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Master's Thesis

# Reimagining Informal Markets: A Parametric Framework for Eliava Bazaar's Regeneration

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## Abstract

Informal markets constitute essential urban systems that support local economies, cultural practices, and social networks; however, they are often perceived as disordered environments and are consequently subjected to redevelopment strategies that risk erasing their embedded social and spatial value. The Eliava Bazaar in Tbilisi exemplifies this tension, where long-standing informal and self-organized dynamics coexist with urgent needs for modernization, safety, environmental improvement, and spatial coherence. This thesis investigates the capacity of parametric design to serve as a regenerative framework that reconciles the adaptive logics of informality with structured urban planning. A computational workflow was developed in Grasshopper to systematically capture, analyze, and translate key datasets—including movement patterns, clustering of activities, environmental exposure, and safety constraints—into operative design drivers. These inputs were normalized into scalar fields and encoded as relationships, thresholds, and dependencies within a parametric model, enabling iterative scenario testing and rule-based spatial generation. The findings demonstrate that parametric tools can effectively operationalize the inherent logics of informal markets, producing spatial configurations that are adaptable, context-responsive, and sensitive to both functional performance and cultural continuity. Rather than imposing rigid formalization, the proposed method supports an incremental and flexible reorganization of the bazaar, enhancing environmental quality, circulation, and spatial legibility while preserving its socio-economic vitality. Overall, the study argues that parametric design extends beyond its computational utility and functions as a conceptual paradigm for reimagining informal urbanism within contemporary regeneration efforts. It offers a means to integrate bottom-up dynamics with top-down planning goals, producing urban environments that are both resilient and inclusive.

# Introduction

## Background and Motivation

Informal markets have always played as an important aspect of urban life, especially during period of transition, where organized and formal planning systems often cannot answer the population's needs. These markets normally considered as disorganized, temporary, or in some cases slum, but in fact they demonstrate an especial form of urban intelligence, one that is highly adaptable, rooted in community practice, and spatially complex. Eliava Bazaar in Tbilisi, Georgia is an outstanding example of these markets. Developing in the period during the collapse of the Soviet Union, Eliava has developed into one of the city's most prominent and crucial commercial hubs, offering almost everything, from clothing and everyday items to used auto parts, tools, and construction supplies.

The bazaar may appear chaotic at first look, but it represents a well-adapted urban ecosystem, its spatial form and functional logic shaped over time by ongoing negotiations between sellers, users, and of course the surrounding built environment. According to Tbilisi undergoing fast urban growth and increasing the need to formalize these types of spaces, an essential question appears: how can places like Eliava be regenerated without effecting the very social, cultural, and economic dynamics that make them fundamental?

In this thesis I will answer the question by investigating how parametric design methodologies, when working according to self-organized urbanism, can help the organic nature of informal systems. The final goal is to introduce a new spatial structure that improve arrangement and sustainability, while respecting the main characteristics of bazaar, flexibility and socialism.

## Research Aim and Objectives

The primary aim of this research is developing a parametric framework in order to reach a solution for regeneration of Eliava Bazaar, a solution that maintains market's informal logic, yet introduces greater clarity, legibility, and long-term resilience in its spatial design. The objectives are:

- Analyzing the social, spatial and functional characteristics of Eliava Bazaar.
- Discovering the importance of self-organized urbanism in shaping informal markets.
- Designing and implement parametric tools that show actual user behaviors and needs within the bazaar.
- To reach regeneration strategies that integrate flexibility with a more ordered spatial structure.

## Methodology Overview

The research is structured around a combination of theoretical research, site analysis, and computational design. It begins with a literature review on informal urbanism, self-organization, and parametric design. Then it is followed by a deep spatial and social analysis of Eliava Bazaar, including different type of studies such as, mapping, interviews, and user behavior studies. A parametric framework is developed with using Rhino and Grasshopper, to simulate and test various regeneration scenarios. These design strategies are evaluated based on adaptability, spatial efficiency, and user integration.

# PARAMETRIC DESIGN

## 1.1 Introduction to Parametric Design

Parametric design has emerged over the last three decades as one of the most influential paradigms in architecture and urbanism—not merely a way to draw complex forms, but a way to **think** and **organize** relationships. As Oxman puts it, *"parametric design is emerging as a unique and distinctive model of design"* (2017, p. 4). This shift reframes architecture from the description of forms to the **generation** of forms through variables, rules, and feedback—what Oxman elsewhere calls the transition from an "age of representation" to an "age of generation" (2006).

At the same time, advocates argue that parametricism has consolidated into a stylistic and methodological paradigm. Schumacher famously claims, *"There is a global convergence in recent avant-garde architecture that justifies its designation as a new style: parametricism"* (2008, p. 14). For him, parametricism *"succeeds Modernism as the next long wave of systematic innovation"* (2008, pp. 14–15), characterized by *"the elegance of ordered complexity and the sense of seamless fluidity, akin to natural systems"* (2008, p. 15). Read this way, parametric design is not only a toolbox; it is a **research programme** with aims, methods, and values, where *"avant-garde styles can be interpreted and evaluated analogously to new scientific paradigms"* (Schumacher, 2008, p. 15).

Yet the genealogy of this paradigm predates digital software. The Italian architect Luigi Moretti articulated the concept of **parametric architecture** as early as the 1940s: *"Luigi Moretti… appears to be the first to have formulated the concept of Parametric Architecture in 1940"* (Gallo & Pellitteri, 2011, p. 1). Moretti defined architecture as a **system of relationships** among structural, functional, and expressive forms, insisting that to achieve architecture these must coincide: *"architecture is defined by a complex system of relationships… [the three forms] must be identical"* (Gallo & Pellitteri, 2011, p. 3). He traced two generative directions—**Structure→Form** and **Form→Structure**—and argued for a renewed primacy of the former, anticipating later form-finding cultures (Gallo & Pellitteri, 2011, p. 3). In his essay *Form as Structure*, Moretti adds a perceptual and mathematical layer: *"Each form can be defined by its differences… a system of ordered differences in a rhythm that constitutes the law of form"* (1957, cited in Gallo & Pellitteri, 2011, p. 4). This early relational and systems-based thinking resonates strongly with contemporary parametric logics.

Contemporary scholarship clarifies that parametric design is fundamentally **relational**. Monedero argues that the term should be understood broadly: *"Parametric design… implies the use of relations… relational modeling… constraint-based design"* (2000, p. 372). He also diagnoses why the field needed this shift: *"Architecture continues to be produced by traditional means using the computer as little more than a drafting tool"* (2000, p. 369), with *"lack of appropriate instruments to modify interactively the model once it has been created"* (2000, p. 369) and a *"lack of resources to maintain relations between parts… during modifications"* (2000, p. 371). In other words, design requires **iterative re-editing**—*"the designer is constantly going forward and backwards… re-elaborating"* (Monedero, 2000, p. 369)—which parametric methods directly enable

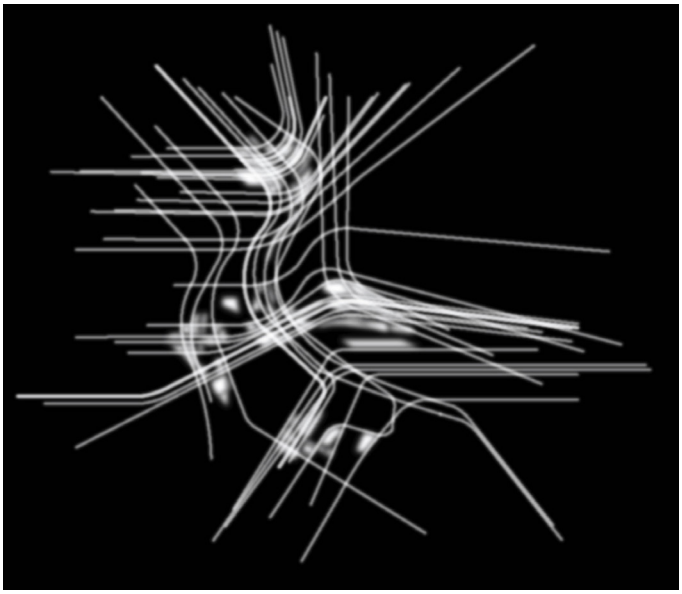


figure1, Zaha Hadid Architects, One-North Masterplan, Singapore, 2003
opposite and above: Fabric and network. This masterplan for a new mixed-used urban business district in Singapore was the first of a series of radical masterplans that led to the concept of parametric urbanism and then to the general concept of parametricism.

**From Representation to Relational Generation**
Across the literature, three complementary strands lock together:

1. **Cognitive and epistemic shift.** Oxman shows that today's *parametric design thinking (PDT)* emerges from the convergence of cognitive models, digital process models, and material/fabrication logics. PDT is defined by schemas, associative relationships, and **differentiation** as a key strategy (Oxman, 2017, p. 4). She writes: *"The formulation of algorithmic parametric schema is a fundamental cognitive capability of creativity of the computational designer"* (2017, p. 12). Crucially, parametric tools replace mere remodeling with **re-editing** mechanisms that perform a kind of computational reflection-in-action: *"replacing traditional CAAD re-modeling with re-editing… similar to 'reflection in action'"* (Oxman, 2017, p. 12).

2. **Methodological heuristics.** Schumacher frames parametricism as a disciplined method with **negative** and **positive** heuristics. The former taboo *"rigid geometric primitives… simple repetition… [and] juxtaposition of unrelated elements"*; the latter prescribe to *"consider all forms parametrically malleable; differentiate gradually… correlate systematically"* (2008, p. 16). This programmatic stance aligns with Moretti's eight methodological points—among them the *"objective observation of all… parameters"* and the *"definition of the relationships between the values of the parameters"*—balanced by *"the Architect's freedom… only if it does not affect the characteristics determined by the analytical investigations"* (Moretti, 1971, cited in Gallo & Pellitteri, 2011, p. 5). Together, they establish a **rigorous-yet-open** framework: rule-governed relation-making with designed degrees of freedom.

3. **Data structures and editability.** For parametric workflows to support design cognition, internal representations must be **editable** and relation-aware. Monedero highlights **E-Rep**—*"an editable high level representation"*—that stores dependencies so modifications propagate coherently (2000, p. 371). Constraints then regulate degrees of freedom: *"A constraint is a relation that limits the behavior… implying degrees of freedom, underconstrained and overconstrained models"* (Monedero, 2000, p. 372). In practice, two families dominate: **history-based parametrics**, where the system "keeps track of the sequence" and recomputes geometry while maintaining relations (Monedero, 2000, p. 374); and **variational geometry**, which *"can recompute a design… independently of the sequence"* by solving constraint systems (Monedero, 2000, p. 374). Oxman's PDT situates these within a broader ecology of associative schemas and process models (2017, pp. 11–13).

### From Typology to Topology—and Differentiation

Parametric design reinterprets architectural knowledge as **schemas** that can be explored and adapted. Oxman distinguishes **typological** parametric schemas (families and sub-types) from **topological** schemas (continuous versioning via associative relationships), arguing that *"understanding how to manipulate and explore associative relationships… in topological geometry"* is central to PDT (2017, p. 17). This underpins the strategy of **differentiation**: *"Differentiation… provides new types of formal, functional, performative, and structural properties"* (Oxman, 2017, p. 24). Schumacher's urban agenda extends the same logic across scales as **deep relationality**—correlating fabric, streets, open space, morphology, and tectonics.

### Historical Depth, Contemporary Relevance

Importantly, parametric thinking is not conceptually bound to software. Moretti rooted parameters in **tradition** and interdisciplinarity, reading form as structured differences and calling for *"exact and complete definition of... parameters"* (Gallo & Pellitteri, 2011, p. 5). Contemporary research renews this ambition with AI and data-rich workflows: *"recovering Moretti's methods… thanks to the power of artificial intelligence and the proliferation of big data"* could open new opportunities (Gallo & Pellitteri, 2011, p. 6). Monedero cautions sequencing—*"It is a mistake… proposing expert systems and AI while no adequate tools to generate and modify simple 3D-models are available"* (2000, p. 369)—but the trajectory is clear: robust relational models first; informed computation next.

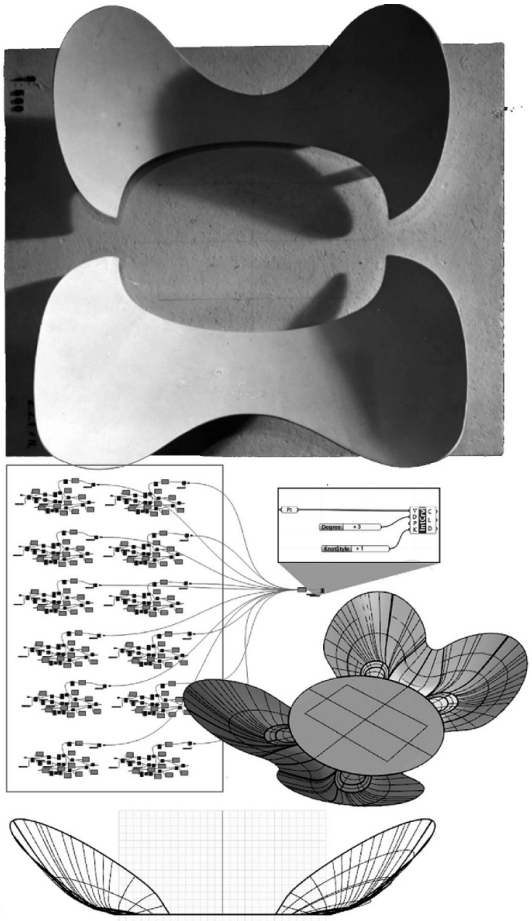


figure2, Luigi Moretti algorithms transcription using Visual Aid for scripting (Grasshopper), Milan, Italy (epresentation L. Vitali,2001)

## Why This Matters for Architecture and Urbanism

Architecture differs from replicated industrial products: *"CAD as used by engineers applies to objects repeated many times… exactly the opposite of what happens in architecture"* (Monedero, 2000, p. 376). Parametric design addresses this by coupling **context-specific constraints** with **editable relational structures**. Schumacher's urban program shows how parametric logics scale to **field conditions**, while Oxman's PDT articulates the cognitive and processual means (schemas, re-editing, differentiation) to **navigate complexity** without reducing it. In this thesis, we therefore take parametric design primarily as a **methodological framework**—historically grounded (Moretti), cognitively/theoretically elaborated (Oxman), operationally disciplined (Schumacher), and technically supported by editable, constraint-aware representations (Monedero)—to structure adaptive, relationship-rich design responses in complex urban contexts.

## 1.2 Theoretical Foundations

### Historical genealogy: parameters before computation

Long before digital tools, Luigi Moretti articulated a parametric conception of architecture grounded in relations. As Gallo and Pellitteri note, *"Luigi Moretti… appears to be the first to have formulated the concept of Parametric Architecture in 1940"* (2011, p. 1). For Moretti, architecture is a **system of interdependent forms**—structural, functional, expressive—such that, *"to have an architecture it is thus necessary for these three forms… to be identical"* (Gallo & Pellitteri, 2011, p. 3). Historically, he distinguishes two generative directions—**Structure→Form** versus **Form→Structure**—advocating a renewed primacy of the former (Gallo & Pellitteri, 2011, p. 3). In *Form as Structure*, he pushes a perceptual-mathematical view of difference: *"Each form can be defined by its differences… a system of ordered differences in a rhythm that constitutes the law of form"* (Gallo & Pellitteri, 2011, p. 4). These claims prefigure contemporary logics of parametric correlation, versioning, and performance coupling.

Moretti's late manifesto specifies eight methodological points—among them *"objective observation of all the conditioning elements (parameters)"* and *"definition of the relationships between the values of the parameters"*—tempered by *"the Architect's freedom… only if it does not affect the characteristics determined by the analytical investigations"* (Gallo & Pellitteri, 2011, p. 5). This coupling of rigor and authorship foreshadows today's balance of constraint-driven design and expressive choice.

### Cognitive and epistemic foundations: parametric design thinking (PDT)

Oxman frames parametric design as a cognitive model that reorganizes how designers think, represent, and iterate: *"parametric design is emerging as a unique and distinctive model of design"* (2017, p. 4). PDT is anchored in **generic schemas**, **associative relationships**, and **information-flow processes** that replace one-off modeling with **re-editing** of rule-based systems. Oxman stresses: *"The formulation of algorithmic parametric schema is a fundamental cognitive capability of creativity of the computational designer"* (2017, p. 12). Critically, parametric environments *"replace traditional CAAD re-modeling with re-editing… similar to 'reflection in action'"* (2017, p. 12), aligning computational work with Schön's iterative design cognition.

Within PDT, **differentiation** becomes a core strategy for generating families of context-responsive solutions: *"Differentiation… provides new types of formal, functional, performative, and structural properties"* (Oxman, 2017, p. 24). Oxman's distinction between **typological** schemas (families/sub-types) and **topological** schemas (continuous versioning via associative dependencies) clarifies the shift from static type to dynamic relation: *"Understanding how to manipulate and explore associative relationships and dependencies in topological geometry are among the central concepts"* (2017, p. 17).

