, during which basic requirements are assessed. The second and final phase of the decision-making process takes place at the property's resident association (called Hausverein). Among the various conditions the members of the individual association consider is the candidate resident's ability to align with the association's principles, in particular, the motivation to volunteer an average of 3-4 hours per week at the Hausverein.

This modus operandi not only delivers, as will be seen in a moment, a respectable business performance but also drives a virtuous cycle and the creation of strong, resilient communities.

The 2024 financial indicators for Wogeno (Wogeno Zürich, 2025) reveal a capital-to-assets ratio of 14.1%, which can therefore be considered moderate but sustainable; an operating margin of 15.4%, i.e., an excellent operating efficiency; and a sustainable exposure to mortgage financing, as it accounts for about 57% of the real estate. These metrics, and others, interpreted through the cooperation aspect, demonstrate financial viability that, while prioritising affordable rents, guarantees a very democratic governance model and a return on investment. In a nutshell, Wogeno, which is one of the many housing cooperatives in Zürich, manages to reduce rents to its members by about 15-20%, in line with other cooperative structures, demonstrating that the application of the principles of solidarity, subsidiarity and the common good is practical, not only from the point of view of business management, but also for the establishment of cohesive societies based on strongly shared principles. In Zürich alone, several other similar cooperatives, albeit with more traditional governance models, confirm the approach's validity. Regarding the two-level governance characteristic of Wogeno Zürich, it is a timely application of the principle of subsidiarity at an advanced, well-structured level. The first decision, in fact, is taken at the cooperative level for the more technical aspects, the competence of the 'cooperative' social body, which is at a higher level than the Hausverein. The second, and final, decision concerning the more specific aspects of the actual residence is taken by the local association, a lower level of competence but more suitable for this phase.

Milan Food Policy

In addition to the aforementioned cases of the application of distributist principles, others are only hinted at, one being the Milan Food Policy (Municipality of Milan, 2015), conceived in 2015, which consists of the definition of a municipal food system in which approximately 1.4 million residents are served through a food policy that prioritises local food from regional producers and is recognised internationally as a model for the creation of sustainable urban food systems. This mechanism includes a democratic governance model that involves citizens in policy decisions. In addition, 2300 urban vegetable gardens and a specific agricultural hub have been developed through it.

Mumbai Grahak Panchayak

Also in Mumbai, there is the Grahak Panchayat (Pai et al., 2017), a reality similar to the Milan Food Policy, which is essentially a consumer cooperative serving about 36,000 households and offering an average 20 per cent discount on market prices thanks to collective purchasing power. The Grahak Panchayat has been in operation for about fifty years (it was founded in 1975 to defend consumer rights), which has proven its long-term sustainability, also thanks to the ownership by members as cooperative members, democratic governance and the ability to self-organise in self-help groups, where at least 11 households join together to make monthly collective food purchases.

Also in this case, the economic model is based on Distributism principles and follows the rule, very common in such contexts, of 'no profit, no loss', which leads to managing the system in such a way as to cover, with adequate safety margins, the running costs, without aiming at profit in economic terms as much as at improving the common good.

Mutua Sanitaria Besnate

The latest example of the application of distributist principles is the Mutua Sanitaria di Besnate (MSB). Although it is a unique model in Lombardy today, in the past it was a model virtually ubiquitous in Italy. The MSB was founded in 1921 as a mutual aid society, a model of local aggregation for the provision of both medical-health and insurance-pension services. In 1978, with the start of the reform of the Italian National Health System (SSN), the other experiences all ended and merged into the SSN, while the MSB continued. MSB today is a cooperative society based in the small municipality of Besnate (around 5,000 inhabitants) in the province of Varese that provides medical services according to a not-for-profit principle, reinvesting all profits in improving services, and with a participatory governance model involving patients. Here, too, there is a strong identification with the territory and, although the MSB also serves non-residents, its core is within the municipality's population.

In this example, one can see how Distributism principles apply in contexts beyond the classic enterprise or food supply.

Distributism and Urban Shrinkage

As exemplified in the previous cases, the application of Distributist principles through cooperative systems or public-private collaboration brings several advantages that, analysed in the course of this research project, are summarised in the following table, where we consider some of the various challenges imposed by the socio-economic and demographic collapse, the consequent response (in synthetic terms) produced by the implementation of a Distributist philosophy and the operational mechanism that allows, in practice, to mitigate or even reverse the negative trend. All these elements, it should be noted, require medium- to long-term timeframes to deliver results.

Shrinkage Challenge	*Distributist Response*	*Operative Mechanism*
Lack of local identity	Create territory-based community identity.	Communities define cultural and economic identity through local institutions and enterprises, primarily through participatory governance and local networking and cooperation.
Economic collapse	Build a cooperative-based local economy.	Create small and large-scale enterprises with genuine cooperative governance across all economic sectors.
Cultural decline	Establish cultural circles and apprenticeships.	Community-owned schools and cultural institutions creation or empowerment; integrated apprenticeships within productive enterprises.
Infrastructure decline	Empower local infrastructure governance.	Delegate infrastructure management to local communities with microfinance support for local operations, and at the same time, create a network for cooperation among neighbouring communities.
Absence of planned growth	Create guild-based governance.	Guilds and cooperative enterprises provide participatory planning containers and collaborative implementation vehicles.
Population decline	Create local economic opportunity.	Develop the local economy by attracting workers through job creation and facilitating home acquisition, for example, through cooperative housing or cooperative credit initiatives.
Population aging	Support families with children.	Distributist enterprises allocate earnings fraction to social development, particularly family support and schooling; increased local wages support family formation.

Table 1 - How Distributism can fight the urban shrinkage

A framework for Urban Planning

This section presents a framework for urban planning that integrates the growth principle with realistic planning, effectively counteracting the decline of

collapsing cities. Such a framework requires various elements of participation and planning that Distributism facilitates.

The first is participatory design: urban planning must be based on genuine involvement of the entire community and be continuous, without interruption, throughout all phases, from planning to implementation and on to the various fundamental operational phases that follow.

The second type of participation is a structure based on a distributist guild, creating an institutional mechanism for sustained, persistent participation well beyond mere initial consultation.

A third pillar is multidimensional development. Urban interventions must address the physical, social and economic dimensions simultaneously. Approaches that are based solely on the infrastructure, and thus the physical issue, fail to deal with collapsing contexts. The economic development of the community, its social reinforcement, must be well represented in planning and thus complement the physical infrastructure. It could be said that, from the point of view of urban planning, it is necessary to work on three types of infrastructure at the same time, i.e. traditional physical infrastructure, social infrastructure and economic infrastructure, considering that social and economic infrastructure are a much broader context that also includes the creation of virtuous dynamics.

Finally, there is flexibility at the scale transition level. This means that it is necessary to create a planning tool that initially facilitates organisation in elementary forms, typically self-organisation at the small-scale level, but then, over time, provides for their replacement by larger-scale expansion, creating development pathways from small to large without requiring the abandonment of participatory governance.

Thus, it is possible to hypothesise three main directions for planning in collapsing cities.

The first guideline is to create a community-based organisation that is flexible during the growth phase. Urban planning must, in fact, initially be based on a small-scale self-organisation that preserves, however, the capacity to evolve towards a larger scale. This approach recognises that it is not possible to suddenly reverse a trend and then implement infrastructure at the city or significant institution level, because this would prove ineffective. The correct approach is to lay the foundation for future expansion as the population stabilises and potentially reverses the trend. The distributist solution enables this approach because guild structures provide an organisational framework that is highly effective, scalable and easy to activate. Guilds of local artisanal producers and those of cooperative enterprises can begin at a very local scale but quickly confederate into regional structures, as demonstrated by the Mondragon and Emilia-Romagna cases, creating both immediate improvements and enabling subsequent capacity building.

The second direction is to build a place-based economy and thus develop connecting infrastructure. Sustainable distributive economies require a strong connection with neighbouring communities. Therefore, the aim is not an autarchic village, but an economic exchange of goods and services that involves working regionally with partnership activities at the regional level, but maintaining control and ownership at the local level, thus a place-based economy of goods and services that is grafted onto a logistical network and is regionally coordinated, while keeping its roots firmly planted in the local area. This means that a communication and transport infrastructure must be developed to facilitate connectivity, particularly remote connectivity. Intelligent transport systems integrated with intelligent logistics nodes can be a modern, feasible example of such a network, enabling local producers to reach regional markets while maintaining local economic control easily.

The third guideline is the use of technology as a catalyst. Indeed, technology, in particular the use of software systems and blockchain, the latter especially in terms of smart contracts, can:

- Dramatically accelerate the growth of a distributist economy, enabling the rapid creation of a network of collaboration and communication between distributist companies,
- Enable rapid and reliable information sharing,
- Facilitate peer-to-peer economic transactions,
- Create a transparently managed supply chain.
- Enable participatory governance through digital platforms.

Of course, all this requires a digital infrastructure. In the case of Albania, for example, this would already be possible due to the narrow digital divide. Where such an infrastructure is lacking or deficient, it is the task of urban planning to provide for or enhance it.

At this point, it is possible to define spatial tactics for urban planning.

In the following table, the principles of a distributist economy have been applied to urban planning tactics, with examples of how they can be implemented.

Discussion

While distributism offers compelling solutions to urban shrinkage, its implementation faces substantial challenges. In this section, a SWOT analysis developed during the research is reported.

Strengths

The main strengths are summarised below:

- Local sustainability: Community-based organisations demonstrate intrinsic stability and resistance to external shocks
- Self-organisation capacity: Communities develop internal governance with-

Distributist Principle	*Urban Planning Tactic*	*Spatial Implementation*
Local communities living and operating in the territory	Plan rapid local recovery; create expansion rooms for future growth.	Quick-development districts, reserved expansion land, and phased master planning
Small-and large-scale cooperative enterprises across sectors	Develop productive districts at dual scale.	Handicraft zones and industrial areas; hybrid zones combining residence with workshops/laboratories; logistic exchange nodes
Apprenticeship and community-owned schools	Plan education near productive activity.	Schools positioned adjacent to handicraft and industrial zones; integration of learning with productive work
Local work opportunity with microfinance	Develop smart local transportation systems.	Public transit connecting residential areas to productive zones; fibre-optic and digital infrastructure; accessible microfinance access points
Guilds as planning and implementation containers	Systematic guild involvement in all planning and execution phases.	Guild representation in planning committees; guild coordination of implementation; guild management of operation and maintenance
Local economy producing private property with solidarity awareness	Develop mixed housing, retail, and production zones.	Integrated residential-commercial-industrial neighbourhoods; community-owned social housing alongside private ownership; retail activation
Social earnings allocation for family support	Reserve planning capacity for community social investment.	Designated spaces for kindergartens, healthcare facilities, cultural centres, planning for community governance and ownership

Table 2 - Urban tactics derived from Distributism

out dependency on external expertise (know-how preservation)

• Participatory governance: Integrated involvement increases legitimacy and implementation effectiveness (and creates identity and sense of belonging)

• Economic stability: Distributed ownership creates resilient enterprises less vulnerable to asset-stripping and capital flight

Weaknesses

The main weaknesses identified in the research are summarised below:

• Slow developmental process: Guild formation and cooperative enterprise development require time; expectations for rapid results often lead to abandonment

• Awareness and capacity requirements: Communities must develop business literacy, governance skills, and cultural commitment to cooperation; these capacities may be underdeveloped in areas experiencing decades of state socialism or market abandonment

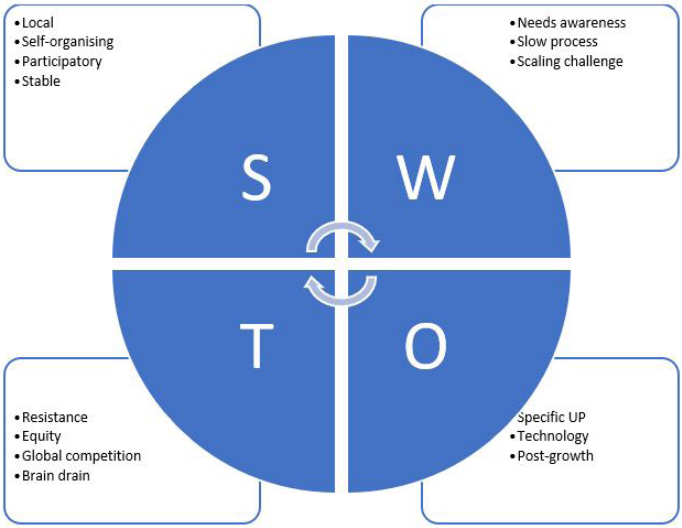

Table 2 - Urban tactics derived from Distributism

• Scaling challenges: While Mondragon demonstrates large-scale viability, the transition from small craft enterprises to industrial scale remains complex and incompletely documented (and could be a future research direction).

Opportunities

Various opportunities have been identified and are described below:

• Specific urban planning methodologies: Developing specialised planning approaches designed explicitly to support local communities and reverse shrinkage could substantially improve distributist implementation

• Technology integration: Digital platforms and blockchain could dramatically accelerate cooperative coordination and market access

• Post-growth paradigm shift: Growing intellectual acceptance of degrowth economics creates favourable conditions for non-conventional development models based not only on growth but also on social and economic justice

Threats

Various threats have been reported, and they are summarised below. Mitigating these threats can represent new research directions.

• Institutional resistance: Existing power structures and professional planning cultures resist paradigm shifts

• Capital requirements: Initial development of cooperative enterprises requires access to capital; traditional financial systems often resist cooperative lending

• Global competition: Local enterprises face competition from multinational corporations with superior capital, technology, and market access (in this case,

the local market is the flyingwheel to preserve enterprise stability)

•Brain-drain continuation: Even successful local economies may struggle to retain educated youth attracted to global opportunity (sense of belonging can reduce this)

Conclusion

This paper shows that collapsing cities pose a specific challenge for urban planners and require a fundamentally different planning approach. In the context of urban growth, Albania exemplifies the severity of this change, with an accelerating population decline and structural economic decline threatening the long-term viability of some peripheral regions.

Conventional growth-oriented planning paradigms have proven ineffective and, paradoxically, have often worsened the collapse, consuming resources, attempting to attract immigration, and failing to meet the needs of existing residents.

An alternative paradigm, based on the socio-economic principles of distributism, can offer prospects for creating cohesive communities, generating a robust local economy and reversing the flow of migration.

The examples of the Mondragon Corporation, the Emilia-Romagna cooperatives, and others demonstrate that Distributist principles can be implemented at any scale, providing both economic efficiency and social justice in a manner not possible with conventional capitalist or socialist state approaches. However, translating Distributism into a collapsing environment requires the development of specific urban planning methodologies explicitly designed to support local communities by fostering distributist enterprises, guild-based governance, and integrated interventions that address physical, social, and economic aspects simultaneously.

The economic and demographic challenges many Albanian cities face today are not a temporary cyclical phenomenon but structural transformations that require awareness, intellectual honesty, and the capacity for strategic innovation. Accepting the reality of this situation creates a space to develop approaches that are more effective and efficient in recovering urban conditions, rather than continuing to pursue failed growth strategies. Distributism, well-rooted in centuries of cooperative experience and contemporary successes, offers a viable path towards the rebirth of urban centres. Rigorous academic research, active community involvement, and policies that support these aspects can translate Distributist principles into an urban planning methodology capable of reversing the collapse while creating more equitable, participatory, and sustainable cities in the meantime.

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Evaluation of geomorphological conditions in the dynamics of urban development evolution in the city of Gjirokastra

Dr. Andri HOXHA
Department of Geography, University of Tirana, Albania, andri.hoxha@unitir.edu.al
ORCID: 0009-0002-5189-7420

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Abstract

The current process of urbanization requires the understanding and assessment of geomorphological conditions in function of urban infrastructure. Gjirokastra is a city located on the eastern slope of the Mali i Gjerë mountain ridge, with a direct connection to the Drino valley. The urban geomorphological heritage is closely linked to urban geomorphology and the dynamics of landform transformations. Through urban geomorphology, the suitability of relief elements has been analyzed in relation to the expansion of residential and industrial objects. The dominant position of Gjirokastra Castle in relation to the surrounding segments created the conditions for the formation of the earliest urban center of the city, which then expanded toward the surrounding hills and the terrace of the Drino valley. The vertical zoning of the terrain has determined the placement of Ottoman-style houses in the hilly sector and apartment blocks along the Drino valley. Looking ahead, the gradual expansion of the city requires analysis of current terrain modeling processes. Scientifically-based criteria must be applied in the expansion of the cultural heritage zone, taking into account the evolution of landforms, which over the last four centuries have undergone significant morphological changes due to increasing urban pressure and cultural tourism.

Keywords:
cultural heritage, relief, tourism, urbanization

4.14. 1. Introduction

Urbanization is one of the major challenges that the world faces. (Schneider et al. 2009) Urbanization and correlated infrastructure building highly impact and sometimes completely destroy landforms. Nevertheless, urban areas are particularly interesting from a geomorphological point of view for three reasons:(Reynard,2017) Currently, urban geomorphology addresses new questions such as ecosystem services pro¬vided by geomorphological processes and land¬forms(Picket et al. 2001), (Gordon et al. 2012), (Gray et al. 2013) interconnections between geomor¬phological and anthropogenic systems, studied through holistic approaches, and the need to merge physical geography and human and social sciences approaches.

Geomorphological surveying is the basis of other kinds of analysis and relative applications for each case study and it consists of the following:

a. scientific literature and technical materials collection;

b. a multitemporal and multidisciplinary approach;

c. field surveying.

The multitemporal and multidisciplinary approach is based on aerial photograph interpretation, historical cartographic documents analysis and comparison to actual topography, nature of bedrock and deposits analysis through, qualitative and quantitative assessment, reference to historical documents and maps, or photograph. Field surveys are fundamental for observations and direct data checking. We also consulted numerous geographical books and papers to collect information relevant to the geomorphologic characteristics that were present.(Pica,2024)

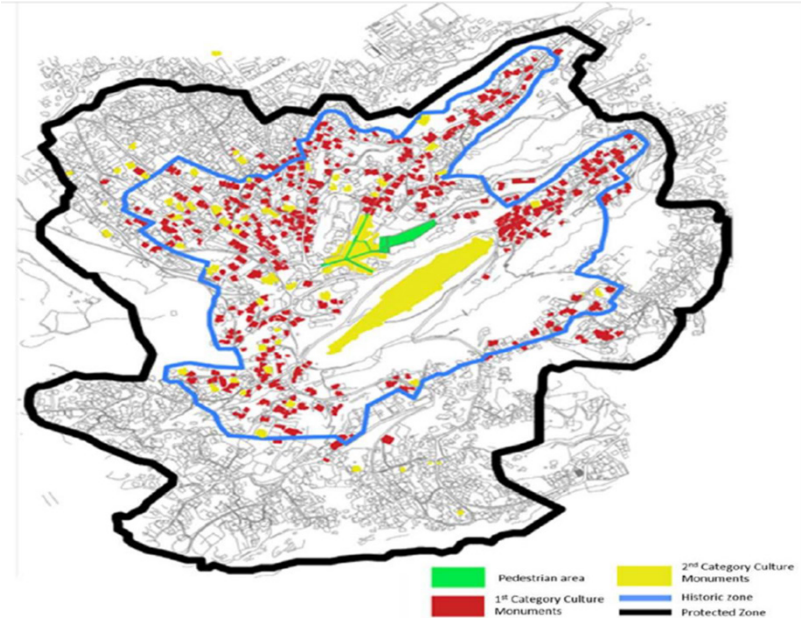
The city of Gjirokastra is included in the eastern part of the Drino River Valley, which is included in the physical-geographical subunit of the Southern Mountainous Region in the territory of the Republic of Albania. The city has a population of 16,569 inhabitants.(INSTAT,2023) This valley lies between the mountain range of Mali i Gjerë in the west and the mountain range of Lunxheria in the east. The Drino Valley serves as a connecting corridor with the Republic of Greece, and greatly influences the penetration of continental air masses towards the interior of the territory of the Republic of Albania.

1. the geomorphological context (site) of Gjirokastra City (Onde 1966) is part of his“image” and his fame (e.g. the revers of Monoclinal Crest of Mali i Gjerë);

2. Urban sprawl often interacts with geomorphological processes (e.g. landslides) and landforms (e.g. fluvial or coastal forms), and necessitates specific methods to deal with geomorphological processes;(Mohapatra et al. 2014)

The World Heritage Site of the Museum-City of Gjirokastra was inscribed on the World Heritage List in 2005. It is a compact city with a Historical Center built of stone buildings one above the other. A good part of the alleys are pedestrian streets, because they were conceived in another era. In the characteristics of these ensembles, a decisive role is played by the configuration of the terrain on

which they are built. The most picturesque ensembles that we can find in Gjirokastra are: “Old Pazar”, the “PIlakë” neighborhood and the “Hazmurat” street of “Qafa Pazarit” is part of the Museum Zone, of the first category, with a width of 5□6 m., with a high slope and paved with stones. Within the historic area of Gjirokastra there are 323 Cultural Monuments.(Fondi i Zhvillimit Shqiptar,2022)



Map 1: Map of the historical area and cultural monuments in the city of Gjirokastra. Source: Fondi i Zhvillimit Shqiptar,2022

Based on a bibliographical review, this paper addresses the main challenges of research on geomorphological heritage in urban contexts, the definition and characterization of urban geomorphological heritage and the various methods developed for describing, mapping and assessing urban geomorphological heritage;(Reynard, 2017)

Geomorphology interacts in various ways with city and urbanization:

a) Landforms contribute to the landscape and natural heritage of city. They sometimes participates to the “image” of the city. Thus, the landscape of Gjirokastra, is inseparable from the cuestas and terraces of Drino Valley.(Fernandes et al. 2010)

b) Landforms may also constitute a constraint to urban development. Some¬times it is the boundary between two geo¬morphological contexts that prevents urbani¬zation in certain directions, such as, for example, the relationship between the mountain range of Mali i Gjerë to the west and the Drino valley to the east of the city of Gjirokastra. Some specific geomorphological contexts also give rise to important urban planning constraints.(Bondesan 2017).

Photo 1. The central part of the city of Gjirokastra. Palorto neighborhood in the lower sector and Dunavat neighborhood in the upper sector. Source: Hoxha,2025

4.15. 2. Methodology

The scientific paper contain the main features of the city of Gjirokastra: the city typology, in terms of size,the geographical context, in terms of landscape; the main geomorphological processes acting; the study topic; and the methodological approach used. A brief overview neighborhoods of the city, including their geological and geomorphological frameworks. (Pica, A, et al.2024) We also consulted numerous papers and geographical books and papers to collect information relevant to the geomorphologic characteristics that were present. In addition, important information on natural landforms that are now hidden was obtained from interviews of elderly people who described the recent modifications. The analysis of the landforms in the study area was performed by means of a geomorphological survey. We obtained information on the action of surface processes over time to show how the area has been subjected to rapid morphological changes. Multidisciplinary data integration allows the recognition and reconstruction of geomorphological characteristics; in particular, anthropogenic erosion and accumulation.(Pica,2024)

4.16. 3. Results

The natural landscape in which Gjirokastra has developed was primarily moulded by fluvial processes. Specifically, the following rules were adopted:

(1) Man-made landforms were included in this category when they completely erased the natural morphology (in this case, an indication of the previous morphology was given, if possible); (Del Monte,D'Orefice, Luberti, Marini, Pica, Vergari, 2016)

(2) Natural landforms modified by man, but still recognizable, were grouped in the original morphogenetic process category.(Del Monte,2017)