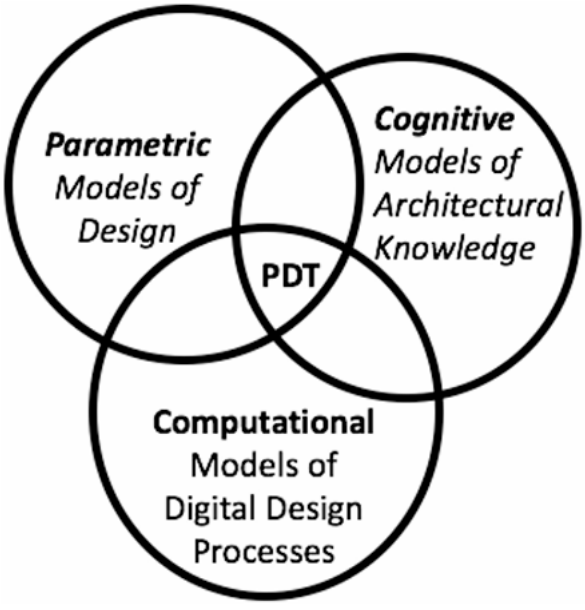



figure3, Diagram of intersecting fields of research in PDT (Oxman,2017)

**Method and style: parametricism as a research programme**

Schumacher argues that parametricism has matured into an epochal design style and methodological research programme: *"There is a global convergence… that justifies its designation as a new style: parametricism"* (2008, p. 14). He asserts it *"succeeds Modernism as the next long wave of systematic innovation"* (2008, pp. 14–15), marked by *"the elegance of ordered complexity and the sense of seamless fluidity, akin to natural systems"* (2008, p. 15). Beyond aesthetics, parametricism is disciplined by **heuristics**. Its **negative heuristics (taboos)** reject *"rigid geometric primitives… simple repetition… [and] juxtaposition of unrelated elements"*, while its **positive heuristics (dogmas)** call to *"consider all forms parametrically malleable; differentiate gradually; inflect and correlate systematically"* (Schumacher, 2008, p. 16).

Read alongside Moretti's eight points, Schumacher's heuristics situate parametric design as both **method** and **style**: rule-based, correlation-seeking, and differentiation-driven, yet open to expressive authorship within analytic bounds (cf. Gallo & Pellitteri, 2011, p. 5).

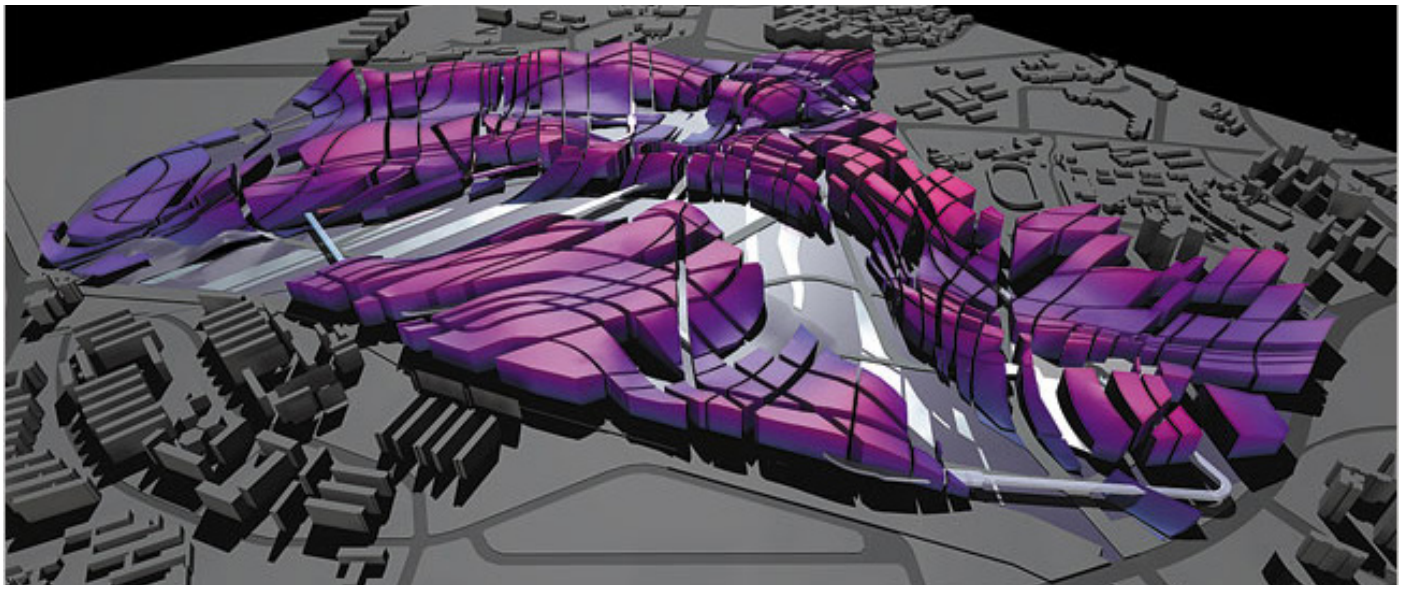


figure4, Zaha Hadid Architects, One-North Masterplan, Singapore, 2003 (NewYork Times,2006)

**Representations and mechanisms: constraints, editability, and features**

Monedero clarifies the representational substrate for parametric work. First, the term is fundamentally **relational**: *"Parametric design… implies the use of relations… relational modeling… constraint-based design"* (2000, p. 372). He diagnoses the shortfalls of conventional CAD—*"the computer as little more than a drafting tool"* (2000, p. 369)—emphasizing the need for systems that support **interactive modification** and **maintenance of relations** during edits (2000, pp. 369, 371).

Two families of parametric mechanisms dominate:

- **History-based parametrics**: the system *"keeps track of the sequence… Recomputing the model will… change some geometry while maintaining relations"* (Monedero, 2000, p. 374).
- **Variational geometry**: the system *"can recompute a design… independently of the sequence"* by solving constraint equations (Monedero, 2000, p. 374).

Underpinning both is **E-Rep**—an *"editable high level representation"* that encodes dependencies so changes propagate coherently (Monedero, 2000, p. 371)—and a constraint logic that regulates **degrees of freedom** in under/over-constrained states: *"A constraint is a relation that limits the behavior… implying degrees of freedom"* (2000, p. 372). At a higher semantic layer, **feature-based design** recognizes elements as having functional identity beyond geometry: *"a feature is an entity that belongs to a semantic order higher than the geometric one"* (Monedero, 2000, p. 375). These layers together enable robust, revisable models consistent with design cognition and project complexity

**From typology to topology: differentiation as design intelligence**

Integrating Moretti's structural-relational stance with Oxman's PDT yields a clear methodological arc: parameterize **relations** (not just dimensions), structure them as **schemas**, and explore **versioning** through controlled **differentiation**. Oxman's topological lens offers the operative leap from static type to dynamic **field** behavior (2017, p. 17, p. 24). This also reframes craft: the designer curates *what varies* and *how relations hold* rather than merely *what shape results*. Monedero's caution against premature AI—*"a mistake… proposing expert systems and AI while no adequate tools to generate and modify simple 3D-models are available"* (2000, p. 369)—usefully sequences innovation: first build **sound, editable schemas**; then layer **analytics, performance**, and eventually **AI** (cf. Gallo & Pellitteri, 2011, p. 6).

**Scaling up: urban fields, deep relationality, and self-organization**

Parametric thought scales from components to cities. Schumacher's **parametric urbanism** *"construct[s] new field logics… via the mutually accentuating correlation of multiple urban systems: fabric modulation, street systems, [and] open spaces"* (2008, p. 18). He contrasts modernist universal space with parametric **differentiated fields**—*"Space is empty. Fields are full, as if filled with a fluid medium"* (2008, p. 18)—and explicitly links to **self-organization**: *"Complexity theory… and the research of Frei Otto… taught us to recognise… patterns that emerge from processes of self-organisation"* (2008, p. 17). In this frame, parametric urbanism is not imposition but **choreography of relations**, tuning flows, densities, and interfaces so local differentiations aggregate into legible, adaptive wholes.

**Final word**

These foundations justify a **methodological reading** of parametric design for urban regeneration (rather than a purely stylistic one):

- Historically grounded **relationalism** (Moretti) legitimizes parametric work in contexts with deep cultural/typological strata.
- Cognitive/process models (Oxman) support **re-editable**, feedback-rich workflows that suit incremental transformation.
- Heuristics of **differentiation and correlation** (Schumacher) guide multi-scalar coherence without uniformity.
- Constraint-aware **representations** (Monedero) ensure edits maintain dependencies across components, systems, and scales.

In the later chapters, these principles will be operationalized for **Eliava Bazaar**—treating the market as a living field of relations to be clarified, parameterized, and **differentiated** (rather than overwritten), aligning parametric control with the **self-organized** logics that give the place its identity.

## 1.3 Tools & Methods

**Overview**

This research adopts a **parametric workflow** as the principal methodology to engage with the complex dynamics of the Eliava Bazaar. Informal markets such as Eliava operate through **self-organized logics**—emergent systems of spatial occupation, negotiation, and adaptation that are not pre-designed but instead grow incrementally over time. These logics resist static planning approaches and demand methods capable of **capturing fluid relationships rather than prescribing fixed outcomes**.

Parametric design offers such a framework. Rather than treating architecture as the pursuit of a final form, parametricism emphasizes the **definition of rules, constraints, and relationships** that generate adaptable configurations. As Oxman (2017) explains, "Parametric design… [is] a unique and distinctive model of design thinking" (p. 209), where the act of design shifts from form-making to the management of interdependencies. This makes it especially suited to contexts where urban environments are in constant flux, such as informal markets.

The theoretical foundations of this approach can be traced back to Luigi Moretti, who in the 1940s introduced the notion of "parametric architecture," describing it as the study of "the relationships between the dimensions dependent upon the varied parameters" (Moretti, 1971, p. 203). Moretti's pioneering vision emphasized architecture as a system of interdependent variables, anticipating contemporary computational methods. This historical perspective highlights how parameters can encode diverse conditions—structural, spatial, and social—and how these can be orchestrated into adaptable forms.

Patrik Schumacher (2009) further developed this paradigm by framing parametricism as a "new global style" that succeeds modernism. He argues that "there is a global convergence in recent avant-garde architecture that justifies its designation as a new style: parametricism" (p. 14). Central to this style is the principle of **continuous differentiation**, which replaces the rigid uniformity of modernist approaches with dynamic variation. For Schumacher, the true power of parametric methods lies in their capacity to "organise and articulate the increased complexity of our post-Fordist society" (2009, p. 15). This perspective directly resonates with the challenges of informal urbanism, where multiple actors, functions, and spatial claims coexist in overlapping patterns of use.

In this study, the **parametric workflow functions as both an analytical and generative tool**. Analytically, it enables the mapping of existing informal patterns and the identification of key parameters that shape spatial organization—such as circulation paths, clustering of functions, or availability of green spaces. Generatively, it allows the testing of multiple scenarios, where parameters can be adjusted to explore how small shifts in spatial rules affect the overall organization of the bazaar. As Schumacher (2009) notes, parametricism establishes "design research programmes" (p. 16) in which methodological rules guide designers to avoid outdated rigidities while embracing differentiation and correlation. This positions parametric methods not simply as technical tools but as part of an **ongoing epistemological shift in architecture and urbanism**.

Ultimately, adopting a parametric workflow provides a methodologically rigorous yet flexible approach to addressing informal urbanism. Instead of imposing rigid order, it seeks to translate self-organized logics into a **structured adaptability**, where rules and relationships replace fixed blueprints. This aligns the thesis with contemporary discourses on computational design, urban informality, and adaptive urban regeneration, setting the foundation for the subsequent methodological steps.

**Data Collection and Analysis**

To operationalize the parametric workflow, this research assembled a combination of **primary and secondary datasets**. The aim was to capture the spatial, environmental, and operational dynamics of Eliava Bazaar in a way that could later be formalized into parametric rules. Data were not gathered as static records but as **actionable variables** that reveal tendencies, thresholds, and constraints within the bazaar's everyday functioning.

The first dataset concerned **movement and access**, documenting pedestrian traces, desire lines, entry points, and vehicular edges. These elements were crucial for identifying how users actually navigate the bazaar, often in ways that diverge from formally designated paths. As Hillier (1996) argues, "movement in the city is not random but structured, following intelligible spatial logics" (p. 29). In Eliava, these logics manifest as informal circulation patterns that both respond to and reshape the built environment.

A second dataset focused on **use and clustering**, mapping stall typologies, adjacency patterns between vendors, informal storage practices, and service points such as water and electricity. Such clustering is typical of informal markets, where, as Roy (2005) observes, "informality is not the exception to planning but its constitutive outside" (p. 148). The clustering patterns, therefore, do not simply reflect disorder but represent **embedded systems of economic and spatial rationality**.

A third category addressed **environmental factors**, including solar exposure, prevailing winds, noise zones, and surface runoff. These conditions directly affect comfort and usability, shaping where vendors prefer to cluster or avoid. For instance, Batty (2005) notes that "urban systems can be understood as adaptive structures that self-organize around flows of energy, people, and resources" (p. 45). In this sense, environmental conditions become active variables in the emergent ordering of Eliava.

Finally, a set of data on **safety and governance** was assembled, including fire lanes, emergency access widths, and known congestion hotspots. These layers reflect the interface between self-organization and regulation, revealing potential points of conflict where informal practices obstruct safety requirements. Boonstra and Boelens (2011) emphasize that "self-organization does not exclude governance but rather reframes it as negotiation between top-down and bottom-up forces" (p. 106).

Once collected, these datasets were **normalized and layered** to generate analytical insights that could guide the design process. For instance, pedestrian movement data was translated into measures of **flow intensity**, identifying origin–destination densities and doorway attractors. Accessibility metrics were derived from distances to entry points and arterial streets, while comfort conditions were quantified through **solar exposure hours, shading potential, and noise attenuation values**. Safety was similarly translated into measurable thresholds, such as required clear-width buffers and turning radii for emergency access.

These transformations allowed the diverse datasets to be expressed as **continuous scalar fields** ranging from 0 to 1. By abstracting the data into relative gradients rather than fixed values, they could be mapped onto **associative parameters** in the parametric environment. This scalar approach enabled the construction of **geometric rules** in Grasshopper that dynamically respond to shifting conditions: for example, circulation corridors that widen in response to higher pedestrian density, or clustering patterns that adapt to thresholds of solar exposure.

Through this process, **raw observations were elevated into design drivers**. Movement patterns became attractor fields for circulation geometries, environmental gradients informed comfort envelopes, and governance constraints translated into safety buffers. The layered analysis thus provided the foundation for a parametric model that does not merely reproduce existing conditions but actively simulates and reorganizes them. In this way, the data collection and analysis stages serve as the crucial intermediary between the **informal self-organization of Eliava Bazaar** and the **computational logics of parametric design**.

**Computational substrate: from algorithms to parametric schema**

We adopt the computer not as a drafting board but as an algorithmic machine. As Kotnik reminds us, "*computable functions are precisely the algorithmic ones*" (Kotnik, 2006/07). The design consequence is direct: the project formalizes inputs → transformations → outputs so that interventions can be regenerated, compared, and audited.

Parametric design implements this via associative graphs. In propagation-based systems, "*a design state [is] an acyclic directed graph… with algorithms for ordering the graph and propagating values*" (Woodbury, Aish & Kilian, 2007). Within this graph, "*nodes… are schemata containing variables and constraints,*" whose update algorithms compute dependent values (ibid.). Such a graph "models a… collection of instances" generated by assigning values to independent variables (ibid.). Practically, this gives us a versionable framework (many options, one model), and a re-editable medium (change relationships, not just geometry).

Oxman terms this scaffold the parametric schema—"a unique type of mathematical model" in which the designer "designs the code… to design the design object" (Oxman, 2017). Current tools support re-editing: they replace "re-modeling with re-editing computational mechanisms," giving a digital analog to Schön's reflection-in-action (Oxman, 2017).

Two further principles organize the schema:

•Differentiation: a strategy to encode local specializations within continuous fields—"differentiation gradient thinking" (Oxman, 2017).

•Materialization: integrating Material Fabrication Design (MFD) so that form–structure–material are co-informed, not sequential (Oxman, 2012, 2016).

Finally, following Moretti, we treat form as a system of relations—"parametric architecture… define[s] the relationships between the values of the parameters" while pursuing "exactness of relationships in their general structure" (Moretti, 1971). This aligns the project with a Structure → Form direction when structural, functional, and expressive logics converge.

## Grasshopper

Grasshopper, developed by David Rutten at Robert McNeel & Associates in the mid-2000s, emerged as a response to the growing demand for visual scripting within Rhinoceros 3D. Initially released under the name Explicit History, the tool allowed designers to construct complex parametric models without the need to write traditional lines of code. This early approach provided a history-based framework where design operations could be recorded and modified dynamically. Over time, the platform evolved into what is now known as Grasshopper—an intuitive, node-based visual editor that enables designers to control geometry through algorithms and logical relationships. By the late 2000s (2007–2009), Grasshopper gained traction among architects and researchers, particularly because of its open and modular structure, which supported integration with third-party plugins such as Kangaroo (a physics engine), Ladybug Tools (for environmental analysis), and Elk (for GIS and mapping). These extensions made the software particularly relevant for urbanists and environmental designers, who could leverage real-world data in computational design workflows.