In terms of lithological construction, the eastern sector is mainly composed of lower oligocene flysch rocks, which are characterized by a low degree of stability. In the western peripheral edges of the city, cretaceous limestone rocks appear.(Collective of Authors.,2014) In the eastern peripheral sector of the city, quaternary deposits of continental facies appear, with a large presence at the levels of the river terraces of the Drino valley.(Mezini,1985) During the periods of morphotectonic and morpholithological evolution, the tectonic factor, through the subsidence tectonic movements of the Drino synclinal structure during the quaternary age, as well as the uplift tectonic movements during the end of the Quaternary, has significantly determined the morphological development of the valley. While the lithological factor, through the flysch rocks that make up the arms of the Drino synclinal structure as well as the flysch and limestone rocks that make up the ridge of Mali i Gjerë, have determined the degree of selective erosion of the activity of external processes modeling the relief.(Collective of Authors.,2014) In the upper sectors above the Dunavat neighborhood, respectively along the spine of the monoclinal ridge of the Mali i Gjerë ridge, built of limestone rocks, very close to the “Ali Pasha Bridge” and the “Former Stone Aqueduct” of the city of Gjirokastra, in addition to the morphological development of karst grooves and canyons, phenomena of surface erosion of temporary water flows also develop, such as the Gjokana, Çullo, Gjonaj streams, etc. (Krutaj,1991) The spine of the monoclinal ridge of the Mali i Gjerë presents the morphological features of the structural surface, over which the dense karst hydrographic network circulates. Collapse processes often occur, due to the combination of unstable siltstones and clays in the lower part with strong sandstones in the upper part, causing the loss of the balance of the aforementioned rocks, which as a result have caused massive piles of flysch to break off in the neighborhoods of Punëtori, Cfakë, Kodra e Shtufit, Dunavat, etc. The Eocene and Paleocene sandstones, which lie in the upper sector of the city of Gjirokastra, are distinguished by their great impermeability and have conditioned morphological contrasts in the relief, causing a dense network of rocky and muddy streams, with quite diverse directions, which as a result have formed consistent valleys with symmetrical slopes.(Collective of Authors,2014) While in some fragments of the upper sector of the city, due to the opposite slope of the flows, in relation to the slope of the monoclinal structure of the Mali i Gjerë, obsequent valleys have been formed, with quite symmetrical slopes and small sandy rocky ledges of 2-3 meters, accompanied by a bottom with a linear extension of water beds. Some of the grooves and valleys in the flysch rocks have been formed due to slope processes, such as landslides, collapses and surface erosion. Karst groundwater in limestone rocks circulates to the bottom

of the Drino valley, such as the Viroi spring to the east of the city. Within the framework of the relief features formed in the monoclinal structure, it results that all these forms have reciprocal relationships between them, because some of the morphological constituent elements, such as the back and forehead of the monoclinal ridge of Mali i Gjerë and the cuesta with flysch composition, contact the consequent, obsequent and subsequent valleys. The flysch lithological scarp in the Këculla segment, appears with great height, due to the low value of the erosion base level in the Dunavat and Palorto neighborhoods. In the lower eastern segment of the city, at an altitude of 150-170m, near the 18 Shtatori neighborhood, the presence of the depositional glacis belt is clearly visible, which gradually becomes identical with the first level of the Drino river terrace. The structural terrace in the Varosh, Cfaka and 18 Shtatori neighborhoods were formed due to selective erosion during the destruction belt between the Oligocene flysch rocks and the Eocene fragmentary limestones. In the Dunavat i Poshtëm and Dunavat i Sipërm neighborhoods, the slopes have clear elements of the structural surface, mainly in limestone rocks, which are intensively cut by the Çullo, Gjinaj and Dunavat rock falls, which transport large amounts of proluvium and colluvium deposits. Erosion glacis are formed and develop in sectors consisting of Paleogene flysch rocks, which are unstable, mainly along the fragments of the slope range of the structural relief, such as along the foot of the monoclinal ridge of Mali i Gjerë, etc.(Derruau,1965) Streams glacis are mainly formed in the monoclinal structure, such as in the cuesta that appear on the hill of Hazmurat, Dunavat i Poshtëm and the Cfaka neighborhood.(Dumas,1977)

4. Discussion

In the discussion, the following strengths of the approach are highlighted: the multi temporal analysis of multidisciplinary data allows the analysis of anthropogenic erosion and accumulation of types and rates and their impact on natural morphodynamics, and to plan and manage the urban sprawl adequately: the investigation of these factors enhances the knowledge of hardly transformed natural dynamics and the interaction between anthropogenic processes and natural ones in triggering natural hazards; the above mentioned analysis and related results are useful for inventorying urban geomorphosites, testifying to the anthropogenic geomorphological evolution of the relief.(Pica,2024) Most of the hydrographic network is currently affected by linear erosion, even if the major streams are subject to erosion control and drainage management. Several ancient gullies have no topographic evidence, being completely filled by anthropogenic deposits such Gjonaj Çullo, Dunavat etc.(Del Monte, Fredi, Pica, & Vergari, 2013)In the eastern area, many scarps overlooking the Drino alluvial plain have polygenetic origin: erosion started by fluvial incision along the lines of tectonic weakness. Some stream elbows Manalat, Dunavat, Çullo etc, indicate a tecton-

ic control on drainage network development. The main ridge “Castle of Gjirokastra” presente a cuesta landform on monoclinal structure, with flysch stones mainly with siltstone and marlstone, generally impermeable which condition the temporary and fragmentary development of mud streams.(Del Monte, 2017)

In Gjirokastra City, population growth and human activities have gradually transformed natural geomorphological processes over the centuries; the rapidity of construction activities may have dramatically different impacts on natural topography. The geomorphological analysis supporting hazard assessment is important considering that human activities hardly transform natural dynamics in urban areas. Considering what we stated above about human activities and natural dynamics, in our opinion the interaction between anthropogenic processes and natural ones over time should be considered in natural hazard assessment. The analysis of landscape evolution and paleomorphologies in urban area provides useful knowledge for a better comprehension of the interactions between human and geomorphological processes.(Pica, 2024)

5. Conclusion

The geomorphological research into the urban environment has potential for enhancing basic knowledge of natural and anthropogenic morpho-evolution and for making cities and human settlements safe, resilient, and sustainable, as planned in Sustainable Development (geohazards assessment.(Pica,2024) This brief overview of the relationships be¬tween geomorphology and urbanization, and various aspects of urban geomorphological heritage, shows that urban contexts have been neglected within geomorphological heritage research in recent decades. Indeed, on the one hand, the interactions between landforms and urbanization are complex and multiple. As for the geotouristic products, they are not really devel¬oped compared to what has been done in rural and natural contexts.(Reynard, Pica, Coratza, et al, 2017) Landform designing may take into account three main factors: the integration of the artificial forms with the sur¬rounding landforms; the viewpoint design; and the composition of a view with visual ob¬jects, as such structural landforms, mass wasting landforms, fluvial and karst landforms etc.(Yamaguchi et al. 2008)

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Megaprojects as Ruins-in-Waiting
A Postmodern Reading of Incompletion in Tirana

MSc. Kejsi Veselagu,
Department of Architecture and Engineering, POLIS University, Albania,
kejsi_veselagu@universitetipolis.edu.al
***ORCID:** 0000-0001-5249-9710*

DOI: 10.37199/c41000408

Abstract

In Tirana, the unfinished has become an architectural condition in its own right. This paper investigates the socio-political and aesthetic logic of the incomplete, over-promised and speculative megaprojects, framing them as "ruins-in-waiting" that reflect the deeper ideological structures of postmodern urbanism. Engaging with Jean-Francois Lyotard's critique of grand narratives and Frederic Jameson's analysis of late capitalist spatial production, the paper argues that incompletion functions not as a flaw in the system, but as a defining expression. The projects of the high-rise towers become visual and material manifestations of a city governed by deferred futures and aestheticized promises. To further contextualize this phenomenon, the paper draws a conceptual parallel with the surreal etchings of Giovanni Battista Piranesi. His visionary ruins are employed as a critical lens through which Tirana's contemporary landscape can be read: monumental yet suspended, intricate yet devoid of use. By analysing this visual language and political economy of the megaprojects, the paper proposes that Tirana offers a paradigmatic case of post-socialist urbanism in which the ruin is no longer a remnant of the past, but a permanent placeholder for futures that never arrive.

Keywords:
Incomplete, postmodern, towers, visual

Tirana and the Dichotomy of the built and unbuilt

Walking through the city of Tirana today is to navigate a space that is organized by a pervasive opposition: the built and the unbuilt, the material and the promised. Cranes punctuate the skyline while banners advertise photorealistic renders of soon-to-be towers, their foundations lie dormant for months or years or finished buildings stand unoccupied, their interiors awaiting programs that never arrive. The city manifests an urbanism of anticipation, a choreography of fragments both emerging and stalled.

This condition is not peripheral but central to Tirana's contemporary identity. The speculative architecture that dominates the cityscape comprised of luxury high-rises, mixed-use megaprojects, and branded landmarks, forms an urban grammar in which incompletion becomes normalized. The city's "architecture of becoming" is a stable condition, wherein the incomplete is not a defect but a mode of existence.

The paradox of this environment is evident: the city appears to be perpetually under construction, yet the trajectory toward completion is constantly deferred. Whereas in traditional urban development the unfinished denotes a temporary stage en route to completion, in Tirana it often signals a prolonged suspension. This prompts a key question: what is the meaning of this incompletion, and what does it reveal about the ideological structures governing contemporary urbanism?

Postmodernism, Late Capitalism and the Architecture of the Unfinished

The architectural and urban condition of contemporary Tirana cannot be adequately understood through conventional paradigms of development, progress, or urban growth. The proliferation of megaprojects where some are rising, some stalled, some completed yet curiously unoccupied, reveals a deeper structure of meaning that transcends technical explanations of construction cycles or market fluctuations. Instead, Tirana's urban reality invites an interpretation grounded in the theoretical legacy of postmodernism and its associated critiques of representation, capitalism, and cultural production.

Jean-François Lyotard's diagnosis of the postmodern condition as one defined by the collapse of meta-narratives provides an epistemic framework for understanding why contemporary architecture often appears unmoored from cohesive ideological direction. Without unifying legitimating stories, legitimacy shifts toward efficiency, performance, circulation, and market logic (Lyotard, 1984). Fredric Jameson complements this perspective by interpreting postmodern cultural production (including architecture) as a direct expression of late capitalist economic structures. For Jameson, architecture becomes a site where financial abstractions manifest spatially, resulting in a built environment dominated by spectacle, commodification, and pastiche (Jameson, 1993).

These theoretical tools expose how the logic of incomplete or speculative megaprojects in Tirana is a product of deeper ideological mecha-

nisms. The “unfinished,” the “over-promised,” and the “ruins-in-waiting” are symptomatic expressions of the postmodern collapse of narrative and the capitalist drive toward immaterial accumulation. When these forces converge in a rapidly transforming post-socialist capital city, the result is a unique urban landscape in which the future is constantly announced and never fully materialized and thus a city governed by deferred promises.

To illuminate this condition, it is necessary to engage in a double reading by first analysing Tirana’s incompletion through the lens of Lyotard’s performative legitimation and Jameson’s late-capitalist spatial production and then situating the aesthetic logic of these megaprojects in a conceptual dialogue with the visionary ruins of Giovanni Battista Piranesi. The comparison between Piranesi’s etched past and Tirana’s rendered futures demonstrates that both operate through fantasy, spectacle, and the production of images that exceed material reality. In Tirana, however, this spectacle pertains not to ruins of the past but to ruins-in-waiting, objects whose destiny is in perpetual suspension.

Lyotard and Jameson’ postmodern problem

The problem of Legitimacy

Lyotard’s conceptualization of postmodernity as the epoch in which meta-narratives have collapsed offers a powerful interpretive entry point. In The Postmodern Condition, Lyotard argues that the legitimating stories that once anchored knowledge and action, such as the Enlightenment belief in human progress or the Marxist vision of collective emancipation, have ceased to function (Lyotard, 1992). With their collapse, society no longer possesses shared criteria for determining what counts as true, valuable, or legitimate.

In architecture, modernism exemplified an era of strong narratives. Functionalism, rationalism, technological progress, and social improvement served as legitimating frameworks that structured architectural production. The modernist claim that form should follow function provided a normative anchor that aligned aesthetic, social, and moral criteria.

Postmodernism, by contrast, operates without a unifying story. According to Lyotard, in a world deprived of grand narratives, legitimacy shifts from epistemic or moral criteria to performativity (ibid). What matters is what functions efficiently, circulates effectively, or produces value which can be economic, symbolic, or political.

This shift is highly visible in today’s architectural culture, especially in rapidly transforming cities such as Tirana. Here, buildings are not primarily evaluated according to their functional utility or social purpose, but by their:

- Market performance (investment return, branding value)
- Symbolic Capital (visibility, iconicity)
- Political utility (signaling modernity, supporting governance narratives).

Legitimacy becomes tied to spectacle, circulation, and the promise of fu-

ture capital accumulation. In this framework, incompletion irreversably becomes a performative gesture. A megaproject under construction can already generate financial transactions, symbolic presence, and political messaging. Its value circulates long before its walls solidify. Its renderings, announcements, and speculative imagery contribute as much to its legitimacy as its eventual architectural form. The building "works" even before it exists. Thus, the unbuilt tower wrapped in its glossy render is an operative image and a performative node in a wider apparatus of legitimation.

Late Capitalism

If Lyotard identifies the epistemological crisis that shapes postmodernity, Jameson on the other hand reveals the structure underpinning it. In Postmodernism, or the Cultural Logic of Late Capitalism he argues that postmodern culture emerges directly from the dynamics of late capitalism, in which financial abstraction becomes the dominant organizational force (ibid). Architecture, for Jameson becomes one of the most visible representations.

Architecture serves as the medium through which the abstractions of capital become material. Real estate development is a prime example: the value of a building lies not in its materiality but in its status as a financial instrument, a vessel for investment flows, debt structures, and speculative revenue and as such building is treated as mere assets.

In Tirana, this dynamic is heightened by its post-socialist transformation. In the decades following the collapse of state socialism, property markets opened rapidly, regulatory frameworks struggled to keep pace, and foreign investment became a primary engine of urban change. Under these conditions, architecture becomes commodity, mosly a brand, also a sign-exchange system and a speculative instrument.

Jameson's concept of pastiche further showcases the aesthetic dimension of this process where pastiche refers to the imitation of styles without underlying depth or historical grounding. His comparison between Van Gogh's Peasant Shoes and Warhol's Diamond Dust Shoes is emblematic: Warhol's work, emptied of existential content, circulates as a glamorous surface detached from material or existential experience (figure 1).

Applied to architecture, this explains why buildings like Steven Izenour's "Duck" once epitomized postmodern semiotics: they openly displayed their rhetorical and symbolic function. But when compared to Tirana's Skanderbeg Tower by MVRDV, a semi-abstracted image of Albania's national hero translated into a skyscraper façade, the Duck appears almost sincere and entirely realistic, shifting its position more closesly to Van Gogh's boots than Walhol's flatness. The Skanderbeg Tower represents a new intensity of symbolic commodification, where national identity is rendered as a marketable skin (figure 2).

Figure 1. Comparison of Van Gogh's peasant shoes and Andy Walhol's Diamond Dust Shoes. Source: The Postmodern Condition

Figure 2. Comparison of Steven Izenour's "Duck" shed and MVRDV's Skanderbeg Tower. Source: Wikimedia Commons

This shift indicates that contemporary Tirana presents itself as a hyper-postmodern stage in which the pastiche has become fully naturalized, and symbolic forms serve as instruments of capital circulation.

Ruins-in-waiting

Aesthetics and Piranesi

Vitruvius' triad: firmitas, utilitas, and venustas, provides a classical lens through which to understand the emergence of the ruin as an aesthetic object (Pollio, 2018). Ruins are buildings that have lost their stability (firmitas) and their use (utilitas), preserved only through their aesthetic expression (venustas). As such, the ruin is architecture reduced to its image.

Giovanni Battista Piranesi's 18th-century engravings of Roman ruins exploited this condition. In the etchings of collapsed temples and fractured walls, Piranesi simultaneously recorded material reality and injected imaginative grandeur. His ruins were real and material but also simmulatenously imaginary and fantastical. His drawings blurred the line between the historical fragment and the speculative reconstruction. (Wilton-Ely, 1988)

Crucially, Piranesi's work demonstrates that the aesthetic experience of ruins is not passive but projective. It requires imagination. The observer must envision what once stood or what the fragment signifies. This projective element makes the ruin a fertile metaphor for the architecture of the incomplete.

Tirana's Renders as "Ruins-in-Waiting"

In Tirana, Piranesi's speculative imagination finds its contemporary analogue of the drawings of the past into the renderings of the future. The photorealistic 3D renderings that circulate on billboards, social media, and planning announcements actively shape urban perception, influence capital flows, and produce their own legitimacy. These renders share key characteristics with Piranesi's etchings in the fact that they both exceed material reality which they embellish and exaggerate. They rely on fantasy to produce symbolic appeal and to project a reality that is not (yet) present.

But unlike Piranesi's ruins, which depict the past, Tirana's renders depict a future that may never arrive or it id does it is not entirely compatible with what was exactly promised. They are images without substance, architectural fantasies awaiting materialization. Their aesthetic beauty often surpasses what is ever constructed, creating a speculative layer that hovers above the physical city. This makes the renders "ruins-in-waiting": visions of buildings whose material futures remain uncertain, whose eventual decay begins even before completion, because their primary function is to perform a circulatory economic role rather than a utilitarian one.

The formal parallels reinforce this conceptual link. When one places Piranesi's Hadrian's Villa alongside ODA's proposals for Tirana, or compares the stacked, arch-like geometries of the Via Appia ruins to the CHYBIK + KRISTOF tower, the resemblance is striking. The eroded crown of the Cecilia Metella Mausoleum finds its aesthetic echo in the perforated top of the MET building. These similarities reveal that Tirana's architectural imaginary draws from the same grammar of spectacle and monumentalization that animated Piranesi's visions (figure 3).

Virtuality and Materiality

Giovanni Battista Piranesi embellished the material ruins of Rome, extending fragments of stone into visionary worlds through the force of his imagination. Tirana's speculative architecture reverses this dynamic. Instead

Figure 3. Comparison of Piranesi's drawings with the renderings of Tirana's towers. Source: Author

of elaborating what already exists, contemporary development embellishes futures that have not yet materialized. Renderings, virtual fly-throughs, and polished promotional images precede and often overshadow construction itself. These images fabricate the promise of a future. In this sense, the city's architectural culture moves through anticipation rather than memory.

Although these speculative projections gesture toward a virtual horizon, they do not float freely above the city. Their authority depends on material and the tactile residue of ongoing urban transformation. Tirana's urban reality emerges through

the interplay between these two registers. The city is shaped through the labor of cranes and concrete, but also through the continuous circulation of alluring images, political declarations, and commercial narratives. The speculative sphere influences perception as strongly as the physical one, creating a hybrid environment where architecture unfolds simultaneously in digital and material form.

This interdependence becomes particularly visible when examining Piramida, Skanderbeg Tower, and Downtown One, three emblematic projects (figure 4) whose renderings and built forms diverge in revealing ways. Each project involves an atmosphere constructed digitally: perfect light, idealized vegetation, curated skies, and an urban cleanliness that no inhabited city can sustain. The shapes presented in the renderings often correspond closely to what is eventually built, yet the emotional register of the renderings rarely transfers into reality. The fantasy evaporates once the building acquires weight, texture, and the contingencies of everyday urban life.

In the case of Piramida the visualizations present a luminous cultural hub infused with transparency and lightness. Circulation appears effortless; the heavy socialist monument seems reborn as a frictionless creative space. Once encountered materially, the renovated structure behaves differently. The concrete retains its density; its edges remain sharp; its mass does not dissolve under the glow of digital skies. The visualization imagined a building in continuous suspension, but the physical structure reasserts its gravity and its historical residue. The atmospheric qualities of the renderings (vibrancy, purity, an almost utopian openness) never fully translate into the completed work.

A similar tension emerges with Skanderbeg Tower. In the images distributed prior to construction, the tower appears sculptural, luminous, and monumental without heaviness. Its façade seems to absorb light and radiate it back into the square. Once built, the same façade reads differently. The structure dominates the space through mass rather than radiance; the protruding forms cast shadows more forcefully than in the renderings; and the building settles into the urban fabric with a gravity that the polished visuals actively suppressed. The draws convey an object liberated from context; the physical building participates in the context more bluntly.

Downtown One provides an even clearer example. Its renderings present a tower with crystalline precision: a pixelated façade gleaming against an ideal sky, framed by a cityscape stripped of disorder. In the built version, the surfaces lose their digital brilliance. Real glass behaves differently from its virtual counterpart. The tower becomes a part of the city's complexity rather than a purified symbol of futurity. The distance between representation and materiality becomes unmistakable: the building adopts the mood of Tirana rather than reconfiguring Tirana into the mood of its renderings.

Figure 3. Comparison of Piranesi's drawings with the renderings of Tirana's towers. Source: Author

Results

The comparison across these three cases reveals a consistent pattern. Renderings and buildings form a dynamic relation, each shaping the other in specific ways. The digital images generate a momentum where they stimulate desire, attract investors and frame public expectations long before the first concrete pour. The images circulate through media ecosystems (billboards, marketing campaigns and the press) and their momentum establishes cultural legitimacy by constructing an aesthetics of progress that precedes the actual experience of the urban environment.

At the same time, the material structures constrain and recalibrate these

digital imaginaries. The foundations and frames provide the necessary evidence that the projected futures might eventually take shape. Construction gives the speculative images a foothold in reality, even if the final product diverges from their atmospheric promises. Materiality interrupts the seductive smoothness of the renderings, introducing texture, imperfection, and the lived rhythms that digital environments cannot fully simulate.

This interplay produces an urban condition where incompletion becomes a sustained mode of existence. A building generates its greatest symbolic, political, and financial energy in the period between announcement and completion. During this interval, the project is both present and absent, both visible and invisible. It occupies a liminal status that enables it to carry maximal speculative charge. Once the building is complete, the speculative horizon closes; its symbolic potency begins to stabilize and often diminishes. The project becomes ordinary, subject to the friction of daily life rather than the excitement of projected possibility.

This dynamic reshapes how legitimacy functions in Tirana's architectural culture. Rather than deriving authority through material endurance, functional necessity, or civic embeddedness, many projects rely on performative gestures. Announcements, visualizations, and ceremonial groundbreakings operate as crucial acts that define the identity of the project more powerfully than the completed building itself. The image of futurity becomes a primary urban tool. The virtual plane accompanies the built environment while it also actively directs it.

The consequence is a city composed of dual temporalities: one experienced physically and incrementally, and another encountered through promises, projections, and aestheticized futures. Tirana becomes a landscape in which architecture is constantly in the process of arriving. The city asserts itself through ambition, through images and through speculation. Materiality alone cannot explain its transformations; nor can digital representation. Only the entanglement of the two captures the full scope of its evolving urban condition.

Conclusion

Tirana offers a paradigmatic case of post-socialist urbanism in which the unfinished becomes a defining spatial and ideological category. The megaprojects that populate the city's skyline whether built, unbuilt, or perpetually under construction, express not only the pressures of global capital but also the collapse of architectural legitimacy into performativity.

Through Lyotard, we understand the loss of shared narratives and the rise of performative legitimation. Through Jameson, we recognize the commodification of architecture and the intensification of pastiche under late capitalism. Through Piranesi, we see how speculative imagery shapes the aesthetic and affective dimension of the city.

In this triangulation, the contemporary high-rise towers of Tirana emerge as

ruins-in-waiting: objects suspended between material solidity and virtual fantasy, between political projection and economic speculation. They are placeholders for futures that remain perpetually deferred and in this sense, Tirana institutionalizes incompletion, making it the core logic of its urban condition.

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Territorial Reasoning Beyond Coordination

Prototyping Urban Suitability Score Maps for custom readings of post-transition Tirana

MSc. Fulvio PAPADHOPULLI,
IF, POLIS University, Albania,
fulvio_papadhopulli@universitetipolis.edu.al
***ORCID:** 0009-0002-1693-664X*

MSc. Megi TAFAJ,
FAD, POLIS University, Albania,
megi_tafaj@universitetipolis.edu.al

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Abstract

In some post-transition cities characterized by dense urban palimpsest, we observe that urban transformation advances through a patchwork of opportunistic interventions that often contrast approved, city-wide strategies. In Tirana, the cumulative effect of such decisions is a territory where large-scale masterplans coexist with fragmentary, site-specific developments, producing both visible dynamism and deep spatial incoherence.

This paper introduces a lightweight, data-driven methodology for prototyping Urban Suitability Scores (USS) as adaptable metrics which can inform and support decision-making.

Using cadastral parcel data, a compact set of urban indicators (e.g., accessibility, regulatory capacity, amenity proximity), and by introducing a Lean Canvas Model as an interpretative reading bridge, we developed a generative workflow in Grasshopper (Rhinoceros 3D) that tests the possibility to translate qualitative stakeholders' priorities into quantitative, weighted attributes. These are later clustered via a Gaussian Mixture Model (GMM) algorithm (LunchBox ML plugin) to evidence suitability classes' fluctuation trend for targeted interventions. The clustering output renders them into spatially explicit, optimized, gradient-coded maps.