Grasshopper has since become a widely adopted platform in urban design for developing parametric and data-driven models that dynamically respond to changing inputs. Designers are able to define rules and relationships—for example, building heights, density thresholds, setbacks, or circulation networks—and immediately visualize the spatial and environmental consequences of these parameters. This capability supports the exploration of multiple design scenarios, enabling performance testing against criteria such as solar exposure, wind flow, accessibility, and regulatory compliance. Plugins like Ladybug, Elk, and Decoding Spaces further enhance these workflows by integrating GIS data, conducting microclimatic simulations, and analyzing spatial accessibility. The result is a design environment that fosters faster iteration, precision, and evidence-based decision-making.

One of Grasshopper's distinctive advantages is its accessibility to non-programmers. Its visual programming interface lowers the technical barrier, allowing architects, urbanists, and planners to employ computational methods without requiring deep coding expertise. At the same time, its transparent and interactive nature supports collaborative planning processes, enabling stakeholders to visualize real-time impacts of design changes and engage more effectively in decision-making.

Beyond its standard capabilities, Grasshopper benefits from a highly extensible and community-driven ecosystem. Hundreds of plugins expand its functions far beyond geometric modeling, including Wallacei for evolutionary optimization, Heteroptera for advanced data manipulation, and many others. Moreover, Grasshopper supports scripting in Python and C#, facilitating integration with external platforms such as Excel, GIS software, and advanced simulation engines. This transforms Grasshopper from a parametric modeling tool into a flexible computational framework capable of customized workflows, automation, and real-time analysis. As such, it is increasingly regarded not only as a modeling environment but as a comprehensive design platform for creating adaptable, sustainable, and performance-driven urban environments.

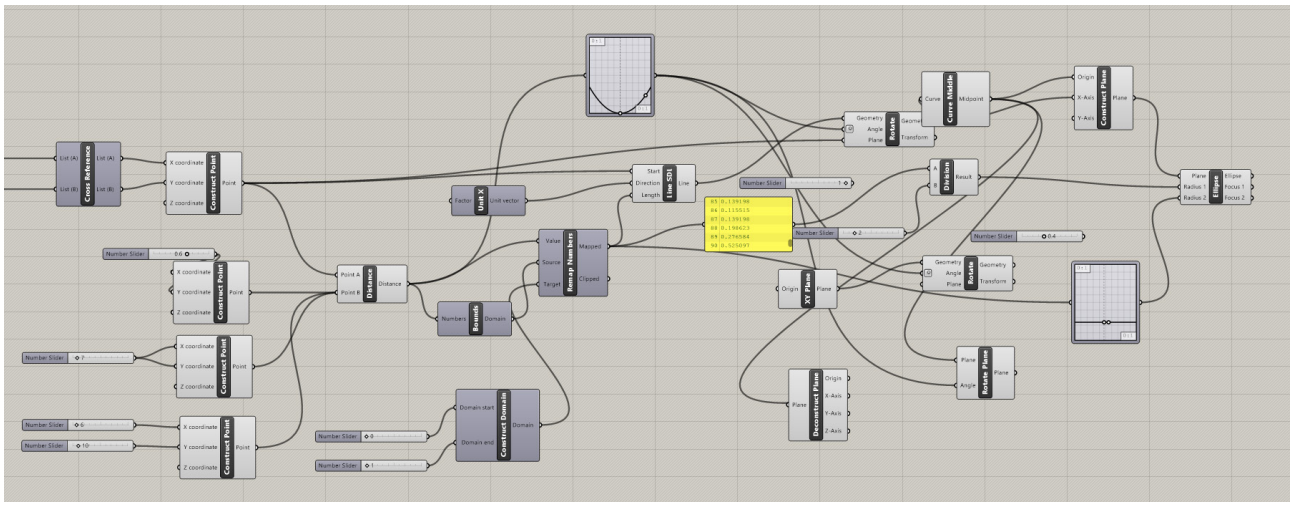


figure5, Grasshopper workflow

**Case study**

In this case study, Grasshopper was employed as a computational platform to enhance urban design processes by developing custom tools for generating street networks and subdividing urban blocks—tasks that had traditionally been difficult to manage within parametric environments. By integrating advanced modeling methods from CityEngine into Grasshopper, researchers were able to expand the toolset available to architects and urban designers, making complex urban simulations accessible within a platform already widely used in architectural practice. This integration not only streamlined workflows but also facilitated the creation of more realistic, data-informed, and context-sensitive urban models.

The methodology was tested in two distinct contexts: a Master's thesis project in Moscow and a teaching exercise in India. In both cases, the parametric workflows allowed the design outcomes to adapt dynamically to local conditions, such as proximity to infrastructure, transportation networks, and landscape features. These context-aware rules helped move beyond generic masterplanning strategies toward site-specific urban morphologies.

While early iterations of the workflow revealed limitations—particularly in the realism of street network generation—the introduction of custom scripts and plugins significantly improved the process. Over time, the approach demonstrated Grasshopper's capacity not only as a form-finding tool but also as a flexible platform for urban planning and design experimentation. By combining scripting, parametric rules, and external data integration, the case study illustrated Grasshopper's potential to bridge the

This work highlights the importance of extending computational design tools beyond the architectural object, enabling designers to tackle the multi-scalar complexity of urban environments. It also reinforces Grasshopper's role as a pedagogical and research instrument, capable of equipping future designers with the ability to explore adaptive, generative approaches to urbanism.

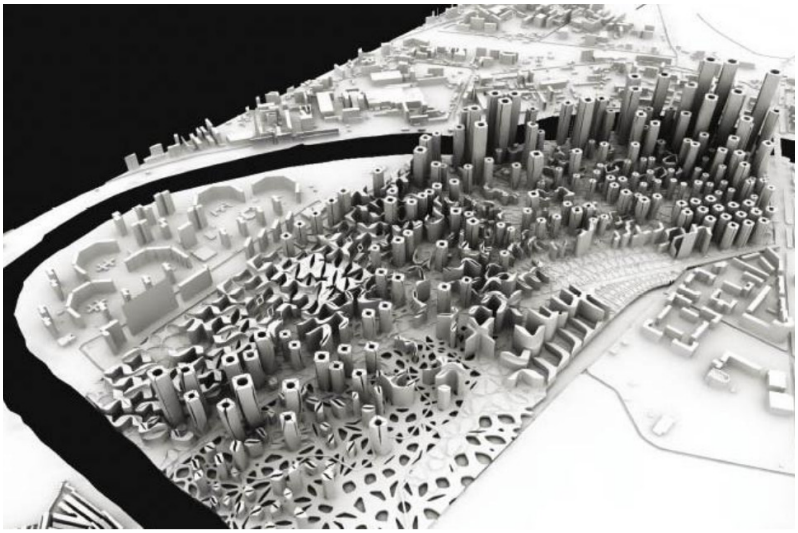


figure6, Final urban design proposal of the master's project in Moscow. Source: Schmitt, Koltsova 2011.

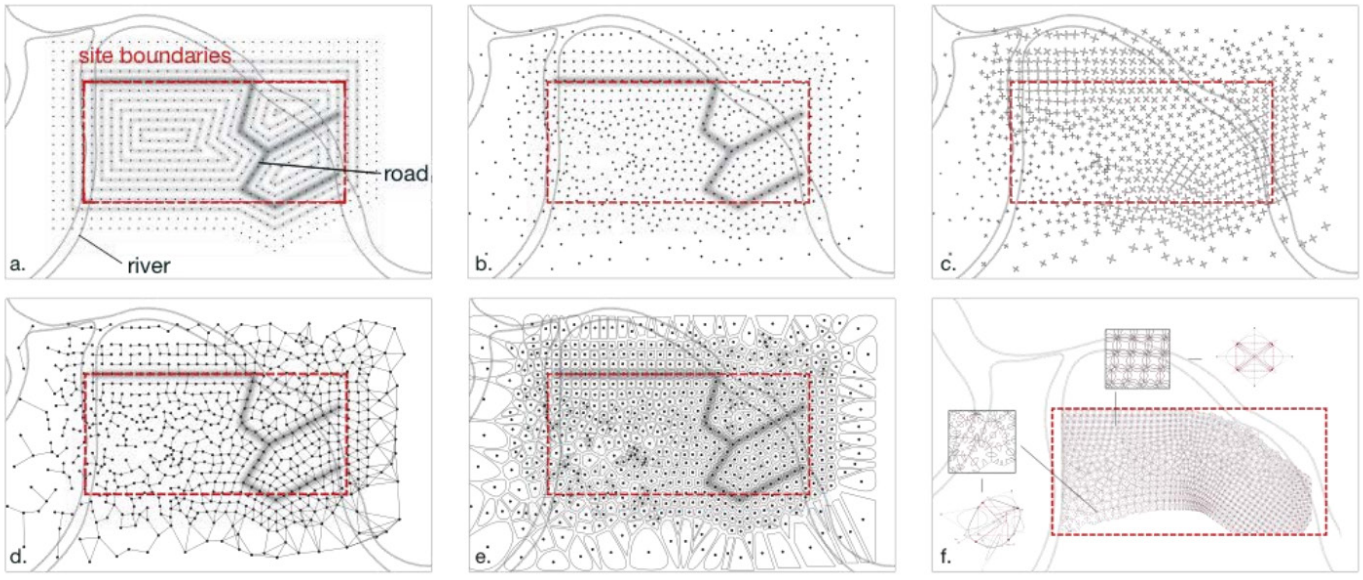



figure7, a. Initial point grid setup b. Point shift c. Orientationd. Connectivity e. Voronoi subdivision f. Geometry in Voronoi cell (Schmitt, Koltsova 2011)

## 1.4 Parametric Design in Urbanism

The integration of parametric design into urbanism marks a significant shift in how cities are conceptualized, modeled, and regenerated. Historically, urban design has relied heavily on fixed masterplans and prescriptive zoning, often producing rigid spatial configurations unable to respond to the complexities of urban life. In contrast, parametric urbanism introduces a methodology that treats cities as dynamic systems composed of interdependent variables. As Kolarevic (2003) observes, *"the digital medium allows architects to describe not the shape of a building but the logic of its generation"* (p. 14). Applied to urban contexts, this principle means that cities can be designed and adapted through the manipulation of parameters such as density, connectivity, or environmental conditions rather than through fixed blueprints.

### From Architecture to Urbanism

The migration of parametric thinking from the scale of buildings to that of cities reflects a broader recognition of urban complexity. Schumacher (2009) positioned parametricism as a new architectural paradigm, declaring that *"all elements of architecture are parametrically malleable, adaptive to contextual forces, and mutually correlated"* (p. 15). While Schumacher emphasizes aesthetics and formal flexibility, his claim has deeper implications for urbanism: it suggests that the logic of correlation and adaptation can extend across neighborhoods, infrastructures, and entire cities. Batty (2013) underscores this systemic orientation, stating that *"the new science of cities is based on the premise that urban systems are complex, adaptive, and computational"* (p. 12). In this sense, parametric urbanism is not merely about creating complex geometries, but about encoding relationships and rules that allow cities to self-adjust in response to changing conditions.

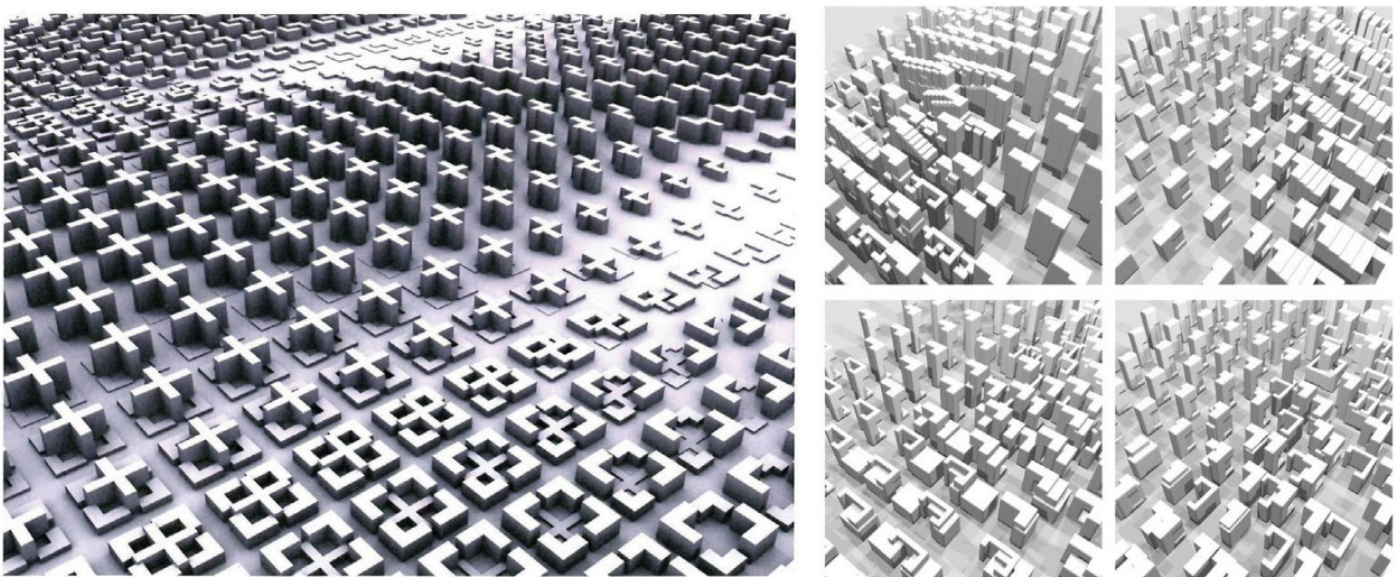


figure8, Building prototypes generated within the computational matrices as urban fabric: Controlled transformation of the par metric variations lets the emergence of hybrid typologies and their smooth transformation in a coherent manner (Calıskan,2017)

### Parametric Urban Modeling and Simulation

One of the main contributions of parametric urbanism lies in its capacity to simulate urban scenarios through the manipulation of parameters. Batty (2009) notes that *"urban modeling provides a way of exploring possible futures of cities through controlled variation of assumptions and parameters"* (p. 53). Tools such as Rhino and Grasshopper enable designers to create computational models where form is a function of input data, constraints, and iterative algorithms. Hudson (2010) highlights this as a paradigmatic shift: *"parametric design strategies transform architectural practice from the design of forms to the design of systems of relationships"* (p. 40). In urban contexts, such systems allow planners to test different configurations for housing density, transport connectivity, or green space distribution, and to immediately see how changes ripple through the entire model.

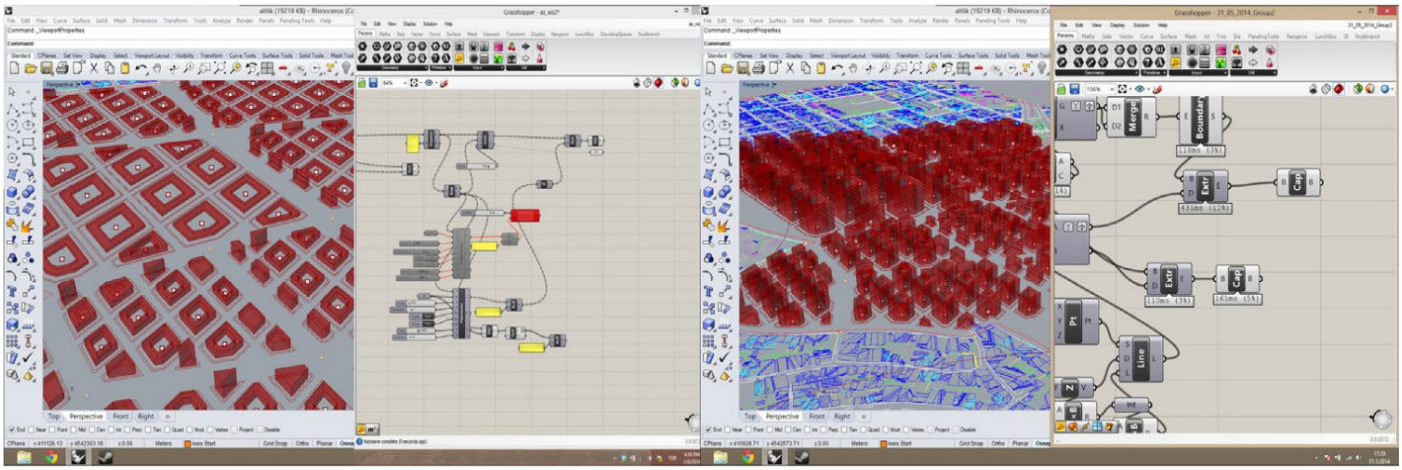


figure9, The visual definition of the design algorithm in the parametric platform of Grasshopper (Calıskan,2017)

Importantly, parametric modeling is not only about efficiency but also about exploration. Woodbury (2010) reminds us that *"parametric design does not just describe what is, but what could be, opening a space of possibilities defined by relationships among parameters"* (p. 21). For urbanism, this means that instead of delivering one final plan, designers can produce a spectrum of adaptive scenarios, empowering decision-makers and communities to select or combine pathways that best respond to contextual realities.