This back-testing frames the tool not as a predictive engine, but as an experimental diagnostic device for territorial reasoning. This research contributes a transferable framework for reading the fractured development trajectories of post-transitional urbanism, to reveal hidden dependencies or patterns that inform and support different urban scale related decision-making processes.

Keywords:
Gaussian Mixture Model, Territorial Reasoning, Tirana, Unsupervised Learning, Urban Suitability Score, USS

INTRODUCTION

Post-transition cities, emerging from post-socialist or otherwise centrally regulated regimes, are frequently marked by discontinuous trajectories in which mega-projects puncture inherited plans through strategic political and economic alliances. Cases such as Belgrade's Waterfront, Moscow's MIBC, Gran Torre Santiago in Chile, Tbilisi hotels or Astana's emblematic skyline reveal how high-impact architectural "punctures" become instruments of modernization while sidestepping normative planning strategies. This phenomenon is not approached here in a critical register, for we recognize the intricacy of governing such layered and fragile urban conditions; rather, it is understood as an opportunity to enrich the a priori analytical reasoning of territories. Within this frame, Tirana is chosen as the focal case, due to the intensity of operationalizing these fragmented interventions, through politically driven and superpositioned planning strategies which coexist alongside officially approved ones (Papadhopulli & Beqiri, 2024). We thereby introduce an early-stage prototype as workflow pipelines which can reveal custom, user-specific analytical fluctuations in a territorial city-scale, by channeling data-driven dynamics into clustering maps of suitability. During the "Bread & Heart Festival", held for the first time in Tirana in June 2025, a physical scaled model curated with traditional crafting techniques, showed all the emerging "Archi-punctures" of the reinvented new Tirana, which is step by step creating a new structural urban spine of the city. Therefore, it is important to analyze the impacts and risks of their geographical placement implications (Figure 1).

More than three decades after the full collapse of centralized planning, Tirana continues to evolve through a sequence of these fragmented and overlapping interventions. Formal urban planning is nominally structured by the General Local Plan (PPV) and guided towards the TR030 vision, conceived by Stefano Boeri's team and approved in 2017 - envisioning a polycentric "kaleidoscopic city" that balances urban growth with ecological restoration, social inclusion, and infrastructural renewal. The objective is to convert Tirana into a sustainable and accessible metropolitan network through the integration of peri-urban areas, enhanced transit, an orbital forest, and vertical densification (Stefano Boeri Architetti, n.d.).

This vision operates in parallel with the "booming" approvals of the National Territorial Council (KKT/NTC); which is a collegial body led by the Prime Minister and empowered to grant permits of strategic interventions (National Territorial Planning Agency [AKPT], n.d.). In practice, the Council has repeatedly introduced high-density, parcel-by-parcel developments that diverge from municipal planning objectives or structural urban unit coordination, as part of a parallel strategy with national priority. In 2024 and 2025 alone, the NTC approved and published at least 27 archipunctures spread around the city, ranging from a minimum height of 20 to a maximum of 65 stories along major cor-

ridors, including a proposed 100-storey skyscraper; thereby surpassing the scale/spread envisioned by TR030 (Figure 2). These bypassing decisions are a prime example of a recentralized, top-down spatial development logic that often contrasts the TR030 growth model. As a result, Tirana's planning politics often devolve into the adjudication of these puncturing mega-projects, while territorial consequences such as strained mobility networks, amenity provision spread, and uneven regulatory application across neighborhoods, accumulate incrementally; producing both visible chaoticism and persistent spatial incoherence.

Figure 1. Mockup exhibited at "Bread & Heart" festival. Source: authors (2025).

Urban studies literature describes that Tirana's history is marked by repeated "restarts," shaped both by residents informally setting their own rules and by authorities struggling to reassert control (Dhamo, 2021). Although contemporary urban development benefits from more consolidated institutional structures and legislative frameworks compared to the time before we had a General Local Plan, the mode of city-making continues to reflect the fragmented urban fabric that emerged during the 1990s bottom-up urban sprawl; only now, on a larger scale, through top-down interventions. Urban growth in Tirana exemplifies what Smart and Koster (2024) describe as the entanglement of formality and informality, where state-led planning, legislative improvisations, and retroactive legalizations coexist with irregular practices, producing a dual layer of urban governance in which formal regulatory frameworks are continually negotiated, adapted, and operationalized. Acknowledging this condition, we propose an explorative extension tool of urban analytics that

Figure 2 - Bulevardi “Dëshmorët e Kombit”, central axis of the city, marshals the historical heritages of the 20th century. TR030. Source: Stefano Boeri Architetti. Retrived 2025

democratizes the ability to read the city in custom ways, by supporting decision-making in different scales and fields, opening up new possibilities for participatory urbanism (Ma, 2025). A flexible parametric workflow is introduced to analyze the Tirana “archipuncturing” phenomenon, exploring possible operational extensions of suitability zones, adaptable to the diverse needs of citizens, public institutions and private stakeholders/investors.

As Koolhaas (1995) has stated, future urbanism will no longer pursue control, permanence, or strict definitions. Rather, it will cultivate adaptable fields that enable processes to unfold without crystallizing into fixed forms. Instead of focusing on stable configurations, it must engage with the reconfiguration of infrastructures, the expansion of possibilities, and the acceptance of continuous modification and uneven development. Building upon this viewpoint, as well as similar approaches (Esri, n.d., 2025, WambuaLouis, 2024, Li, Zhou, Gu, Guo, & Deng, 2022), the paper proposes an explorative contextualization in reading urban fragmentation through cluster maps. These custom maps reveal a latent potential of territorial reasoning. We investigate this latency through the case

of archipunctures, which are large and programmatically intense architectural intervention, positioned as a strategic nodes across the city, capable of affecting wider urban performance. It operates as a lens for interpreting the methodological results involved, which intend to identify strategic sites of intervention via adaptable indicators. These interventions are envisioned as leverage points that have a future potential to reshape urban flows, redistribute accessibility, and stabilize fragile morphologies. The primary obstacle is the identification of such potential sites in the presence of incomplete information, contested priorities, and limited institutional capacity. To address this issue, the workflow tries to translate the aspirations of qualitative stakeholders into spatially legible and interpretable guidance. The approach is not deterministic, but open-ended. It prioritizes iterative, data-driven insights that facilitate targeted yet scalable forms of urban transformation, rather than striving for comprehensive control. Such data-driven approaches echo broader debates on how big data and urban informatics can extend the analytical repertoire of urbanism by uncovering hidden patterns and enabling new forms of territorial reasoning (Offenhuber & Ratti, 2014).

Methodologically, the paper explores a compact, parametric clustering model designed to translate divergent priorities into intervention maps, while introducing a reinterpretation of spatial optimization modelling (Ligmann-Zielinska, 2013), generating suitability zones/surfaces. Indicators such as transit accessibility, amenity density, allowable FAR, parcel geometry, proximity to open spaces, etc. can be derived from cadastral and open datasets, normalized, and combined within a Grasshopper pipeline through stakeholder-defined weight vectors. A Gaussian Mixture Model (GMM) clustering routine then produces suitability classes, rendered as gradient maps across the urban fabric. This process raises an important research question: can such models capture qualitative differences in stakeholder agendas and render them spatially legible through mapping fluctuation trends? By exposing the effects of shifting weight vectors, the tool allows the same territory to be “read” simultaneously through the perspectives of developers, municipalities, infrastructure agencies, or even students and citizens.

In this study, clustering was approached not as a fixed partition but as a probabilistic modeling of latent structures through Gaussian mixtures. To determine both the number and stability of groupings, optimization was conducted over cluster count and initialization parameters, prioritizing global likelihood and parsimony rather than point-level assignment. This procedure ensures that the resulting categorizations remain both statistically robust and interpretively coherent for urban analysis.

Methodology

Workflow Anatomy

This approach is intended and better serves to read the complexity of cities

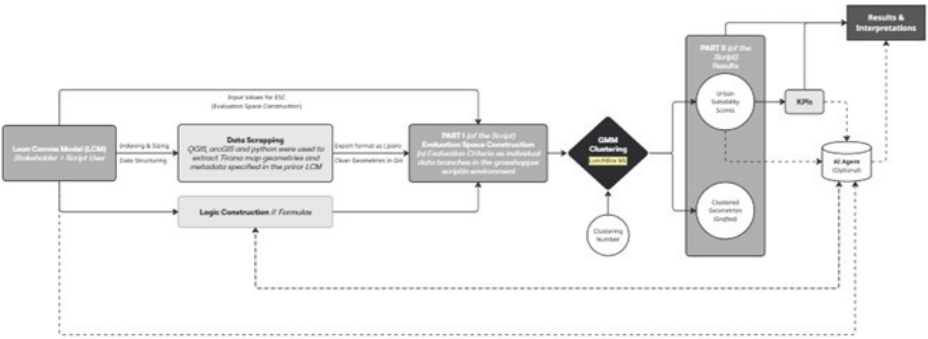


Figure 3 - Workflow anatomy - Pseudocode. AI Agents are a possible extension to the workflow.
Source: Authors (2025)

which are characterized by dense urban palimpsest and governed by unconsolidated data regimes. As a consequence, the case study is anchored in Tirana. Urban Structural Units (USU) strike a balance between the unmanageable granularity of parcel-scale data (which stand at a threshold with big data operations) and the vagueness of administrative zones; offering a territorial “pixel” that condenses morphology, function, and relational position; while remaining accessible through NTPA (National Territorial Planning Agency/ AKPT) datasets. At the same time, they match the scale at which traffic patterns, amenity distribution, and morphological coherence can be meaningfully grasped, and at which municipalities and market actors typically operate. The pipeline is implemented through a GIS-CAD bridge in which data are curated in QGIS, serialized to interoperable formats, and computed in Rhinoceros/Grasshopper with modular components for normalization, weighting, and unsupervised clustering. The method is explicitly designed for extensibility: stakeholders can introduce new indicators, revise formulae, alter decision thresholds or even connect an AI agent for continuous feedback, without disrupting the structure of the pipeline. (Figure 3)

Suitability surfaces found in existing models, are further specified as Urban Suitability Scores (USS), visualized as continuous spatial fields that synthesize heterogeneous criteria into a single scalar representation of how favorable each location is for a stated objective at a certain time. Built through multi-criteria decision analysis, indicators are first standardized (e.g., min–max, z-scores), then weighted to reflect stakeholder priorities, and aggregated via operators such as weighted linear combination or ordered-weighted averaging. The resulting surfaces can be ranked, thresholded, or embedded as objectives or constraints in location-allocation and land-use optimization models. By converting discrete rules and trade-offs into a transparent gradient rather than binary masks, they provide an auditable bridge between empirical evidence and spatial optimization routines (Malczewski & Rinner, 2015).