## Adaptability and Informality

Perhaps the most promising application of parametric design in urbanism lies in contexts of informality and regeneration. Informal markets and settlements emerge through processes of self-organization, shaped by economic necessity, social networks, and spatial improvisation. Frazer (1995) anticipated such dynamics when he wrote that *"architecture, like nature, should evolve by a process of adaptation and selection"* (p. 7). Informal settlements, in this sense, can be seen as evolutionary systems where spatial configurations are constantly negotiated. Parametric approaches, with their capacity to encode multiple constraints and generate modular, flexible solutions, provide a way to engage with this fluidity rather than suppress it.

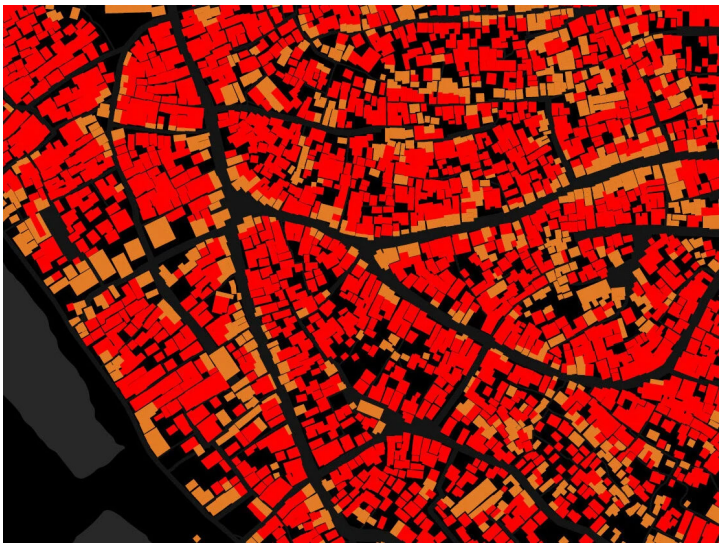


figure10, Morphogenesis of Informal Settlements (Atlas of informal settlement,2023)

This approach resonates with Batty's (2013) view of cities as "computational machines, processing flows of people, goods, and information through patterns that emerge rather than being imposed" (p. 19). By leveraging parametric methods, regeneration projects can balance top-down interventions with bottom-up adaptability, ensuring that formalization does not extinguish local practices.

## Challenges and Critiques

Despite its potential, parametric urbanism is not without critique. Parisi (2013) warns that computational design risks privileging algorithmic autonomy over social needs, noting that *"computation is never neutral; it produces its own aesthetic and political consequences"* (p. 4). Similarly, Batty (2009) cautions that *"models must be continuously calibrated against real urban data, otherwise they risk becoming abstract exercises detached from the realities of urban life"* (p. 56). These critiques remind us that parametric urbanism should not be understood as a purely technical exercise but as a socio-technical practice. Without engagement with communities and contextual knowledge, even the most sophisticated algorithms may reproduce exclusion or rigidity.

Another challenge concerns accessibility. As Hudson (2010) observes, *"parametric design requires a cognitive shift and new skill sets that are not yet widely diffused across the architectural profession"* (p. 41). When applied to urbanism, this challenge becomes even more acute, as successful projects often demand interdisciplinary collaboration between architects, planners, engineers, and local actors.

**Conclusion**

Parametric design in urbanism represents a methodological and conceptual departure from static planning towards adaptive, relational, and data-informed strategies. Its emphasis on variability and relationships rather than fixed forms enables designers to grapple with the complexities of urban systems. As Kolarevic (2003) suggests, parametric methods allow us to "replace singularity with multiplicity" (p. 15), a principle especially relevant in contexts of informality where multiplicity is the rule rather than the exception.

At the same time, parametric urbanism's promise lies not only in aesthetics or efficiency but in its potential to reconcile top-down planning with bottom-up self-organization. When grounded in real data and community engagement, it can provide regenerative frameworks that respect the adaptive logics of informal markets and settlements. However, as Parisi (2013) reminds us, computation must remain critically examined to avoid becoming an end in itself. The task, then, is to harness parametric design as a tool for inclusive, resilient, and adaptable urban futures.


figure11, The major schemes from the Kartal-Pendik Masterplan designed by Zaha Hadid Architects, 2006 (Caliskan, 2017).

# INFORMAL URBANISM

## 2.1 Introduction to Informal Urbanism

### Defining Informal Urbanism

Informal urbanism refers to the processes and spaces that emerge outside formal planning regulations, often as adaptive responses to exclusion, rapid population growth, and socio-economic pressures. It is not merely a residual category of urban development but a generative mode of urbanization that continuously interacts with formal systems. As McFarlane (2012) argues, *"informality is not a sector but a mode of urbanization, a practice that interweaves with formal systems and institutions"* (p. 90). This definition challenges the conventional binary of formal versus informal, emphasizing instead their mutual entanglement and co-production.

From this perspective, informal urbanism extends beyond unplanned housing or street vending. It encompasses a wide range of everyday practices—from settlement building and incremental construction to adaptive reuse of spaces and grassroots markets—that collectively shape the spatial and social fabric of cities. It represents a form of urban knowledge production rooted in local agency and lived experience, often in tension but also in negotiation with state regulations.

figure12, Informal morphologies - locations include Buenos Aires, Caracas, Cairo, Jakarta, Johannesburg, Karachi, Lima, Manila, Mumbai, Nairobi, Rio de Janeiro and Skyros (Atlas of informal settelments, 2023)

## Historical Context and Evolution

The study of informality gained prominence in the 1970s, particularly in the Global South, where unregulated housing and markets were widespread. Early research framed informality as a survival mechanism for marginalized communities. Bromley (1978), for instance, described informal street markets as *"flexible, adaptive, and deeply embedded in the socio-economic fabric of cities, often serving as survival strategies for marginalized groups"* (p. 1034). These markets, though frequently viewed as chaotic by authorities, demonstrated their own forms of order and resilience.

By the 1990s, scholars began reframing informality through the lens of complexity theory. Batty and Longley (1994) argued that cities should be understood as *"self-organizing systems, characterized by non-linear growth, feedback, and emergent order"* (p. 18). This marked a shift away from deficit-based views of informality, instead recognizing its rationality and its capacity to generate functional urban systems. Informality was no longer regarded as a pathology to be eradicated but as an inherent and often efficient mechanism of urban development.

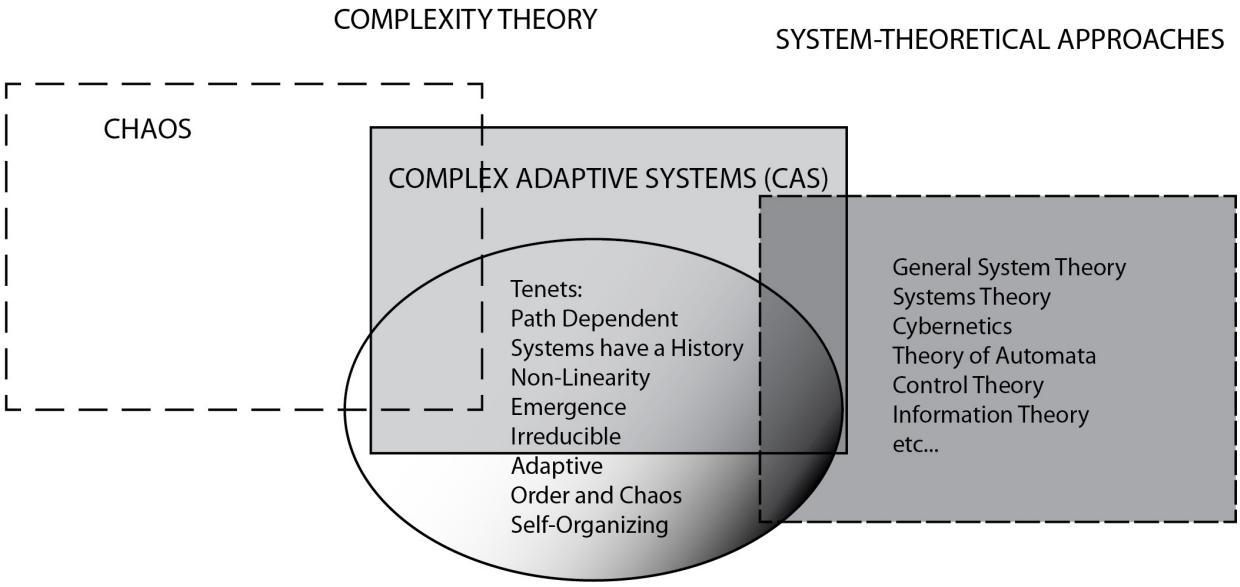



figure13, Complexity theory visual diagram (mdpi.com, 2019)

**Characteristics of Informal Urbanism**

Several characteristics define informal urbanism. First, it is inherently **self-organizing**: spaces and activities emerge incrementally, guided not by master plans but by local decisions, negotiations, and needs. As Beirão (2011) observes, *"uncertainty and complexity seem to be dominant paradigms in the growth of cities, and even when planned, the development of cities is difficult to predict"* (p. 74). Informal processes embrace this uncertainty, offering flexible spatial arrangements that adapt to shifting social and economic conditions.

Second, informal urbanism is marked by **adaptability**. Structures and settlements are often designed for modification, expansion, or relocation. This flexibility allows communities to adjust their environments in response to new opportunities or challenges, a quality that formal planning often struggles to accommodate.

Third, informal urbanism is characterized by **hybridity**. Informal practices rarely exist in isolation; they intersect with formal systems of regulation, infrastructure, and governance. McFarlane (2012) highlights this dynamic when noting that *"informality is not the opposite of planning but often co-produced through it"* (p. 95). For example, informal markets may be tolerated, partially regulated, or even integrated into formal urban frameworks, producing hybrid spatial orders that defy simplistic categorizations.

figure14, Drone photo of Eliava Bazaar in Tiblisi, Georgia 2024

## Contemporary Relevance

In contemporary debates, informality is increasingly recognized as a legitimate and productive force in urbanization. Rather than eradicating informal practices, urban theorists and practitioners are exploring ways to harness their adaptive capacities. Batty (2005) stresses that *"informal urban growth exemplifies the logic of complexity, producing emergent structures that cannot be predetermined yet often achieve remarkable efficiency"* (p. 32). This reflects a paradigm shift: informality is no longer seen solely as a problem of governance but as a potential resource for design and regeneration.

For architects and urban designers, this recognition raises fundamental questions about methodology. How can design frameworks incorporate the logics of self-organization, flexibility, and hybridity inherent in informal urbanism? Beirão (2011) suggests one approach through the notion of *Urban Induction Patterns*, defined as *"recurrent urban design moves provided with a generic grammar that replicates these moves and can be applied in many different contexts"* (p. 78). This idea resonates with parametric design thinking, in which adaptability is embedded into the design process itself. Both approaches rely on iterative rules and generative systems rather than rigid, top-down prescriptions.

figure15, Drone photo of Eliava Bazaar in Tiblisi, Georgia 2024

## Towards Regeneration Frameworks

Understanding informal urbanism is particularly relevant for urban regeneration, especially in contexts such as markets and housing where informality plays a central role. Informal markets, often dismissed as chaotic, exhibit highly organized spatial and social logics shaped by economic exchange, cultural practices, and community self-regulation. Bromley (1978) emphasizes that such markets are *"not simply residual but are central to the functioning of urban economies"* (p. 1042).

Incorporating these insights into regeneration strategies means shifting from imposing formal order toward enabling self-organized practices to flourish. It implies designing frameworks that respect local agency, allow incremental growth, and recognize the legitimacy of hybrid spatial orders. This does not mean romanticizing informality but acknowledging its rationalities and integrating its adaptive strategies into broader urban visions.

## 2.2 Theoretical Origins

The theoretical foundations of informal urbanism emerged in the 1960s and 1970s, a period marked by rapid urbanization and the visible proliferation of self-built settlements and informal markets across the Global South. These phenomena challenged dominant planning paradigms, which had long prioritized state-led, top-down models of housing and commercial infrastructure. The result was a body of scholarship that repositioned informality not as an aberration, but as a constitutive mode of urban production—an understanding that has profound implications for how informal markets are regenerated today.

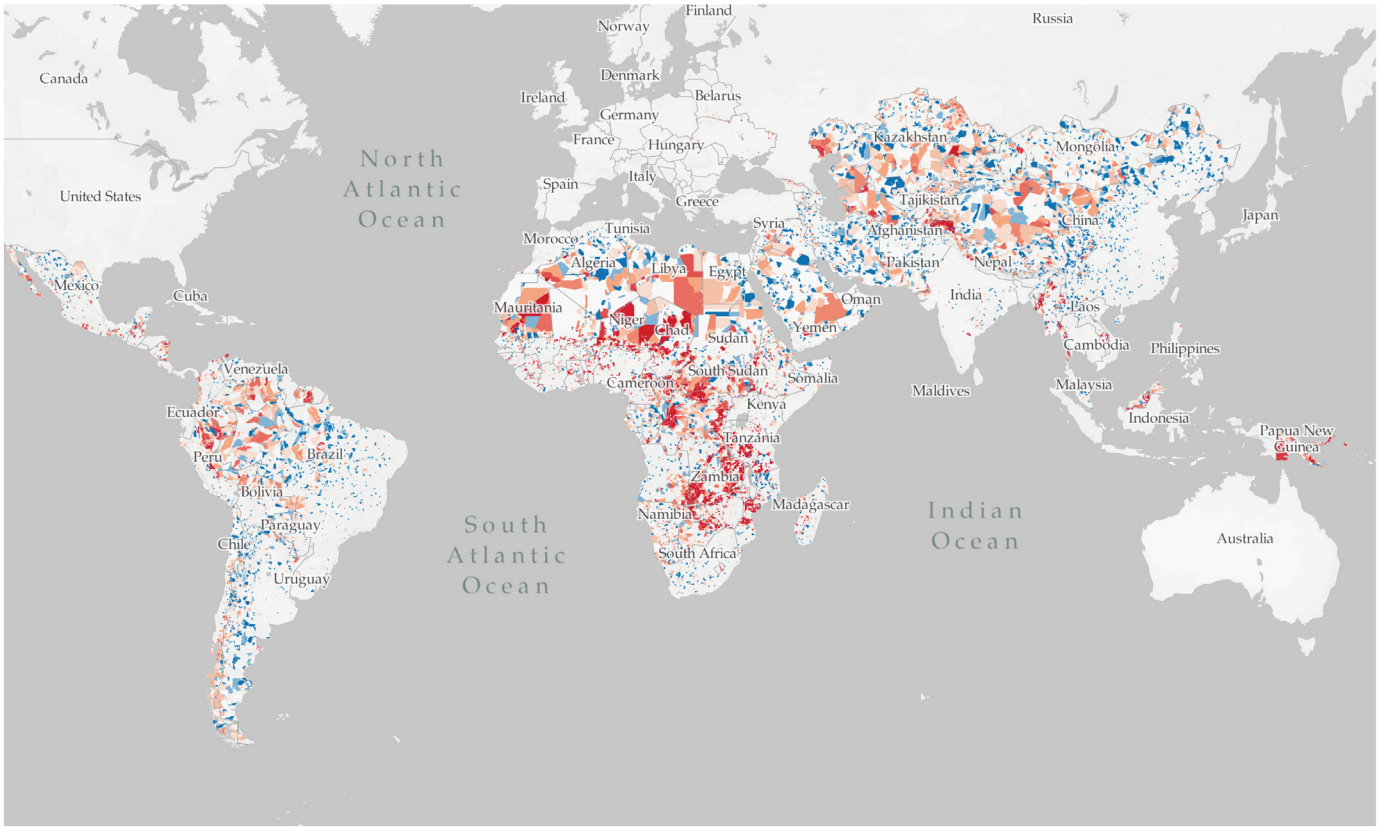



figure 16, Snapshot of the MillionNeighborhoods.org project website, showing the street block level analysis for most nations in the global South. Countries with any colored polygons within their boundaries have been analyzed; at this zoom level, only the largest polygons are aggregated and shown, MillionNeighborhoods.org

### Agency and Self-Organization

John Turner's pioneering work on self-help housing was instrumental in reshaping this discourse. Turner (1976) argued that *"when dwellers control the major decisions and are free to make their own contributions in the design, construction or management of their housing, both the process and the environment produced stimulate individual and social well-being"* (p. 11). By framing housing as a *process* rather than a *product*, Turner highlighted the agency of residents and the incremental, adaptive nature of informal development. While his focus was primarily on housing, the logic readily extends to informal markets: the vibrancy and resilience of street markets are likewise grounded in the capacity of vendors and communities to adapt spaces incrementally to shifting needs. Thus, regeneration strategies must build on, rather than suppress, this bottom-up agency.

### Informality and Economic Systems

A parallel line of inquiry emerged in economics, most prominently through Hernando de Soto's *The Other Path*. De Soto (1989) proposed that informality arises less from disorder than from exclusion, arguing that *"informals are not the problem but the solution, a source of untapped potential for national economies"* (p. 12). By locating informality within systemic constraints of bureaucracy and regulation, de Soto's thesis casts street vendors and market traders as entrepreneurs responding to institutional barriers. For regeneration projects in informal markets, this perspective underscores the importance of designing regulatory frameworks

**Governance and Power**

From the 1990s onward, critical urban theorists expanded the conceptual lens to highlight the entanglement of informality and governance. Ananya Roy (2005) emphasized that *"urban informality must be understood as a mode of urbanization and a mode of governance"* (p. 149). Informal markets, often tolerated in one location but evicted in another, epitomize this selective enforcement. They are not simply outside formal planning but actively shaped by it, producing hybrid regimes of regulation and informality. This has direct implications for regeneration: interventions must recognize that informal markets are co-produced with the state, and thus regeneration efforts require negotiation with both community practices and governmental regulatory logics.

AbdouMaliq Simone further expanded the discussion through his concept of *"people as infrastructure."* He argued that in African cities, social relationships function as critical infrastructures that sustain economic life. As Simone (2004) explained, *"residents provide highly provisional and dynamic platforms of association"* (p. 407). Informal markets exemplify this infrastructural role, serving as nodes where social networks, trust, and improvisation underpin the circulation of goods, credit, and knowledge. In regeneration frameworks, this perspective invites a shift away from purely physical interventions toward approaches that strengthen the social and relational infrastructures of markets.

**Cultural Dimensions**

Finally, Nezar AlSayyad (2004) emphasized the cultural and symbolic dimensions of informal urbanism. He argued that *"the informal city is not simply a product of poverty or necessity, but also of cultural practices and identity"* (p. 9). Markets, in this light, are not only economic engines but also cultural spaces where traditions, identities, and collective practices are expressed and reproduced. Recognizing this dimension in regeneration means designing frameworks that respect markets as cultural institutions, not merely as spaces of trade.

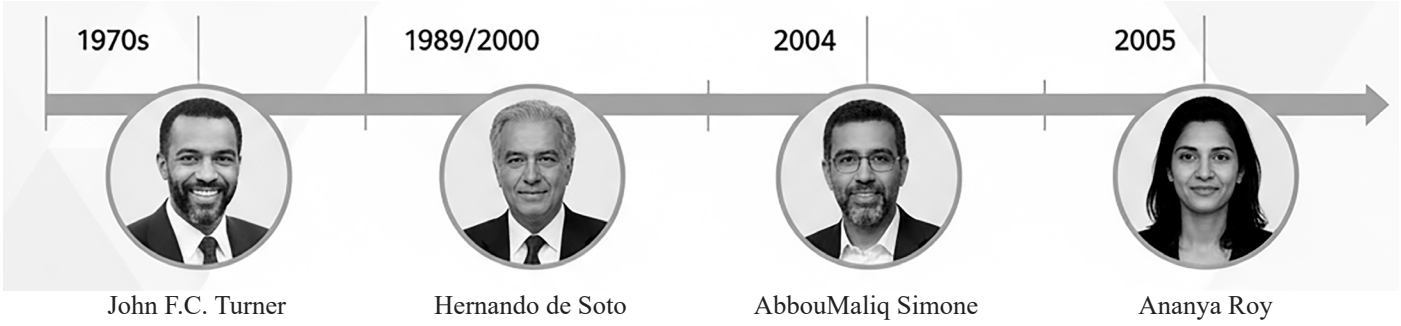



figure17, Timeline of key thinkers in Informal Urbanism

**Synthesis: Informality as Urban Logic**

Taken together, these theoretical contributions reframe informal markets as central to urban life rather than peripheral anomalies. Turner highlights the adaptive agency of communities; de Soto foregrounds structural exclusion and entrepreneurial potential; Roy exposes the role of governance in producing informality; Simone demonstrates the infrastructural role of social networks; and AlSayyad underscores the cultural embeddedness of informal practices. These perspectives collectively argue that regeneration should not seek to erase markets in favor of formalized order, but instead should leverage their organizational logics, economic adaptability, and cultural vitality. In this way, informal markets can be positioned as engines of inclusive urban regeneration, embodying both resilience and innovation within the contemporary city.

## 2.3 Informal Economies and Markets

### Informality as Urban Infrastructure

Informal economies have long been central to the production of urban space, sustaining livelihoods and shaping the everyday rhythms of cities. Far from being marginal or residual, informal markets constitute vibrant arenas of exchange that generate employment, enable access to goods and services, and reinforce social cohesion. As Bromley (2000) observed, *"street vending is an ancient and important occupation found in virtually every country and major city around the world"* (p. 1). These markets are simultaneously economic systems, cultural spaces, and social infrastructures, which explains both their resilience and their contested status within urban policy.

### Social Embeddedness and Community Networks

One of the defining characteristics of informal markets is their embeddedness in community networks. Simone (2004) famously described these social arrangements as *"provisional and dynamic platforms of association"* (p. 407), highlighting how trust, reciprocity, and negotiation act as infrastructures enabling markets to function. In the context of urban regeneration, this means that interventions cannot focus solely on physical form. The relational dynamics of vendors, customers, and community groups are equally vital, as they underpin the adaptability and sustainability of market systems.

### Hybrid Economies and Governance

Informal markets also exemplify the hybridity of urban economies. As Roy (2005) argued, *"informality is not the opposite of planning but often co-produced through it"* (p. 149). In practice, this hybridity manifests when street markets are tolerated in certain districts, regulated through licensing schemes, or incorporated into formal planning strategies. Yet they may simultaneously be subject to evictions, crackdowns, or stigmatization as "disorderly." This oscillation between tolerance and repression reveals that informal markets are not simply outside the formal system but are deeply entangled within it. Regeneration strategies must therefore acknowledge these hybrid arrangements rather than impose rigid dichotomies between "formal" and "informal."

Economically, informal markets function as both survival strategies and entrepreneurial incubators. Bromley (2000) notes that street vending can range from *"a desperate search for a subsistence income through to petty capitalism, or the diversification of big business to boost demand and achieve a higher turnover"* (p. 2). This duality challenges simplistic representations of vendors as uniformly poor or vulnerable. In fact, many informal markets contain a wide distribution of income levels, with some traders achieving considerable upward mobility. For regeneration projects, this suggests that informal markets should be approached as heterogeneous systems, where interventions must balance the needs of small-scale survivalist vendors with those of more established entrepreneurs.

Furthermore, informal markets contribute significantly to urban vitality. Their presence animates public spaces, attracts pedestrian flows, and supports a dense network of micro-transactions. As Bromley (2000) highlights, *"street vendors bring life to dull streets"* (p. 5), transforming otherwise neglected areas into active urban nodes. This capacity for placemaking is especially relevant in regeneration, where informal markets can serve as catalysts for broader neighborhood renewal while preserving affordability and accessibility for local communities.

### Post-Soviet Informality: The Case of Georgia

In the post-Soviet context, including Georgia, the role of informal markets has been particularly pronounced. The economic collapse of the 1990s and the retreat of the state created conditions in which bazaars became crucial survival infrastructures, absorbing unemployed labor and providing essential goods. These markets, such as Tbilisi's Eliava Bazaar, reveal how informality can stabilize urban economies in moments of transition. As de Soto (1989) observed, informality often emerges as *"a solution, not the problem"* (p. 12), filling institutional voids left by weak or absent regulatory systems.

## 2.4 Informality in Planning and Design

### Planning Tensions and the Informal City

The relationship between informality and planning has long been marked by tension. On the one hand, informal practices are often perceived as threats to order, legality, and modernist visions of the city; on the other, they have proven indispensable to urban resilience, adaptability, and social life. Roy (2009) frames this paradox by noting that *"urban informality is not a separate sector but a mode of urbanization that pervades all cities of the global South"* (p. 826). This recognition shifts the debate from whether informality should be eliminated toward how planning systems negotiate, tolerate, and integrate it into urban frameworks.

### Modes of Planning Response

Historically, the dominant planning response has been erasure. Informal settlements and markets were often demolished under modernization agendas that equated order with formalization. This approach treated informality as an anomaly to be corrected. However, scholars have repeatedly emphasized the inefficacy of such strategies. Turner (1976), in his influential work on self-help housing, argued that *"when dwellers control the major decisions and are free to make their own contributions… both the process and the environment produced stimulate individual and social well-being"* (p. 241). In other words, erasure not only disrupts livelihoods but also destroys vital forms of social organization.

A second mode of response is tolerance. Municipalities often allow informal markets or settlements to persist in practice, while withholding full legal recognition. This "gray zone" of governance, as AlSayyad (2004) describes, produces spaces that are simultaneously visible and invisible, sanctioned yet precarious. For instance, vendors may be permitted to occupy streets at certain hours, or squatter settlements may receive partial services such as electricity while remaining officially "illegal." Tolerance allows informality to survive, but it also keeps communities in conditions of uncertainty, vulnerable to eviction or exclusion from long-term urban visions.

The third and increasingly relevant approach is integration. This entails recognizing the spatial, social, and economic logics of informality and embedding them into urban design and policy. As Simone (2004) emphasized in his notion of *"people as infrastructure"* (p. 407), informal practices often provide the connective tissue that sustains urban life. Integrative strategies therefore seek to build upon these infrastructures rather than replace them. Examples include upgrading informal housing with basic services, designing public spaces that accommodate street vendors, or creating participatory frameworks that formalize community decision-making without erasing local practices.

### Morphological and Spatial Logics of Informality

The spatial morphologies of informality further illustrate its planning significance. Informal settlements typically develop incrementally, through accretion and adaptation to context, resulting in fine-grained urban fabrics that contrast with rigid formal grids. Similarly, informal markets often appropriate existing infrastructure—sidewalks, intersections, vacant lots—and transform them into dynamic spaces of exchange. These morphologies embody what Roy (2005) calls *"the logic of incrementalism,"* where space is continuously negotiated and redefined (p. 150). Recognizing these logics in design processes can enrich regeneration by producing more adaptive, inclusive, and context-sensitive urban forms.

For regeneration frameworks, the challenge lies in balancing regulation with adaptability. Erasure often generates displacement and social conflict, while tolerance perpetuates insecurity. Integration, by contrast, offers the possibility of co-produced urban futures in which informal and formal practices intersect productively. By acknowledging the rationalities of informal spatial orders and embedding them within design and planning processes, regeneration can move beyond imposing order toward enabling more hybrid, resilient urban futures.

Figure 18, The edge where the formal city meets the informal city in an aerial photo of Mumbai. (image courtesy of Johnny Miller, 2018).

## 2.5 Critical Reflections

The preceding discussion has illustrated that informal urbanism cannot be reduced to an anomaly or a temporary condition, but is instead a central mode of urban production. Yet, its very ubiquity generates both challenges and opportunities for planning and design. This duality has become a central concern in contemporary debates on urbanism, demanding critical reflection.

### Challenges of Informality

The challenges associated with informal urbanism are well-documented. Informal settlements and markets often lack adequate infrastructure, sanitation, and access to basic services. These deficiencies can generate risks for public health and safety, particularly in dense environments where vulnerabilities are compounded (UN-Habitat, 2016). Moreover, the absence of formal legal recognition frequently places residents and vendors in precarious positions, subject to eviction, harassment, or exclusion from official urban agendas (AlSayyad, 2004). Governance itself becomes strained, as municipal authorities struggle to regulate environments where *"the boundaries between legality and illegality, formal and informal, are constantly blurred"* (Roy, 2005, p. 150).

These challenges underscore why informality is often portrayed as a "problem to be solved." However, attempts at wholesale eradication—through demolition, relocation, or aggressive formalization—have repeatedly failed, not only displacing vulnerable populations but also destroying the socio-economic networks that sustain them (Turner, 1976).

### Opportunities of Informality

At the same time, informality embodies opportunities that formal planning rarely achieves. Informal practices demonstrate resilience, adaptability, and a capacity for rapid response to shifting urban conditions. Simone (2004) described this adaptability in his notion of *"people as infrastructure"* (p. 407), where collective practices substitute for absent formal systems and create flexible forms of urban connectivity. Informal economies, too, sustain livelihoods for millions, functioning as *"central to the functioning of urban economies, not simply residual"* (Bromley, 1978, p. 1042).

Spatially, informal morphologies reveal the potential of incremental growth, self-organization, and hybridized uses of space. Roy (2009) emphasizes that *"informality is not the opposite of planning but a mode through which cities are produced"* (p. 826). Recognizing these adaptive logics allows regeneration to move beyond rigid master plans toward frameworks that enable flexibility, participation, and local agency.

## Why Redesign Informal Urbanism

For design practice, the implication is clear: informal urbanism cannot be dismissed, but neither can it remain entirely unstructured. The task is not to erase informality, nor to romanticize it, but to redesign it—channeling its strengths while addressing its vulnerabilities. This entails creating regeneration frameworks that:

- provide infrastructure without erasing local morphologies,
- integrate informal markets into broader economic networks,
- enable incremental upgrading rather than wholesale replacement, and
- recognize hybridity as an asset rather than a flaw.

As Turner (1976) argued, *"housing and urban environments are processes rather than finished products"* (p. 241). This insight aligns with the broader goal of rethinking informal urbanism as a dynamic design challenge: one where architects and planners work with, rather than against, the logics of self-organization.

## Toward Contextual Analysis and Design Exploration

The reflections developed in this chapter establish a theoretical foundation for approaching informal urbanism not as a marginal phenomenon but as a central and dynamic mode of urban production. By emphasizing hybridity, adaptability, and incrementalism, the discussion has highlighted the need for regeneration strategies that engage with informality as a resource rather than a problem. This perspective reframes urban regeneration as a process of negotiation and co-production, where design must respond to the embedded logics of place, community, and economy.

Building on these theoretical insights, the next chapter turns toward contextual analysis of the site in Tbilisi. Here, the abstract principles of informality and parametric adaptability are situated within the specific socio-spatial, historical, and economic realities of the Georgian context. This step is crucial: without a deep understanding of how informal practices are manifested locally, the principles discussed remain purely conceptual. The contextual analysis therefore serves as a bridge, allowing the theories of informal urbanism and computational design to be grounded in the material, cultural, and political dimensions of the site.

From this contextual grounding, the thesis then progresses toward the design proposal, where the tools of parametric and modular design will be mobilized to operationalize the principles of flexibility, hybridity, and incremental growth. In this way, the design phase emerges not in isolation, but as a response to both theoretical debates and contextual realities, positioning the project as a critical rethinking of how informal urbanism can be regenerated in practice.

figure19, Eliava Bazaar, Tbilisi an informal market

## 2.6 Case Studies

### Mercado Nicolás Bravo – AIDIA Studio (2023)

Overview and Context
The Mercado Nicolás Bravo project in Mexico represents a contemporary approach to urban regeneration through the renewal of a traditional market. Located in Acapulco, this project responds to the dual challenge of upgrading outdated infrastructure while preserving the cultural and social vitality of informal markets that are central to the community's daily life (AIDIA Studio, 2023).

Spatial Organization
The design is organized around a flexible modular framework, which enables a rational yet adaptable distribution of stalls. Circulation is structured to provide clear routes while maintaining the organic vibrancy typical of traditional markets. The architectural language emphasizes permeability and accessibility, ensuring that the market functions as an open, porous space seamlessly integrated with its urban surroundings (AIDIA Studio, 2023).

Construction and Materials
The use of lightweight modular elements is central to the project. Prefabricated units allow for efficiency in construction and future adaptability. Materials such as metal structures and perforated panels are used not only for durability but also to enhance ventilation and natural light penetration, crucial in the warm climate of Acapulco (AIDIA Studio, 2023).

Experience and Atmosphere
The new Mercado Nicolás Bravo is designed to foster an inclusive and vibrant atmosphere. Natural light filters through perforated surfaces, creating a play of shadow and transparency that enlivens the market space. The modularity of stalls encourages diversity of expression by vendors, giving each stallholder room to adapt their unit while still contributing to a coherent collective aesthetic (AIDIA Studio, 2023).

Relevance to Parametric Regeneration

- Parametric adaptability: stall sizes, circulation widths, or canopy dimensions can be scripted.
- Climatic logic: façade porosity can be parametrically optimized.
- Community-centered modularity: the replicable yet adaptable system aligns with socially grounded regeneration.