Adopting a Lean Canvas Model (LCM)

The starting point is explicit articulation of the reading objective, because different urban stakeholders interrogate the same territory with incommensurate questions: translating stakeholder's objectives in quantified input values. In the present case, the objective is to introduce and compute an Urban Suitability Score (USS) across all Urban Suitability Units (USUs) to identify locations most conducive to hosting the next "archipuncture". To make the translation from goals to code auditable, a Lean Canvas Model (LCM), - originally derived from business-oriented frameworks for its directness, specificity, and clarity - is here adopted and adapted to the urban analytical context (Osterwalder & Pigneur, 2010). It is important to note that this scenario remains a hypothetical construct, employed solely to test and validate the methodological pipeline as a first prototype, rather than to reproduce an empirically exact planning case. Nevertheless, the LCM itself is not intended to build a conceptual narrative, but a clear articulated vision with compact design specification which can be interpreted and translated into operationable input values for the later coming parametric script (Table 1). For this reason, it reframes the analytical workflow into a dual register: (a) the language of the stakeholder and (b) the translation apparatus of the urban/architectural specialist. Rather than enumerating every computational detail, the canvas captures the essentials of decision-making by naming the unit of analysis (USU), aligning it with stakeholder objectives, and rendering qualitative aspirations into quantifiable proxies. Objectives such as prestige, visibility, or cost efficiency are assumed for the investor as a relevant case study. Each row of the canvas documents how raw features like distance to the city center (aerial, by walking, by car), proximity to adjacent units, or surface area are converted into normalized indicators and weighted formulas that structure the Urban Suitability Score (USS) metric. In this way, the table functions as both a communicative device and a computational lead; revealing the logic of translation from human-readable ambitions to machine-operable values. The significance of this process lies in its precision of translation. In a time where LLMs are constantly gaining momentum, this approach also contributes to increasing the cognitive capacities of a "prompting" procedure for the users/specialists. The success of the entire workflow, in fact, depends on how accurately qualitative objectives are transcribed into computational formulas at this early stage. By explicitly defining the structure of the USS, the user can anticipate what constitutes a high suitability score and why. For example, if the normalized USS equals 1, it signals that a given USU is the most adequate within the modeled system, falling into the highest-performing cluster. This numerical optimum is not abstract; it is tied to concrete spatial values, which may reveal, for instance, that the most suitable unit privileges proximity to the city center while simultaneously rewarding compactness of form (referring to scenario shown in

Table 1). Such revelations underscore why formula-writing is not a secondary technicality but a central act of urban reasoning. LLM reasoning could serve as an explorative and extensive option to the pipeline, which is further encouraged in future works, by leveraging AI agents' operative platforms like n8n. (Figure 3)

Section	Stakeholder View (Investor)	Urban Specialist Translation (Architect/Planner)	Quantifiable Proxy / Formula
Objective	Identify the most promising location in Tirana to propose a new tower to authorities, maximizing return and visibility.	Translate investor ambitions into measurable spatial indicators to ensure credibility in urban decision-making.	Urban Suitability Score (USS) = Weighted combination of indicators.
Problem / Need	"I need to avoid wasted capital on parcels/zones where approvals will be difficult or where infrastructure doesn't support high-profile investment."	Urban sprawl and fragmented administrative boundaries make ad-hoc speculation risky without systematic analysis.	Problem reframed as: locate Urban Structural Units (USU) with favorable attributes (centrality, density adjacency, adequate size).
Qualitative Interests	Prestige location (close to the city center, visible skyline impact); balance between land cost and growth potential.	Translate 'prestige' into distance-to-center (flexible), adjacency to other active USUs, and capacity of USU area.	(i) Distance to city center (inverse relation), (ii) Proximity index (higher is better), (iii) Area (threshold adequate for tower footprint).
Existing Alternatives	Rely on brokers, media, news, or political lobbying, intuition.	Data-poor intuition produces speculative bubbles, inefficiencies, and regulatory friction.	USS offers transparent, reproducible, and scalable decision support.
Key Metrics	Land value appreciation; approval success rate, potential of high-profile visibility.	Develop scalable metrics from available data inputs: centrality, proximity, area.	USS = w1*(1/Distance) + w2*(Proximity Index) + w3*(Area/MaxArea).
Stakeholder Limitations	Does not understand GIS or Grasshopper logic; thinks in terms of cost, risk, and opportunity.	Must simplify and communicate outputs as ranked maps, heatmaps, or simple scores per USU.	Visual maps + indexed ranking tables.
Resources & Inputs	*Capital investment, lobbying, timeline pressure for project delivery.*	Spatial datasets: USU boundaries from AKPT, city center coordinates, adjacency matrix.	Normalized data tables: distance, adjacency, area.
Unique Value Proposition	"I can make a tower investment decision backed by data-driven urban logic instead of pure speculation."	"We can simulate and compute which USUs objectively score higher for impactful interventions."	USS score per USU, color-graded on Tirana map.
Channels of Communication	Reports to board, negotiation with municipality, media visibility.	Deliverables: executive-friendly maps, index tables, clear narrative bridging business and urban rationality.	Ranked list of top 10 USUs for tower placement.
Success Criterion	*Securing municipal approval and ensuring long-term profitability of the tower.*	Ensuring analysis aligns with real planning constraints and stakeholder expectations.	Top-ranked USUs overlap with infrastructure corridors, high-value proximity zones, and adequate area size.

Table 1. Lean Canvas Model (LCM) - Hypothetical construct - case study example to operationalize the pipeline. Source: Authors (2025)

Base GIS Environment and Data Preparation

The second pipeline proposition starts in QGIS software, an open-source GIS platform selected for its extensibility and ability to integrate Python scripting for custom formulae, as well as for its seamless bridging with Grasshopper for subsequent computational modeling.

The Tirana city map was initialized by connecting to official geospatial repositories and importing all relevant vector layers, including cadastral parcels, infrastructural networks (roads, utilities), public greenery, and georeferenced amenity locations (Figure 4/a). Each layer was harmonized into a unified coordinate reference system (Tirana - 34N, EPSG:32634), cleaned of inconsistencies, and stored in a project-level GeoPackage to ensure reproducibility.

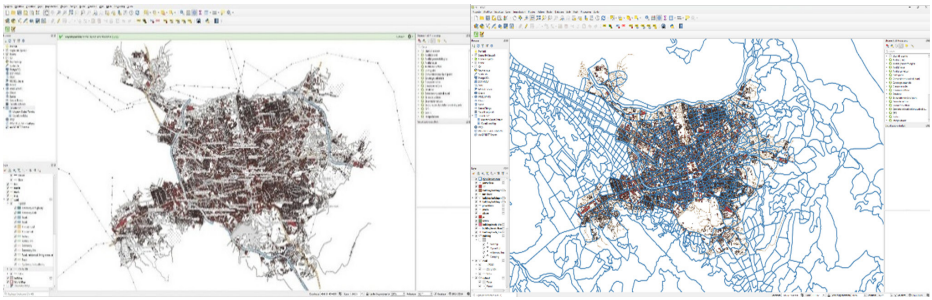


Figure 4 – Extract all data from OSM plugin for QGIS in specific layers (A-Left). Overlap of all OSM geometries with extracted USUs as layers (B-Blue colored, on the right). At this stage, layers are ready to be exported as shapefiles (.shp). Source: Authors (2025)

Data Scrapping

The geometries of Tirana's Urban Structural Units (USUs) were retrieved from the ArcGIS REST services published by the NTPA (National Territorial Planning Agency/ AKPT), publicly accessible through their online portal. The procedure involved connecting QGIS to the ArcGIS online feature service endpoint, which exposes vector data as FeatureServer layers. The service URL was accessed through the ArcGIS REST API, and layers corresponding to USU boundaries were selected and imported into QGIS using the Add ArcGIS Feature Server Layer functionality (Figure 4/b). This ensured that the full polygonal geometries, along with their attribute tables (metadata such as identifiers, surface area, and administrative classification), were preserved. Once imported, the USU layer was exported from the temporary web connection into a local geospatial format (GeoPackage) to guarantee reproducibility and offline accessibility. Metadata were inspected, normalized, and cleaned to align with subsequent analytical needs. The QuickOSM plug-in in QGIS served as a search engine for data scraping in the city scale. Parcels' IDs, Buildings' footprints and IDs, heights,

Ground levels, amenities, function, infrastructure, building-parcel correspondence etc. were extracted when available (Figure 4/a). When missing attributes applied, the data structures were preserved and therefore these items are assigned as nulls. Nulls are later replaced or reduced depending on the data structure's strategy in Grasshopper (Figure 5).

GIS-CAD Bridge & Export Format Recommendations

To establish an operative bridge between the QGIS environment and the algorithmic design pipeline, it is essential to ensure that both spatial geometries and their associated attributes are transferred in a format that preserves the integrity of embedded metadata. This prototype considers Shapefile (.shp) format as one of the most effective to achieve full readability of QGIS layers in the grasshopper environment, by retaining both geometry and attribute structures with high fidelity. Within the Grasshopper for Rhino environment, these files can be ingested through the Heron v4.4 plug-in components, available for download through Rhino's Package Manager. Since we are dealing with GIS data, we need to assure prior to import that the UTM Zone matches with the one of the shapefile. For that, we need to call the SetSpatialReferenceSystem component and

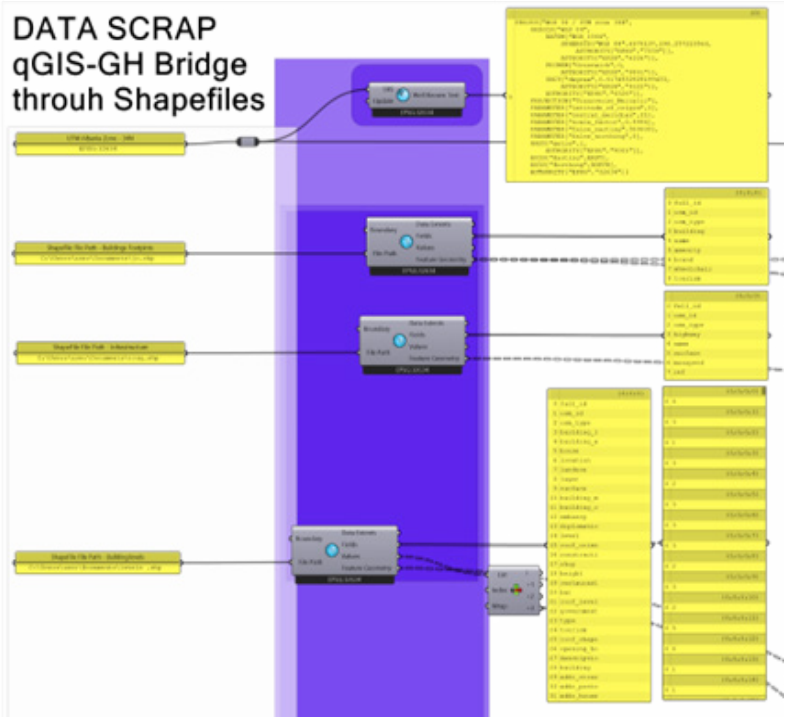


Figure 5 – Data scrapping + Setting Zone 34N EPSG in Grasshopper through Heron Source: Authors (2025).

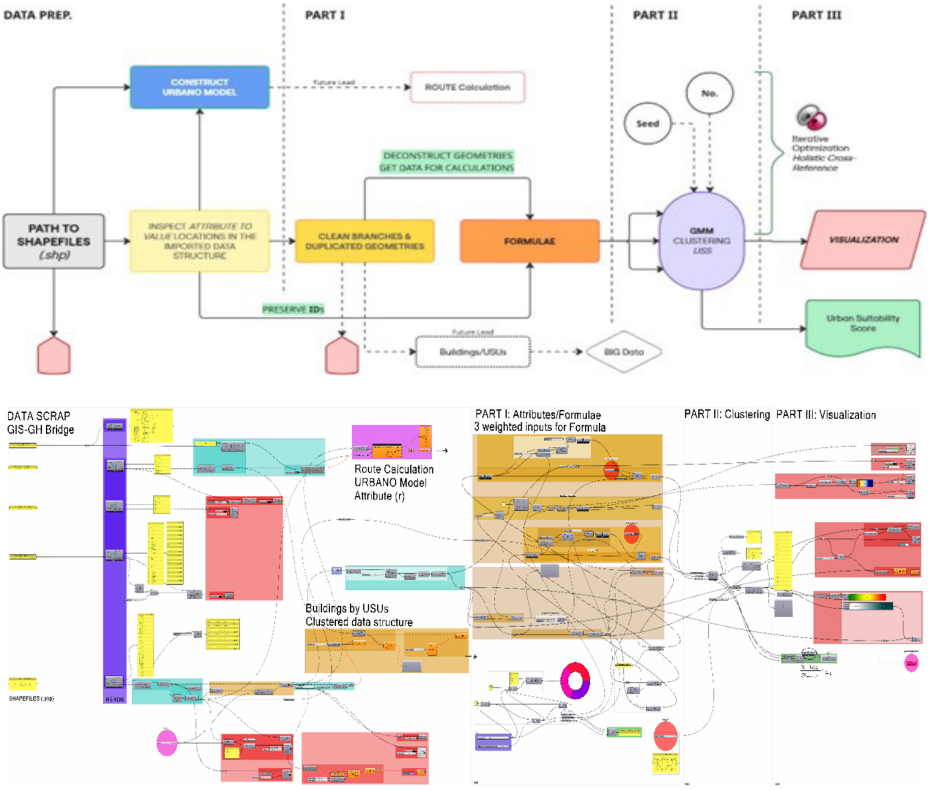


Figure 6 –Scripting pseudocode scheme organized in 3 parts: I, II, III (Above). Script detailed anatomy, organized in 3 parts (Below). Source: Authors (2025)

assign Tirana's Zone 34N, by adding a string "EPSG:32634" as input (Figure 5). The advantage of this method lies in the fact that the component not only imports the geometrical framework but also maintains the relational data structures, enabling their subsequent manipulation, recombination, and transformation within the parametric domain of Grasshopper. It is equally important to recognize that QGIS is not merely a preparatory platform but also a computational environment in its own. The software allows users to calculate and attach derived attributes directly to spatial features through its built-in field calculator and expression system. In practice, this means that certain formulae - particularly those requiring relatively simple arithmetic or aggregation across feature sets - can be pre-computed at the GIS stage before the dataset is transferred into Grasshopper. Such pre-processing can significantly reduce the computational burden on the parametric model, especially in workflows where high-frequency iterations or clustering algorithms are deployed. Thus, the decision of where to compute

specific indicators, upstream in QGIS or downstream in Grasshopper, becomes a methodological consideration in itself, contingent upon the needs of the Lean Canvas Model (LCM) and the scale or complexity of the urban analysis being undertaken. A pseudocode followed by the full script is then constructed (Figure 6)