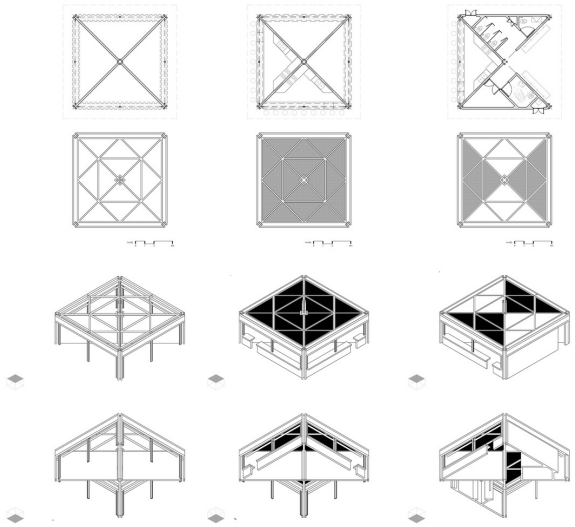


figure 20, Mercado Nicolás Bravo module creation – AIDIA Studio Archdaily,2023

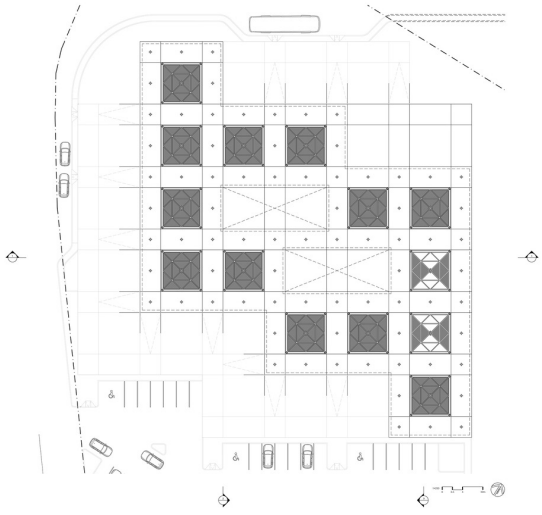


figure21, Mercado Nicolás Bravo site plan – AIDIA Studio Archdaily,2023

figure22, Mercado Nicolás Bravo perspective drone photo – AIDIA Studio Archdaily,2023

figure23, Mercado Nicolás Bravo top view drone photo – AIDIA Studio Archdaily,2023

**Yolechang 2020 Market – UAO Design (2020)**

Overview and Context
The Yolechang2020 Market in China is a temporary urban regeneration project designed to activate unused spaces by providing a vibrant commercial and cultural hub. Positioned within a rapidly transforming urban environment, the market acts as a testbed for new forms of spatial occupation, merging architectural experimentation with local traditions of street vending and collective gathering (UAO Design, 2020).

Spatial Organization
The design revolves around modular canopies and pavilions, adaptable in size and layout. The configuration creates networks of pathways, small squares, and performance areas, producing a hybrid of market and festival grounds. Circulation is dynamic, with shifting densities that mimic informal urban vibrancy (UAO Design, 2020).

Construction and Materials
Built using lightweight steel frame systems and modular panels, the structures are demountable and relocatable. The repetitive modular units allow large spans without losing human scale, while vivid colors and transparent surfaces contribute to vibrancy (UAO Design, 2020).

Experience and Atmosphere
The market is both an event space and marketplace. Daytime shade and nighttime illumination transform it into a luminous spectacle. The permeability of the pavilions creates a fluid relationship between interior and exterior, enhancing spontaneity while maintaining clarity in spatial structure (UAO Design, 2020).

Relevance to Parametric Regeneration

- Modularity as parametric logic: canopy modules parameterized by size and connectivity.
- Density and attractors: clustering and dispersal of stalls simulated through rules.
- Temporal urbanism: system-based, not object-based, design for flexible reuse.

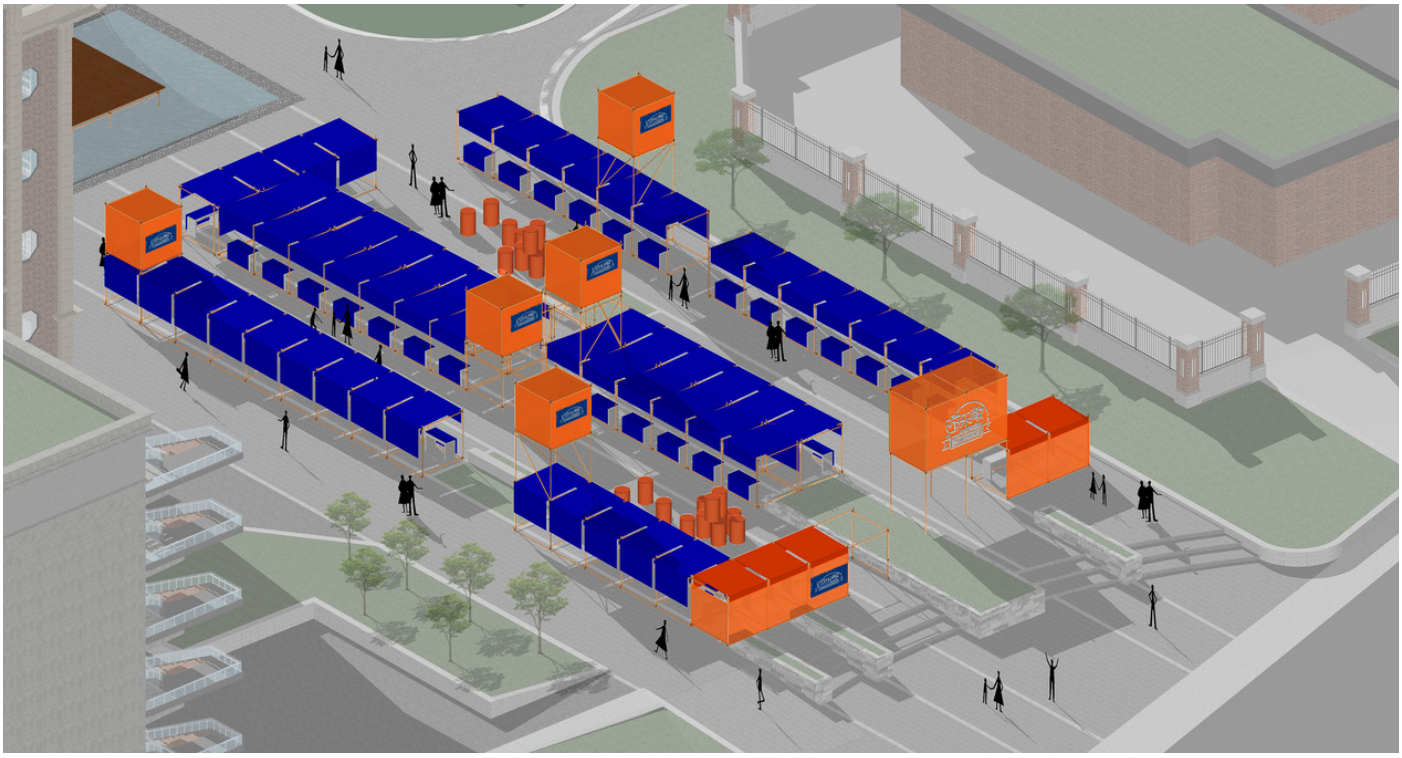


figure24, Yolechang 2020 Market massing diagram – UAO Design Archdaily,2020

figure25, Yolechang 2020 Market – UAO Design Archdaily,2020

figure26, Yolechang 2020 Market – UAO Design Archdaily,2020

**Dadad Market – Bangkok Tokyo Architecture + OPH (2017)**

Overview and Context
The Dadad Market, situated in Nakhon Ratchasima, Thailand, is a temporary evening market installation designed to re-activate underused urban areas after dark. It reflects the flexibility and adaptability of informal urbanism, offering a venue for vendors, artisans, and community gathering (Bangkok Tokyo Architecture & OPH, 2017).

Spatial Organization
The market is arranged as a grid of modular light-boxes, defining courtyards and vendor clusters. The grid introduces order while leaving space for improvisation in stall arrangement, echoing the balance of formal design with informal practices (Bangkok Tokyo Architecture & OPH, 2017).

Construction and Materials
Employing scaffold-like steel pipe frames with clamps, combined with integrated lighting, the system is affordable, demountable, and sustainable. Each stall doubles as a glowing element, transforming the marketplace into an illuminated urban landscape (Bangkok Tokyo Architecture & OPH, 2017).

Experience and Atmosphere
At night, the glowing modules produce a unique sensory experience, blending infrastructure and spectacle. The system creates a strong collective identity for the market while allowing individual vendor adaptation (Bangkok Tokyo Architecture & OPH, 2017).

Relevance to Parametric Regeneration

- Scalable modularity: units parameterized by spacing, size, and lighting.
- Attractor principles: luminous modules function as visual attractors.
- Temporal adaptability: easily relocated, sustaining the logic of informal economies.

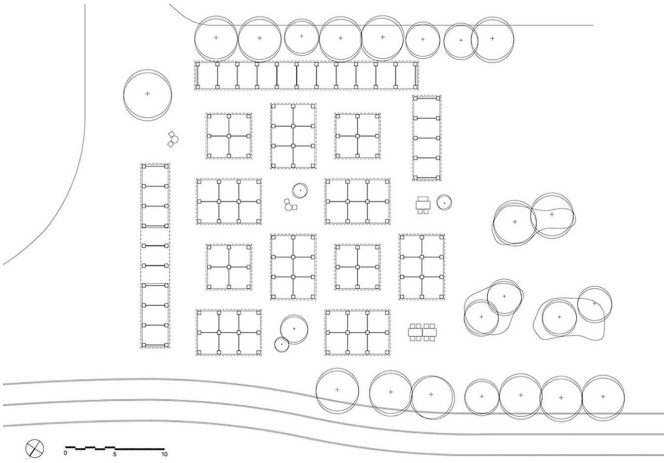


figure27, Dadad Market Plan– Bangkok Tokyo Architecture + OPH Archdaily,2017

figure28, Dadad Market – Bangkok Tokyo Architecture + OPH Archdaily,2017

figure29, Dadad Market – Bangkok Tokyo Architecture + OPH Archdaily,2017

figure30, Dadad Market – Bangkok Tokyo Architecture + OPH Archdaily,2017

# CONTEXUAL ANALYSIS

## 3.1 Georgia in the South Caucasus

Georgia is located in a strategic geographic position in the South Caucasus, at the historical crossroads between Europe and Asia. Its territory and infrastructure have long served trade routes, cultural exchange corridors and migration flows. Since regaining independence in 1991, Georgia's national economy and urban policy have undergone nonstop transformation and privatizations, deindustrialization in some sectors, and a gradual expansion of market-oriented service economies. Tbilisi, as the political and economic core, concentrates administrative functions, transport hubs and the highest density of commerce and industry.
These macro-processes—political transition, market liberalization and regional centralization—created the conditions under which informal trading systems consolidated. In summary, Eliava's existence is legible as a product of national reorganization: large industrial plots were evacuated or underused, transport corridors persisted, and small traders filled the economic vacuum with repair, reuse and wholesale activities.


figure31, illustration of Georgia map, vemaps.com

## Tbilisi as a river city

Tbilisi's urban form is shaped along the Mtkvari (Kura) River, which divides the city into districts of activity. Archeologically, heavy industry, warehouses and logistics lined the riverbanks and the adjacent transport axes. When the Soviet industrial apparatus contracted in the 1990s, many river-adjacent plots experienced abandonment, fragmentation or informal reoccupation.
This linear, ribbon-like morphology is crucial for understanding Eliava market which is not a centrally planned zone but a strip of clustered economic use shaped by proximity to freight access, visibility from a major avenue and adjacency to the river (which provided cheap, available land and buffer parcels).

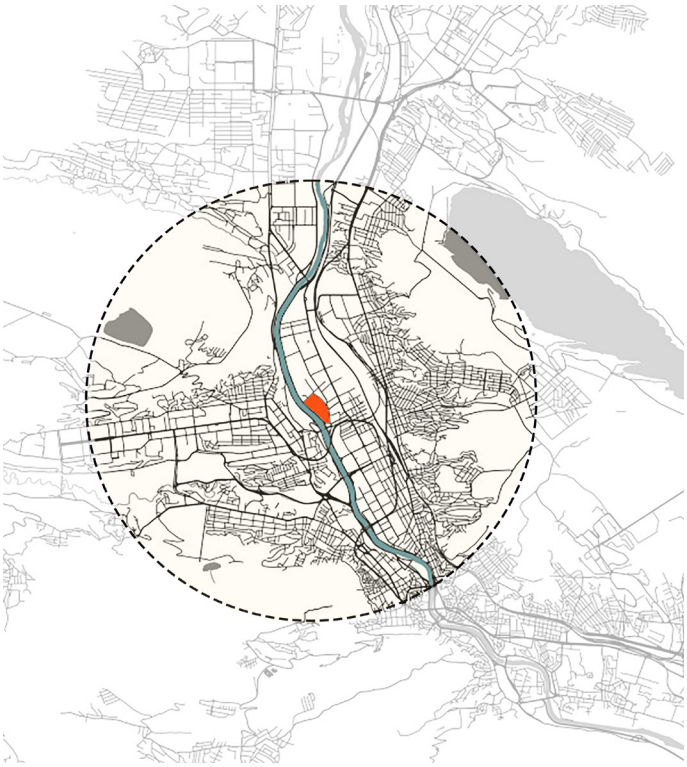


figure32, map of Tiblisi, Eliava market is highlighted

## District and site: where Eliava sits in Tbilisi

Eliava Bazaar is located in the Didube district, northwest of Tbilisi's historical center. Its footprint is bounded informally between Akaki Tsereteli Avenue to the south and the Mtkvari embankment to the north. The nearest metro station lies within walking distance (roughly 10–12 minutes), and multiple bus lines run along the avenue—this multimodal access both fuels pedestrian inflows and supports logistics for heavy and bulky goods.

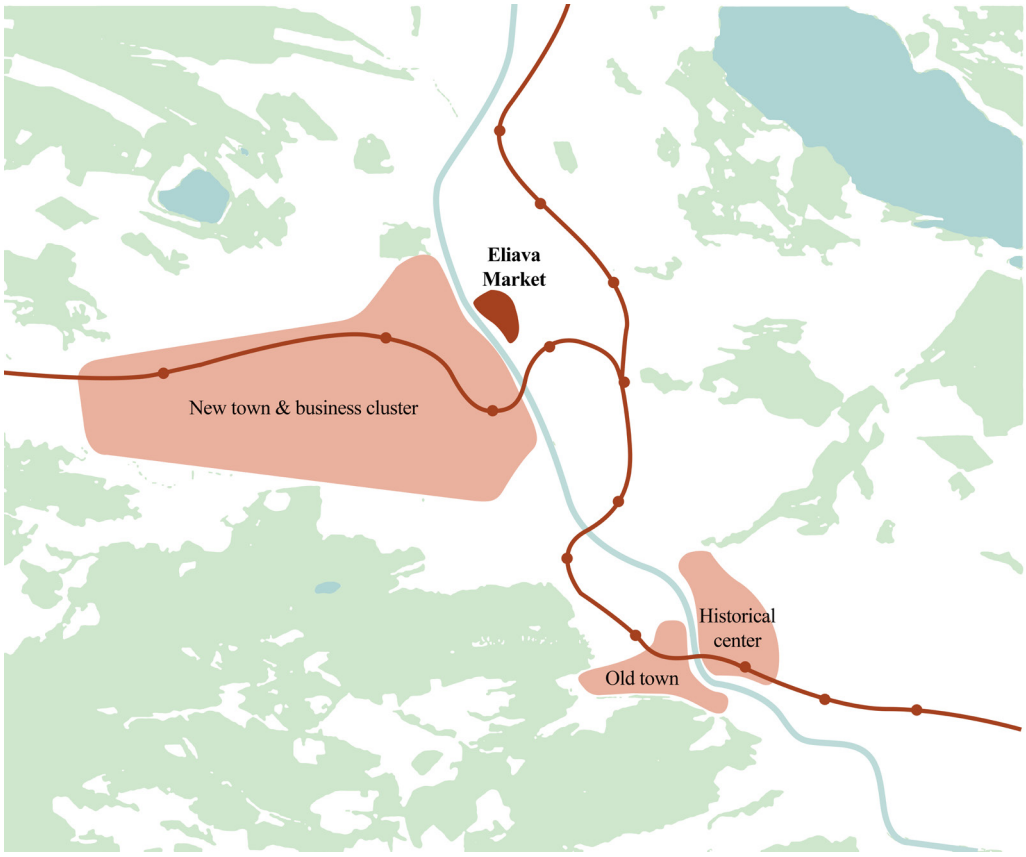



figure33, relation of Eliava market with the important district of the city

At the parcel level, Eliava is composed of a stitched patchwork of lots: former warehouses repurposed as wholesale sheds, private yards used as display and storage spaces, container clusters, and rows of improvised, semi-permanent stall structures.
These spatial elements have been negotiated incrementally by vendors over decades. Ownership is mixed: some lots are privately held, others are leased, and many vendor arrangements rely on informal tenure and tacit agreements. This tenure complexity is a decisive factor for any phased regeneration strategy: formal redevelopment that ignores these ownership realities is likely to trigger displacement and conflict.

According to the following map we can understand the fact that the market is created ocer decades informaly, even in present day almost 13 percent of the lots are not registered.

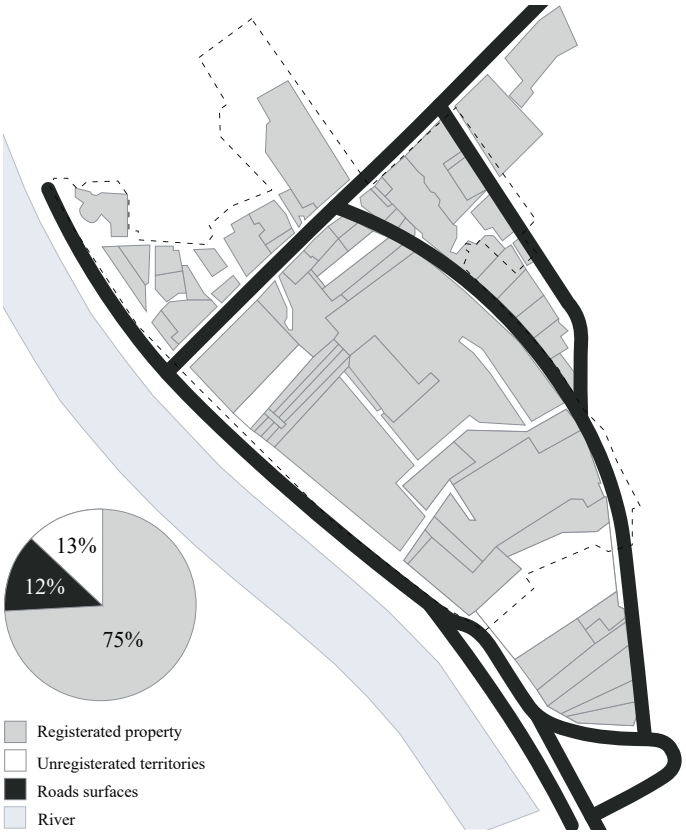



figure34, illustration of registered and unregistered property

## 3.2 Spirit of Eliava

Eliava should be read as a hybrid programmatic assemblage: its dominant functions are auto parts and repair-related retail, construction materials and small-scale fabrication/repair services. The market also supports a micro-economy of food stalls, small cafés, transport services, clothes selling and informal labour intermediation (loaders, small-scale logistics operators).
Beyond program, Eliava is a community of practice. Traders rely on reputation, repeated face-to-face interaction, and tacit knowledge networks (for example, where to source rare parts or which supplier offers dependable quality).

Cultural reportage frames Eliava as a lived environment rather than a neutral marketplace. As Jijavadze (2019) described, it is "a maze of tightly packed stalls with drab tin roofs" (p. 1). The same article observed that the bazaar "opened in 1995 when the Soviet Union collapsed, and Tbilisians sought cheap repair material to fix anything from bathrooms to roofs" (Jijavadze, 2019).

## Origins and evolution (1990s → today)

Genesis (early–mid 1990s): The collapse of centralized Soviet distribution and the sudden absence of formal procurement channels created a market for used goods, spare parts and on-site repair. Vendors and small entrepreneurs appropriated large, underutilized lots near logistical spines, converting them into informal retail and repair clusters. This was not a single coordinated process but an emergent set of local decisions—actors sought the best intersection of visibility, delivery access and demand.

Incremental morphogenesis: Over time, incremental additions—sheds, containers, canopies—created a fine-grained urban morphology: narrow aisles, interstitial yards, patchwork roofing and ad-hoc utility hookups. This morphology enabled dense display of goods and short supply chains between sellers and their clients, but it also created systemic vulnerabilities (narrow emergency access, shared storage of hazardous materials).

Resilience through reconstruction. Reports of the 2017 fire illustrate the market's vulnerabilities and adaptive capacity. OC Media (2017) reported that "four people were taken to hospital with light injuries" during the incident (para. 2). The Caucasian Knot (2017) added that "the fire affected 120 stores, mostly containing paint and construction materials" (para. 3).

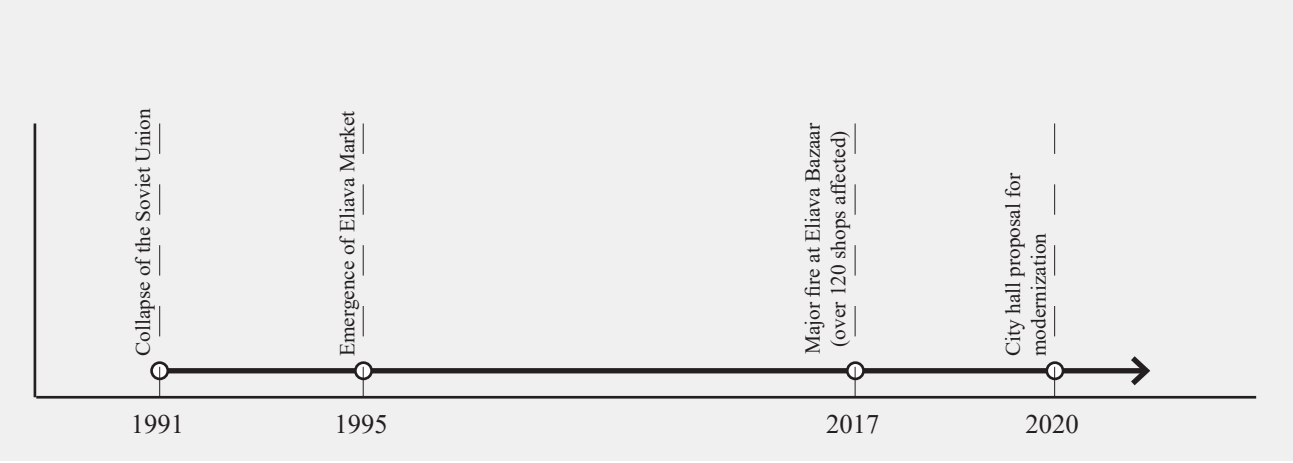



figure35, Important timeline of the Eliava market

## 3.3Current planning discourse

Municipal actors and design professionals are caught between two policy poles: (1) calls to eliminate risks and bring order through formal redevelopment, and (2) cultural and economic arguments to preserve the bazaar's identity and livelihoods. Official statements emphasize safer, hygienic, and visually ordered markets with defined infrastructure (roads, hydrants, waste systems), while competition briefs and local reportage urge solutions that respect the market's social and economic functions.
This tension manifests in three common municipal positions:

1. Relocate and formalize: move vendors to new, purpose-built market halls or industrial parks.
2. Rehabilitate in situ: upgrade utilities, circulation and safety while retaining vendors on-site.
3. Hybrid phased approach: incremental "upgrading" that preserves vendor networks through phasing, temporary relocation modules and community-managed facilities.

Official and design discussions highlight a recurring dual mandate. According to TerraViva Competitions (2024), the challenge was to "enhance Eliava's functionality while preserving its cultural significance" (para. 2). This mirrors the municipal discourse, where local officials frequently denounce "chaotic construction" (Rustavi2, n.d.) while still promising to retain vendors in future plans.

| Criteria | Relocate | Rehabilitate | Hybrid Approach |
|---|---|---|---|
| Economic Impact | High cost; disrupts local economy | Lower cost; incremental upgrades | Medium cost; phased investment |
| Social Risk | High displacement; loss of livelihoods | Low displacement; preserves networks | Low-to-moderate risk; vendors included |
| Feasibility | Difficult (requires land, infrastructure) | Moderate—depends on utilities/site limits | Higher feasibility; flexible phasing |
| Political Acceptability | Mixed—often unpopular with traders | Moderate—seen as safer politically | High—balances safety and preservation |

figure36, comparative evaluation matrix of regeneration strategies for Eliava bazaar

## Existing morphology (diagnostic)

Edges & Spines: The market's most visible edge is Akaki Tsereteli Avenue. This edge acts as a commercial face and a delivery spine. The northern boundary—Mtkvari embankment—is currently a back-edge, servicing drainage and access but also representing a major opportunity for public realm activation.

Internal Grain: The bazaar is made up of an irregular street grid at micro-scale: beaten tracks, short alleys, and shared yards. These alleys are typically narrower than recommended emergency access widths, and their organic routing follows vendor priorities—visibility, proximity to storage, and adjacency to complementary trades.

Utilities & Services: Water supply and electrical hookups are frequently improvised. Waste disposal is uneven, and hazardous-material handling (paints, batteries, oils) is often unmanaged. Fire-fighting access is inconsistent. These service conditions both originate from and reinforce informal practices.

Movement Patterns: Pedestrian flows feed from transit nodes (metro and bus stops) and along the avenue; last-mile truck movements penetrate the market at multiple informal gates. The interchange of pedestrians and delivery vehicles is a daily source of friction and risk.


figure37, illustration of internal paths

## Socio-economic role in the city

Eliava is not only a place to buy parts but a functional node in Tbilisi's economy. It supplies repair shops across the city, supports small contractors and household repairs, and functions as a redistribution node for salvage and second-hand materials. Employment here is often family-based, informal, and intergenerational.
As it's mentioned in the "The future of eliava market" Eliava is embedded in Tbilisi's repair economy. Jijavadze (2019) emphasizes that it is "a place where anything can be found, from Soviet-era spare parts to improvised solutions" (p. 2). Such diversity sustains livelihoods across the socio-economic spectrum, from mechanics to low-income households.
**Social capital & knowledge transfer:** The market fosters skill transmission—veteran vendors teach newcomers practical knowledge: how to repair specific Soviet-era models, where to source rare parts, and how to assess part quality. This knowledge infrastructure is an intangible asset that supports the broader urban economy.
**Cash economies and access to cheap inputs:** For lower-income households and small businesses, Eliava provides affordable options not available in formal retail channels. Regeneration strategies that increase costs or reduce accessibility risk shifting these livelihoods and consumer access away from the local economy.

## 3.4 Risks and opportunities

**Risks**:
1. Life-safety & Fire Risk: Clusters of flammable goods and informal electrical hookups present clear hazards. Any plan must include fire buffers, hydrant networks and reconfigured storage zones.
2. Environmental & River Health: Proximity to the Mtkvari requires interventions for stormwater management, oil/chemical spill containment and runoff pre-treatment—both ecological necessity and regulatory requirement.
3. Circulation & Logistics: Current layouts generate bottlenecks; introducing formal loading bays and designated delivery routes must be done in a way that does not disrupt vendor access to customers.
4. Governance & Tenure Complexity: Scattered ownership, informal tenancies and varied lease arrangements mean top-down redevelopment is politically and practically fraught. Phased, negotiated approaches that secure vendor rights during transition will be necessary.
5. Cultural Loss & Displacement: Heavy-handed redevelopment risks erasing the tacit culture that underpins Eliava's resilience and social networks.

The risks are evident in media accounts. OC Media (2017) characterized the July 2, 2017 fire as "a blaze [that] destroyed a large part of the market, engulfing paint and tire warehouses" (para. 1). These accounts provide authoritative evidence for the urgency of fire-risk management in your regeneration framework.

**Opportunities:**
1.Riverfront Reconnection: Convert the embankment from service edge to a staged public realm—stormwater swales, public promenades and shaded vendor forecourts that give the bazaar a civic face and a drainage buffer.
2.Parametric Re-Plotting & Modular Stalls: Use data-driven models to regroup vendors based on commodity type, hazard profile and footfall. Parametric modules can be sized and positioned to maintain vendor flexibility while formalizing essential safety buffers and logistics lanes.
3.Maker & Repair Hub Strategy: Build certified facilities for hazardous storage, recycling stations for tires and oils, a tool-library and vocational training. These can anchor a city-level identity for Eliava as Tbilisi's official repair ecology.
4.Phased, Participatory Implementation: Use a sequence of interventions that begin with low-cost, high-impact safety and circulation improvements and progressively introduce formal infrastructure and modular stall systems, negotiated with vendor associations.

## 3.5 Site Analysis

The site analysis establishes a rigorous understanding of place before design intervention. It frames the physical setting, patterns of use, governance realities, and environmental conditions that collectively shape performance on the ground. Rather than treating the site as a blank canvas, the analysis reads it as a living system—one formed by incremental decisions, market logics, and everyday practices—so that proposals can build with, not against, its underlying structures.

In this thesis, site analysis serves three roles. First, it **diagnoses** opportunities and constraints by identifying how spatial form, circulation, services, risk, and social practices interact. Second, it **interprets** the self-organized dynamics that sustain livelihoods and resilience, recognizing that apparent disorder often encodes efficient, locally intelligible rules. Third, it **translates** these findings into design-ready parameters—thresholds, relationships, and priorities—that will guide scenario testing and phasing in the regeneration strategy.

The outcome is a shared evidence base: a clear rationale for what should be protected, what must be improved, and where transformative change is both feasible and equitable. By aligning analytical insight with the project's parametric framework, the site analysis ensures that subsequent design moves are context-responsive, measurable, and accountable to users, stakeholders, and the city at large.

## Mass and Void map

The following map illustrates the distribution of built mass and open spaces (void), offering insights into density, permeability, and spatial structure. The red circle marks Eliava Bazaar, project site which is positioned along the river corridor that serves as both a physical and visual divider in the city. On the eastern side of the river, the urban fabric is more compact, with closely spaced buildings and narrow streets. This density is typical of historic districts, where mixed-use blocks dominate. In contrast, the western side shows a less density arrangement compare to the other side of the age gap of the urban development. The market itself has the maximum density in the area.

The river forms a continuous open-space axe along the district. This void provides breathing space in the city and potential for green and public facilities. As we can understand according to the map the creation and rotation of the urban blocks are mostly related to the river showing the fact that it serve an important role in creation of the Acity and urban development.

Within the red circle, the solid–void pattern is fragmented and irregular, showing the self-organized, spirit of the bazaar. Built masses are interspersed with voids of various sizes. This irregularity is a double-edged sword: it allows flexibility and adaptability, but lacks a coherent spatial hierarchy.

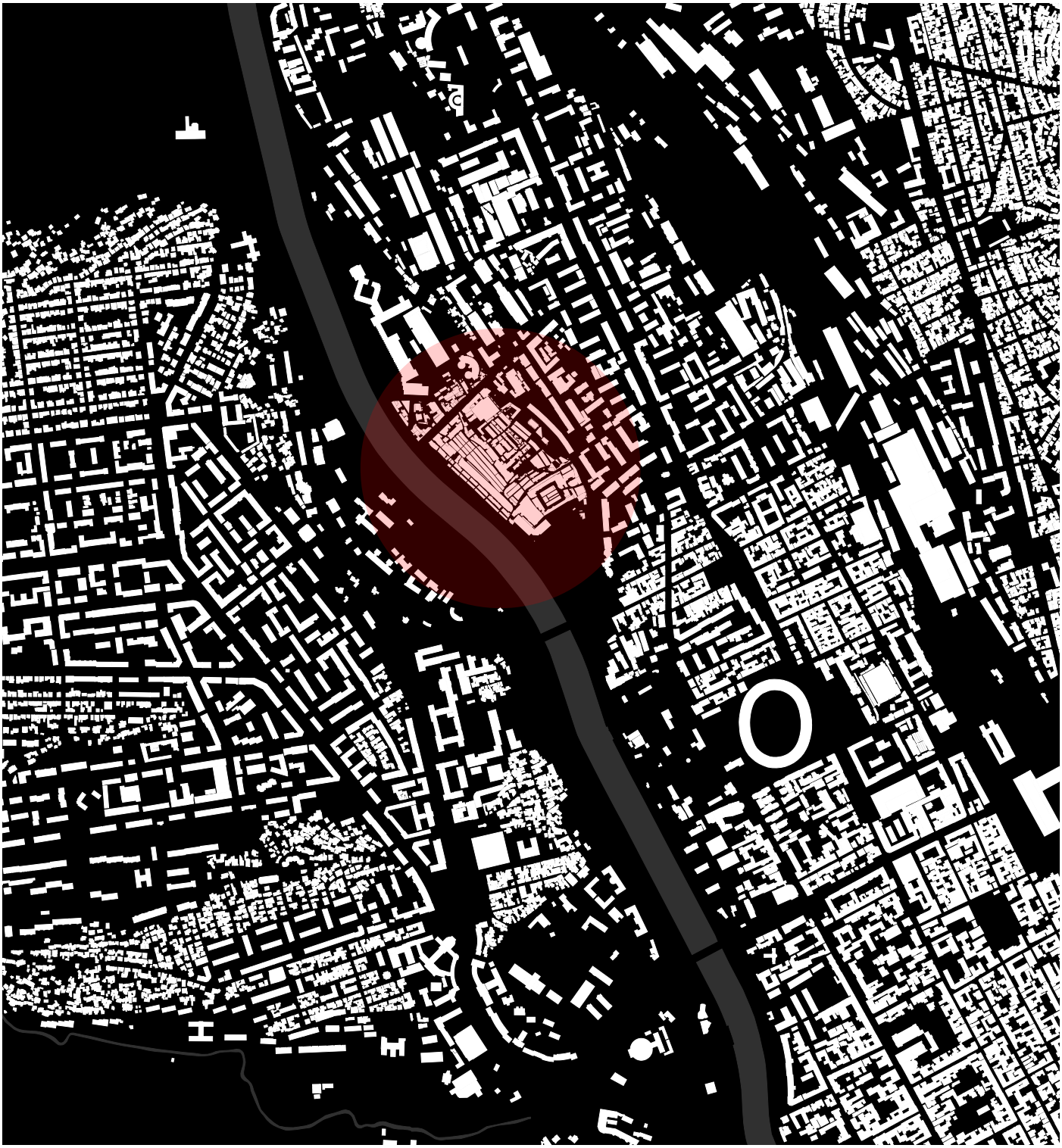



figure38, Mass and void map of the Eliava market

## Main Streets & Public Transportation

“Cities tend to grow along paths or axes that maintain their position unchanged over time” (persistence theory). The routes are elements that influence the development of cities and their morphology. They are generally roads or signs deriving from the ownership division of the land and have been classified into different categories. The map illustrates the primary road hierarchy and public transportation nodes in the vicinity of the Eliava Bazaar, with the project area marked in red. The river corridor runs centrally through the site, flanked by major vehicular arteries that form key connectors in Tbilisi’s mobility network.