Parametric Pipeline – PART I: Attributes

Prior to computation, the USU layer is checked for topology errors (gaps, overlaps). Invalid geometries are repaired, and a planar coordinate reference system with metric units is enforced to ensure that distances and densities acquire matching virtual proportions. Where city center is referenced as a distance anchor, the center point is defined a priori and documented (e.g., the centroid of a designated central business district polygon), noting that a different anchor can be substituted if a stakeholder's objective differs. In our case, the city center will serve as an attractor attribute, as priorly specified in the LCM (Table 1). But geographical features of Tirana restrict the existence of high-density urbanism to an area much smaller than its administrative expansion. For this reason, the map needs to consider the scope of expansion in relation to the scaling needs of reading it. Figure 7 shows how in our case, USUs were culled under a conditional expression in relation to their distance from the city center. A radius of 10 kilometers was considered adequate for investigating the archipunctural potentials of Tirana today, covering up an area which corresponds also to the one of Tirana 2030.

Figure 7 –a) Import all layers in the Grasshopper environment. b) Select only USUs inside a 10km radius area. c) Cull and restructure data branches accordingly. Elefront plugin was used for visualization.

Attributes definition. The Urban Suitability Score (USS) must derive from the systematic translation of investor objectives into normalized, weighted attributes assigned to each Urban Structural Unit (USU) taken under analysis. The method ensures that qualitative ambitions (prestige, visibility, feasibility) are transformed into reproducible spatial indicators. From the use case, 3 main attributes were calculated and used as a testbed for the pipeline:

a) Centrality - is calculated as the inverse Euclidean distance between the USU centroid and the city-center coordinates:

This captures the investor's preference for locations whose spatial centrality

$$Centrality_i = \frac{1}{Distance_i}$$

amplifies visibility, symbolic leverage, and infrastructural integration. Yet centrality may be conceptualized and measured through multiple operative registers. One can, for instance, compute the aerial distance to the center, which expresses not only a geometrical proximity but also a strategic positioning within the territorial frame of the city - an index often correlated with institutional priorities for urban interventions and the escalation of real estate values. A different reading emerges when centrality is traced along pedestrian accessibility. Since the walking time required to reach the city's core mediates tourism-related potentials, diverging from mere aerial measures privileges experiential and infrastructural continuity. Finally, vehicular centrality introduces an additional layer of interpretation, where distance is recalibrated through road-network routing and traffic patterns, disclosing those urban units that, while slightly displaced in geometric terms, are effectively more integrated into the metabolic flows of the city, offering a distinct advantage in relation to central amenities and the dynamics of urban fluxes. All these could be route calculated by constructing an additional Urbano Model through the Urbano plugin for Grasshopper, available under the PackageManager of Rhino 8. It is suggested to not compute all parcel calculations at once, due to the heavy amount of computational time needed to have the whole model of Tirana. Instead, this step can be integrated as a secondary testbed for USUs which are under final considerations.

b) Adjacency is expressed through a proximity index based on contigui-

$$Adjacency_i = \frac{\sum_j A_{ij} \cdot D_j}{\max(\sum_j A_{ij} \cdot D_j)}$$

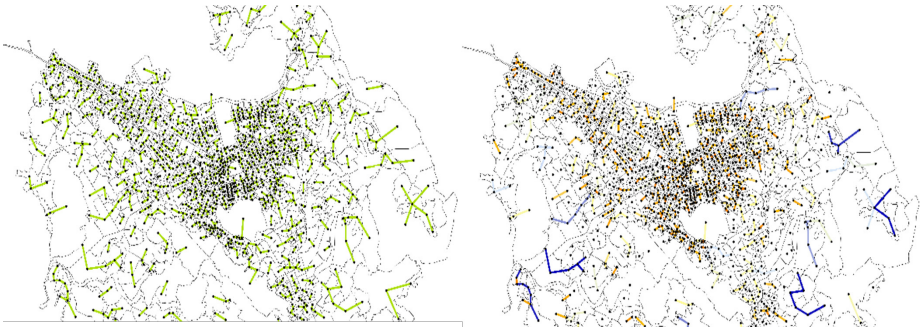


Figure 8 –(a) - Proximity Links, merged & joined (Left); (b) - Proximity Links, clustered by surrounding density (blue< to red>) (Right). Source: Authors (2025).

ty. For each USU, the number and quality of its direct neighbors are quantified through an adjacency matrix. Neighboring USUs with higher density or activity scores increase the adjacency index, normalized between 0 and 1:

where Aij indicates adjacency and Dj denotes the density/activity score of unit j.

By clustering the 3D point proximities of USU centroids in relation to their distance from the city center and their respective area sizes, one can expose the latent structure of the urban fabric beyond its visible geometry. Such an analysis reveals whether parcels tend to consolidate into tightly packed central clusters or remain peripheral enclaves, thereby disclosing patterns of cohesion and fragmentation in the city's growth. The inclusion of area size differentiates expansive parcels, often associated with institutional or infrastructural logics, from fine-grained units more likely tied to residential or incremental development; while the centrality gradient exposes tensions between small, over-pressured inner-city lots and large, underutilized tracts at the edges.

c) *Capacity / Structural Capacity (SC)* is related to the area of each USU alongside its normative indicators, providing insights on its spatial potential for archipunctural insertion. Structural Capacity (SC) in this case is considered as an aggregate of 3 attributes: existing Floor Area Ratio (FAR) - measures current built intensity and indicates revealed market demand, Building Coverage Ratio (BCR) - expresses the degree of ground coverage, where higher values reduce open space and increase ecological stress.

, and Regulatory Headroom (RH) - quantifies the remaining allowance before statutory limits are reached. Three structural archetypes can be generally deducted:

High FAR + High BCR + Low headroom → saturated morphology, high market signal but low insertion capacity.

Moderate FAR + Moderate BCR + High headroom → balanced morphology, prime candidate for intensification.

Low FAR + Low BCR + Very high headroom → slack condition; suitability depends on adjacency and accessibility.

Capacity is normalized relative to the largest USU.

Weight Assignment and Formula Construction.

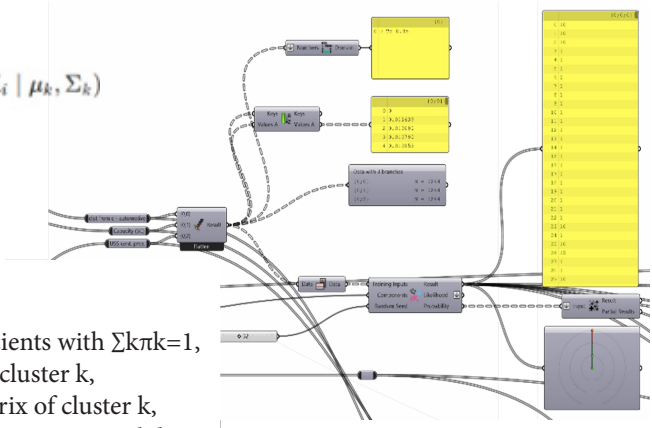
Weights (w1, w2, w3…wn) are introduced to align the formula with investor priorities: centrality as a measure of prestige, adjacency as a measure of visibility and synergy, and structural capacity as a measure of feasibility. Weights must sum to 1. The USS is defined for each USU as:

$$USS_i = w_1 \cdot Centrality_i + w_2 \cdot Adjacency_i + w_3 \cdot Capacity_i$$

Parametric Pipeline – PART II: Clustering

Each USU is represented as a vector xi= [Centrality i, Adjacency i, Capacity i]. The dataset of all vectors is partitioned using the Gaussian Mixture Model (GMM) clustering algorithm. Unlike K-means clustering, which partitions data by minimizing Euclidean distance to centroids, GMM models the distribution of the data as a weighted sum of K Gaussian components, allowing clusters to vary in orientation and spread. This probabilistic formulation is considered as more appropriate because of the hypothesis that urban units may belong to overlapping morphological regimes rather than mutually exclusive types. Formally, the likelihood of an observation xi is:

$$p(\mathbf{X}_i \mid \Theta) = \sum_{k=1}^{K} \pi_k \mathcal{N}(\mathbf{X}_i \mid \mu_k, \Sigma_k)$$



where:
πk - are the mixing coefficients with ∑kπk=1,
μk - is the mean vector of cluster k,
Σk - is the covariance matrix of cluster k,
N ( ) - denotes the multivariate normal density,
Θ={πk,μk,Σk}K/k=1 are the parameters estimated.

Figure 8 –(a) - Proximity Links, merged & joined (Left); (b) - Proximity Links, clustered by surrounding density (blue< to red>) (Right). Source: Authors (2025).

In the GMM framework, reproducibility and variability are governed not by centroid initialization but by the specification of the random seed in the Expectation–Maximization (EM) algorithm on the GMM likelihood results. The seed determines the starting values for means, covariances, and mixture weights. Fixing the seed ensures identical log-likelihood trajectories and stable cluster assignments across runs. Allowing variability, by contrast, enables the testing of robustness, as different initializations may converge toward alternative local maxima of the likelihood function.

Parametric Pipeline – PART III: Visualization

The geo-visualization translates the clustering output into a legible territorial field. Each Urban Structural Unit (USU) inherits a discrete cluster label,

indexed to the Urban Suitability Score (USS) domain, as well as a continuous USS value with a normalized domain [0, 1]. For communicative clarity, we layer a georeferenced choropleth that assigns a stable hue to each cluster class (the categorical reading). We construct a gradient heatmap that encodes the detailed normalized USS, revealing deep intra-cluster intensities. However, this would be more beneficial and preferred in a context where more data are taken into consideration for detailing more clusters (the scalar reading). The map is produced directly on the USU polygonal surfaces, preserving topology and IDs, while a light contiguity-aware smoothing of the scalar surface (queen adjacency) can be optionally applied to prevent false visual discontinuities at unit edges (without distorting computed d values). This dual rendering opens up the possibility for exploring the threshold between reproducibility (cluster classes) and sensitivity (local USS variation) in a single cartographic frame. (Figure 9)

Figure 9. Example Map, colored in base of the USUs' Urban Suitability Scores, structured along a 3 clusters' resolution. Infrastructure is exposed through overlapping route calculations through the Urbano Model, from each parcel to the center. (a) Above - Map showing USS's as per Table 1, overlapped with infrastructural flows; (b) Below - Clean USS Map + Buildings. Source: Authors (2025)

Optimization until Trend Stabilization

While the GMM clustering routine provides an initial partitioning of Urban Structural Units (USUs), the stochastic nature of centroid initialization renders each run susceptible to variability. To mitigate this dependency and ensure robustness, the workflow integrates an optimization loop via the Galapagos evolutionary solver embedded in Grasshopper. Unlike deterministic algorithms, Galapagos treats clustering as an evolving search space in which both the number of clusters and the random seed of initialization are framed as genomes to be iteratively recombined and tested. The domain for cluster size is bounded between 3 and 100, capturing both coarse-grained and fine-grained interpretations of the urban field, while the seed is allowed to vary continuously to explore alternative local minima.

The fitness criterion guiding the evolutionary process is defined as the maximization of intra-cluster probability, or more specifically, the likelihood that an input vector of normalized attributes (centrality, adjacency, structural capacity) consistently belongs to a stable cluster. This probabilistic framing aligns with the methodological aim of producing territorial readings that are not contingent upon single random initializations but instead converge toward solutions that remain valid across multiple stochastic conditions. Through successive generations, Galapagos executes crossover, mutation, and selection functions that gradually steer the population of candidate solutions toward higher stability: pruning configurations that overfit or collapse prematurely. (Figure 10)

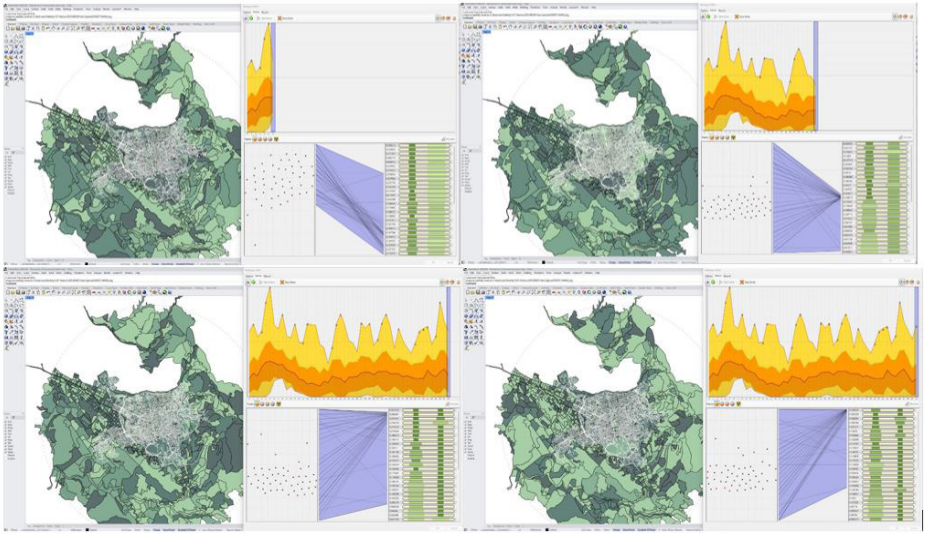


Figure 10. Stabilization of USS waves of possibilities when searching to maximize probability of likelihood results. Observed over 10 optimizations of 5 minutes each, showing trends in the visual results, suggesting the highest probability through overlapping similarities per each scenario. Source: Authors (2025)

Results

The stabilized clustering scenarios, as derived through the evolutionary optimization process, revealed a consistent pattern of urban suitability across Tirana's structural units. High-scoring clusters converged around central and infrastructurally privileged zones, particularly those adjacent to the city center, while peripheral units showed greater volatility before reaching stabilization. This differentiation underscores the model's capacity to translate qualitative investor objectives into spatialized outputs that persist beyond stochastic variance. (Figures 10, 11)

Figure 11. Explorative Maps of USS, colored in base of the USUs' Urban Suitability Scores, structured along a 23 clusters' resolution. Source: Authors (2025)

Read in time, the Galapagos runs map a register of "waves of dependencies": probability-weighted vectorial alignments that thicken or recede, as the evolutionary solver converges (Figure 11). The result is a more flexible and less abstract territorial reasoning model. It captures latent fluctuations of opportunities and risks as gradients of probability dependencies. Stabilized clusters mark potential strategic investment logic while the semi-stable ones suggest contested morphologies and governance seams. In post-transition conditions, these overlays have the potential to provide stakeholders with a clear audit trial, which can help inform spatial consequences and make visible how interests condense into durable corridors. This creates space for negotiated urban futures.

Refering to figure 10, the early iterations show a lot of instabilities: cluster centroids shift rapidly and assignments fluctuate. This exposes the models sensitivity to both seed values and cluster size. However, after the first wave of evolutionary iterations, the trajectories begin to stabilize. Local impacts that initially oscillated across competing clusters gradually consolidate into coherent patterns. This stabilization does not imply a single absolute partition. Instead, it suggests a probabilistic field in which chertain USUs emerge as consistent high-probability members of particular clusters, regardless of seed varation. As a consequence, the evolutionary solver transforms randomness into a way to check the structure of its own generative model, revealing which configurations are structurally robust on map, and which are artifacts of initialization.

The time-dependent nature of this optimization adds another layer of complexity to the analysis. By observing how clusters consolidate across generations, it

becomes possible to distinguish between temporary groupings and those with durable structural logic. For example, central USUs near the city center often become high-performing clusters only after a limited number of iterations, while peripheral or morphologically ambiguous units oscillate longer before stabilizing. This differential rate of stabilization offers insight into how resilient spatial patterns are under conditions of incomplete information and shifting priorities. However, the mapping of such oscillations is suggested to be further explored and analyzed in the future.

To evaluate its computational robustness and interpretive clarity, the prototype workflow was tested in a pedagogical experiment during Tirana Architecture Weeks (TAW24) at POLIS University, in November 2024. A group of 37 fourth-year architecture and urban design students was tasked to engage with the workflow, in order to construct and analyze possible archipuncturing scenarios across Tirana. Students speculated about different scenarios and translated the set of qualitative goals into weighted attributes. We saw how GMM clustering, together with evolutionary stabilization, rendered these goals into simplified, data-driven territorial maps on which we could understand and interpret upon. As illustrated in Figure 12, the exercise facilitated a collective understanding of how complex urban dynamics can be re-encoded into operational models without oversimplifying the qualitative underpinnings. The USUs in the maps used by the students were further narrowed down based on the specific topographical and rural characteristics, as a “discriminative” input. In their scenarios, this was a key step to better understand interests on a pre-confined and adequate territorial scale. This step minimizes the risk of interpretive distortion by removing USUs that do not meaningfully participate in the city’s active urban fabric for that specific scenario.

The workshop confimed that the methodology is not only computationally viable but also communicable across different levels of expertise. Students, many of whom had no prior experience with clustering algorithms, were able to comprehend the translation logic between stakeholder objectives and urban outputs. Furthermore, they were able to engage in critical discussions regarding the implications of varying weight assignments or optimization parameters. This demonstrates that the workflow is as much a tool for territorial reasoning as it holds also potential to become a pedagogical instrument, capable of fostering analytical literacy in urban studies and design education.

Discussion

This study proposes a compact, auditable workflow that converts heterogeneous stakeholder aims into reproducible territorial readings. Three design decisions were central. First, the Urban Structural Unit (USU) was adopted as the operative spatial kernel, permitting city-scale reasoning without collapsing into

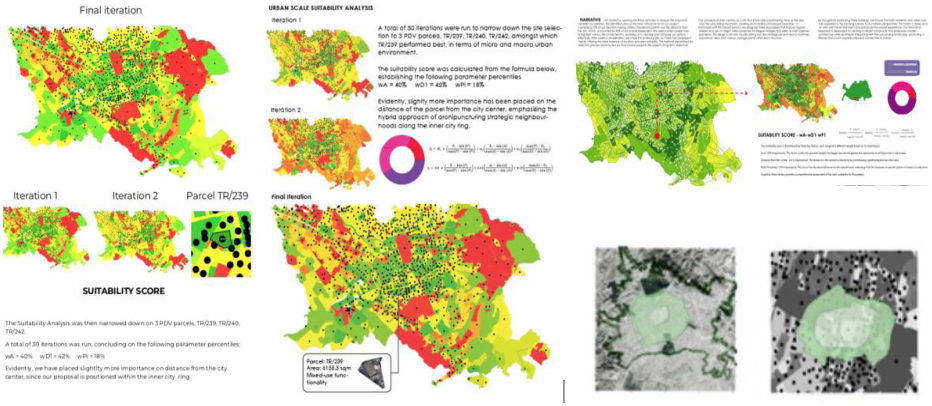


Figure 12. Students' urban analyses by introducing their interpretation of the Urban Suitability Scores. Source: Retrieved from authors in 2025. Part of POLIS archive, under the Tirana Architecture Weeks 2024 Documentation Materials - accessible through internal platforms and published online on social media and official TAW website. Students: Gledis Sinanaj, Sara Nini, Joana Veizi (Right side) - Ankela Doci, Klea Maci, Jonian Celaj (Left side). Workshop leaders: Marco Mondello, Fulvio Papadhopulli, Albi Alliaj. Also available on the Miro board: https://miro.com/app/board/uXjV-LcOoqRU=/

parcel-level noise or drifting into administrative abstraction. Second, qualitative objectives are rendered into normalized indicators through a Lean Canvas Model translation, making the path from intent to computation explicit and revisable. Third, GMM clustering was regularized by an evolutionary loop, where clustering number and initialization seed were treated as genomes, and solutions were selected by their capacity to maximize membership likelihood and remain stable under stochastic variation. Together, these steps turn a potentially fragile classification into a stabilized ensemble that can be interrogated, compared, and replicated.

The stabilized patterns have practical meaning. Units consistently converging into high-performing clusters align with centrality, adjacency, and structural capacity in ways that are legible to decision-makers; units that oscillate longer before convergence are revealed as ambiguous opportunities or risk zones. In other words, optimization is not a cosmetic post-processing step but an epistemic filter that distinguishes robust territorial signals from artifacts of initialization. For actors negotiating post-transition urbanism - where permits, infrastructures, and market cycles rarely cohere - this distinction is not trivial; it informs whether an "archipunctural" proposal is grounded in structure or in noise.

Pedagogically, the workflow proved communicable and transferable. When introduced to 37 fourth-year students during TAW24, participants could articulate objectives, assign weights, and read back the territorial consequences in Figure 12's gradient maps. The exercise validated two claims: that the trans-

lation apparatus makes the computational core inspectable by non-specialists; and that stabilized clustering supports comparative reasoning across scenarios without presuming a single “correct” map. These are non-trivial capacities for studios, municipal units, and private offices alike.

At the same time, this remains a prototype. Its outputs are contingent on indicator choice, normalization strategy, and weight vectors; GMM assumes roughly convex clusters and similar within-cluster variance; and data incompleteness can bias centrality and adjacency measures. These constraints are not disqualifying; they are parameters to manage. In practice, they can be addressed by: (i) subjecting weight vectors to sensitivity analysis; (ii) triangulating GMM ensembles with alternative partitions (e.g., K-Means, spectral, or density-based models) to test invariants; and (iii) incrementally enriching inputs with regulatory, mobility, or temporal permit data as they become available. The point is not to freeze a definitive taxonomy of Tirana, but to maintain an ever-evolving, inspectable and transferrable pipeline where assumptions are explicit and can be tested.

Future extensions are direct and pragmatic: embed uncertainty reporting next to each map; implement multi-objective evolutionary search when stakeholders compete on incompatible criteria; and formalize a cross-validation routine against realized interventions to calibrate indicators and weights over time. These steps preserve the prototype’s agility while tightening its evidentiary claims, advancing it from a catalyst for informed debate toward a deployable instrument for practice.

Lastly, an important structural question arised during the workshop, which far exceeds the intentions of the research itself. How does the outter overall perimeter of the considered maps, affect the overall results? This question opens up many uncertainties we have about the digital world in general, about when and what to consider as “the end” of the pysical boundaries in a digital realm? How do we know where is the right scale to break dependencies across them for a specific analytical process? These are to be tested, not only throughout our methodological proposal, but also in other analytical or reasoning models.

Further Suggestions. Traffic and temporal dynamics can be integrated without changing the core design pattern. Time-stamped exposures (e.g., average speeds or counts by hour) are aggregated to USUs by joining sensor locations to the network and then to USUs via network-constrained buffers; a temporal weighting kernel (for example, emphasizing peak periods) collapses the hourly profile into a scalar per USU, which is then normalized and introduced as another indicator in USS. Where market “boom/recession” mapping is required, the same logic applies: price change gradients or listing density dynamics are computed over moving windows, smoothed to reduce noise, and aggregated to USUs before normalization. The method treats these additions as plug-ins:

the LCM declares the new indicator, the import block reads its layer, and the downstream machinery remains unchanged.

Because data accessibility in Tirana can be intermittent, the pipeline anticipates manual digitization or attribute entry when scraping fails. In Grasshopper, each indicator has an optional manual override port that accepts a user-supplied value per USU. If a manual value is present, it supersedes the computed value for that indicator and USU; the override is logged in an audit table with a timestamp and a free-text justification. This design preserves the ability to proceed under imperfect data while preventing silent substitutions that would undermine reproducibility. Where entire layers are missing (for example, parcel polygons in a newly annexed area), the LCM can specify a mask so that excluded USUs are clearly rendered as “no-data” rather than spuriously assigned low suitability.

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