The project area benefits from a highly strategic location in Tbilisi’s street and public transport network. Its accessibility by road, metro, and bus underpins its role as a vibrant urban node. Any regeneration strategy should build on these connections, prioritizing pedestrian-oriented design while maintaining strong multi-modal access for goods, traders, and customers.

The map shows multiple metro stations (M) and public transport stops (marked points) within walking distance of the project site. The closest metro stations are located on both sides of the river, giving the bazaar high potential for multi-modal access.

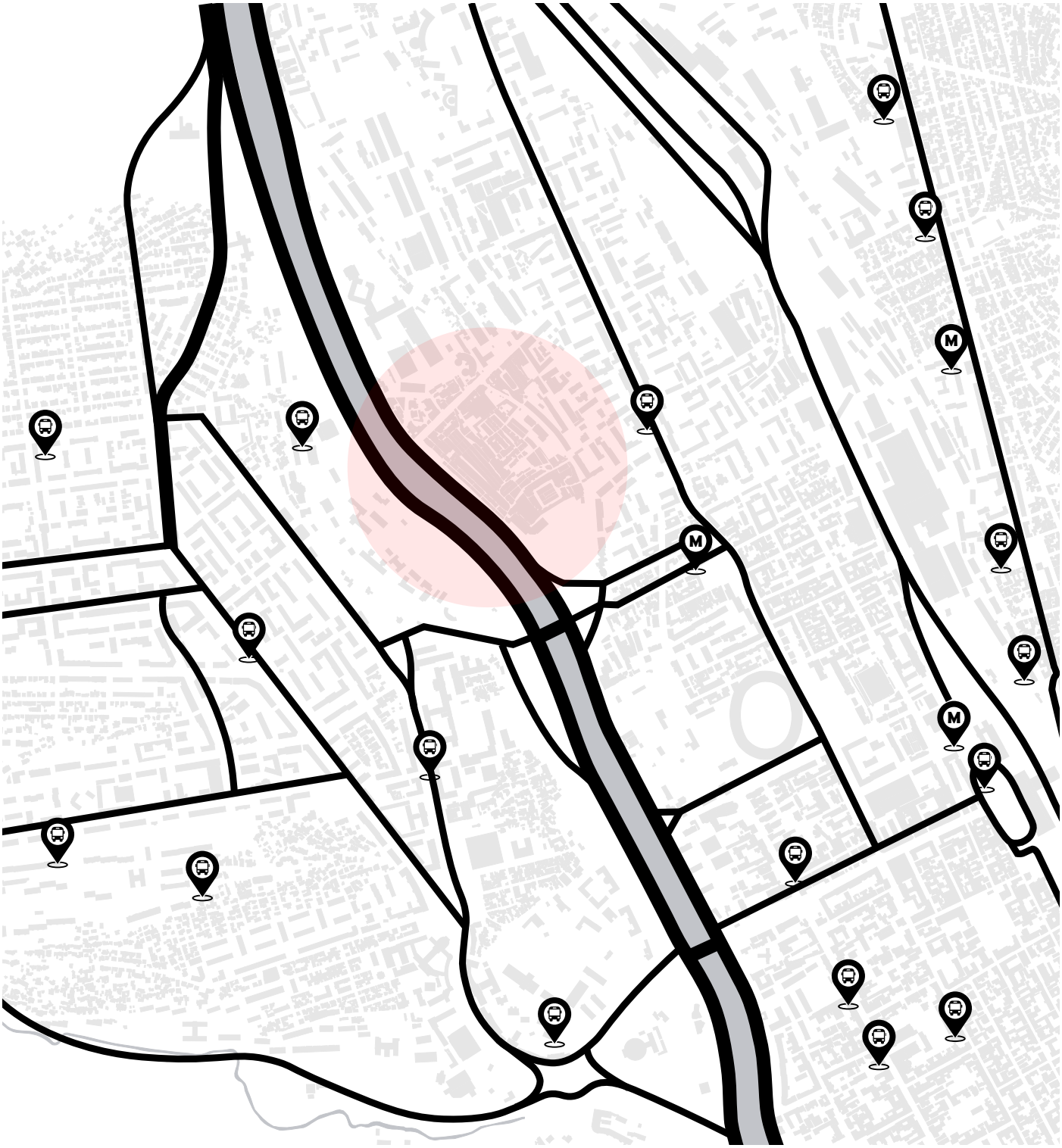



figure39, main street and public transportation map of Eliava

## Greenery

The use of vegetation in urban spaces has always had multiple functions such as symbolic, aesthetic-ornamental, productive and microclimate regulation. Therefore it is a very important layer for reading the territory in relation to the landscape, and fundamental in a period in which there is a lot of talk about sustainable development. The analysis of greenery, as a useful element for improving the quality of life in cities, is necessary because of the careful evaluation of some of its characteristics makes it possible to improve its function and favor its management methods, as well as that allow rational planning of extension interventions.
This map illustrates the green structure around the Market, showing the relationship between the riverfront corridor, neighborhood open spaces, and street-level vegetation. According to the map, greenery along the river forms the primary ecological spine, providing continuous canopy, habitat, and a natural microclimate buffer. From this spine, secondary green fingers extend into the urban fabric as courtyards, school yards, and pocket parks, creating a loose but legible network that links both banks of the river. Within dense blocks east of the river, street trees are discontinuous, leading to localized heat-island pockets and low pedestrian comfort at midday. Also we can see there is a green barier between the river and the urban blocks on the Western side on the other hand where our site is located there is not a park along the river, this fact can help us to use the riverfront as a green gateway to the market: shaded promenades, weather-resilient planting, and seating terraces that meet flood-tolerant design.

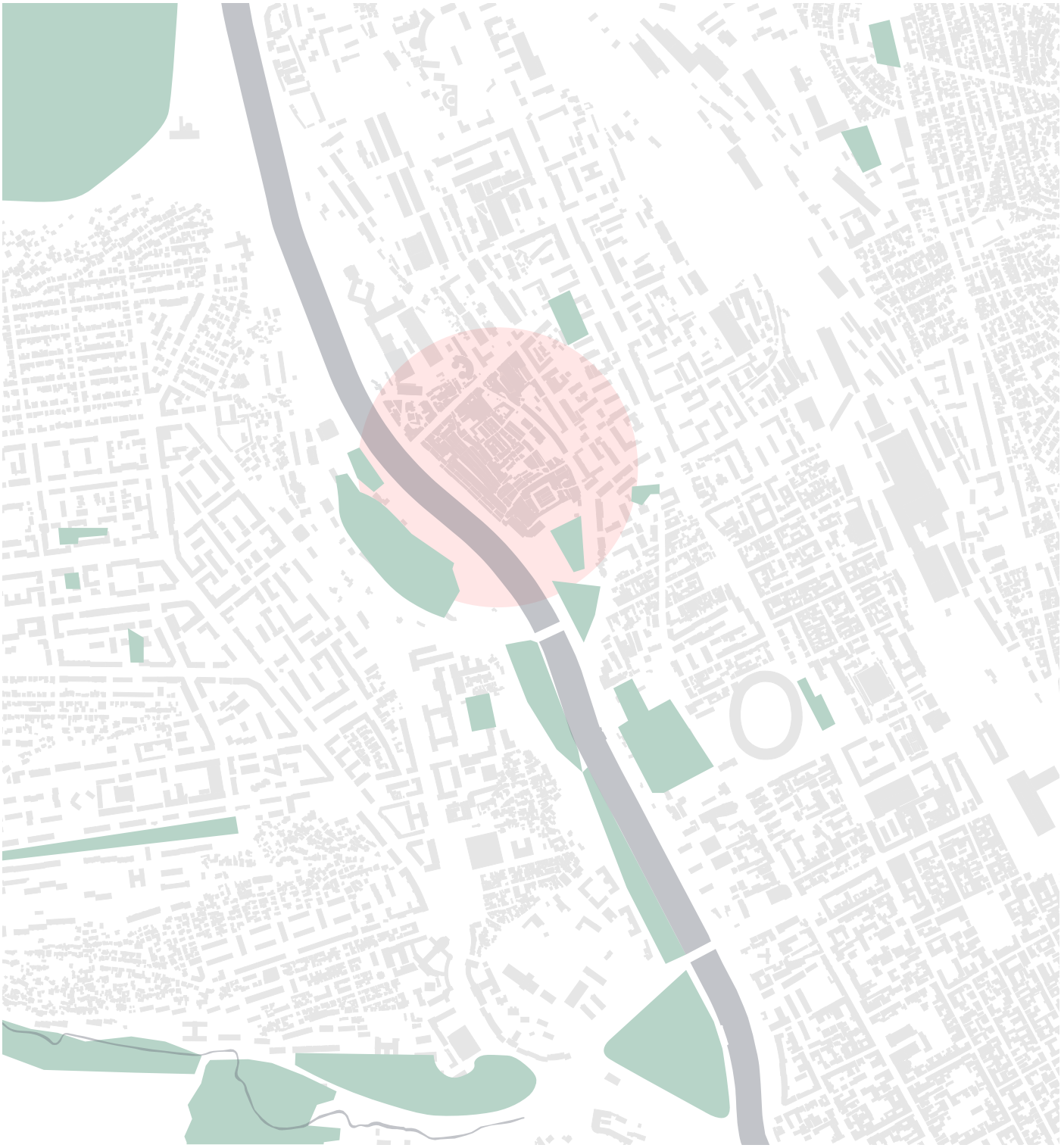



figure40, Green inforstructure map of Eliava market

## Landmark & Cultural Context

Following map illustrates the landmarks within the district, Eliava Bazaar sits at the intersection of several key urban and cultural nodes in Tbilisi. The surrounding landmarks create a strong educational, recreational, and commercial framework, which defines both the opportunities and challenges for regeneration. As we can understand from the map all of the public nodes are sitted at the Southern side of the project site which should be considered during the design process.

Medical University, Technical University, University of Georgia, Georgian American University cluster within walking distance of Eliava, generating a large student and academic population. This provides opportunities for introducing knowledge-based, creative, and tech-driven programs into the bazaar's regeneration, as well as ensuring constant youthful foot traffic.

Boris Paichadze Dinamo Arena (national stadium) attracts large crowds during events, creating periodic spikes in footfall and reinforcing the area's role as a public gathering and transit hub. However, it also creates congestion and requires careful planning for pedestrian–vehicular flows. Tbilisi Zoo  a major leisure destination, the site retains cultural memory and could be re-linked to new green/ recreational initiatives along the river.

Dezerter Bazaar (major wholesale market), as one of Tbilisi's largest markets, it creates synergy and competition with Eliava. While Dezerter focuses on food/produce, Eliava is known for tools, construction, and mechanical goods—together forming a dual market corridor that strengthens Tbilisi's informal economy. Art Palace which can be a cultural anchor that reinforces the heritage and identity layer of the district, showing how Eliava sits between utilitarian commerce and cultural heritage.


figure41, Important nodes map of the Eliava market

# DESIGN PROPOSAL

## 4.1 Overview

The design proposal for Eliava Bazaar emerges as a negotiation between chaos and control—an exploration of how self-organized systems can be reinterpreted through the logic of parametric design. The project seeks to transform the bazaar's current fragmented condition into an adaptable spatial framework that maintains its cultural vitality while introducing spatial coherence, resilience, and efficiency. Rather than imposing a rigid, top-down masterplan, the proposal operates as an evolving system of relationships—a network of parameters that respond to patterns of movement, density, climate, and social interaction.

Eliava Bazaar, located in the heart of Tbilisi, has developed organically over decades, shaped by economic forces, informal practices, and social interdependencies rather than formal planning. This self-organization, while productive in fostering local economies and adaptive use of space, has also resulted in congestion, infrastructural deficiencies, and environmental inefficiencies. The design therefore aims to retain the generative logic of informality while redefining its spatial expression through computational precision. The proposal views informality not as a problem to be erased but as a resource for design innovation.

figure42, drone photo taken from Eliava market, 2024

The main objective of the proposal is to construct a parametric framework capable of mediating between informal processes and formal planning requirements. By translating the bazaar's self-organized behaviors—vendor clustering, movement flow, spatial negotiation—into quantifiable parameters, the design enables a new adaptive model for regeneration. Parameters such as flow intensity, solar exposure, accessibility, and clustering proximity are transformed into drivers of spatial decisions. These relationships are embedded in a computational workflow developed in Grasshopper for Rhino, allowing for dynamic adjustment and iterative testing of urban scenarios.

Ultimately, the proposal aims to demonstrate that parametric urbanism can act as a bridge between self-organization and structured design, producing environments that are simultaneously flexible and ordered, bottom-up and systemic. By embedding informal intelligence into computational logic, the regenerated Eliava Bazaar can become a prototype for adaptive urban transformation in other post-socialist contexts, where informality remains a fundamental urban condition.

## 4.2 Survey and interview with local people

Regarding the survey which is done with several persons who live in the area or work there there are multiple chalenges that we have to consider for the design proposal:

“Summers here are nothing short of a nightmare,” the lady, 62, remarks with a hint of regret in her voice. “We’ve reached out to the City Hall multiple times, but it seems our complaints fall on deaf ears. I made the unfortunate decision of buying a flat facing the mar ket back in 2009, and it’s been a constant battle since then. Opening the windows? Forget about it. Dust covers everything; doing laundry is a hopeless endeavor. We’re on the sixth floor, but I can’t help but worry about those on lower floors; they probably need special masks just to breathe properly. The sad part? Even the trees are buckling under the strain. The relentless noise from the market, the pollution it emits, it’s like a constant assault on our senses. It’s disheartening and frankly distressing to see our living conditions deteriorate like this, with no viable solutions in sight.”

“I was definitely impressed by the size and vitality of the market. In my country - or most European countries - building supplies are mostly sold in big warehouses in the outskirts where only workers can go. Also, there would normally be one big supplier who sells most products. Eliava instead is very much an accumulation of small-scale vendors, each specialized in a single item. This also creates a sense of community as they refer to each other for things they can’t provide. Also, I find the presence of actual artisans fascinating, so that you not only can buy the product but also have it worked and modified on the spot, which is a great thing for creatives and DIY people! Also fascinating is that you can find different “ranges” of the same thing, from the more official shop, to the semi-official, to used items and thrift shops. In general, I find it a great source of inspiration and an asset for creatives looking to solve design problems or simply trying to do things differently.”

“Eliava Market stands as a significant locus in Tbilisi’s urban fabric, although my perception of it diverges from a rather exalted viewpoint held by some. A late owner once asserted its pivotal role in shaping the city, a notion that raised my suspicions, given the historical depth of Tbilisi’s existence. I view it more as a vestige, a remnant left behind by the city’s economic and political transformations, albeit a somewhat toxic one. The land itself, upon closer examination, reveals a distressing truth. It’s saturated with petroleum waste and various fuel residues, rendering it unfit and contaminated.As for its function, Eliava was once a bustling industrial hub with a huge silo as a centerpiece that gradually transitioned into a trade center. Initially monopolizing construction and repair materials, it has now evolved into a mix of shops, losing its former dominance. Reimagining Eliava involves considerations beyond mere commerce. Transforming it into a recreational space, intertwined with the Mtkvari River and extending towards Mushtaidi park, could breathe new life into this area. Connecting it with the other areas hints at an expanded recreational unit, fostering a vibrant ecosystem beyond its boundaries.”

“Working at Eliava Market, it’s like battling nature every day,” shares the vendor with a mix of resilience and weariness. “Imagine freezing in the winter, drenched in the rain, or sweating buckets under the scorching sun. We’re out here, hustling amidst the dust and noise, just trying to make a living. It’s tough, you know? But this market is all we’ve got. There’s no fancy shelter or escaping the weather; this is where we make ends meet. It’s a grind, a real struggle, but what choice do we have? This place puts food on our tables and keeps our families going. So, we show up, hoping for a better day in the chaos of Eliava. Honestly, we all wish for a change here. It’s not just for us, but for everyone who relies on this market. Maybe one day, someone will step in and fix things up. We need this place to be saved. Improving the infrastructure, making covered areas for us to work in bad weather, that could be a start. If they could find a way to lessen the dust and noise, that would be a game-changer. We want to keep Eliava alive, but it needs help, real change, you know?”

“Eliava Market sure presents a fascinating intersection of history, community, and commerce within the urban fabric. This place holds immense potential as a vibrant hub for local economic activity and cultural exchange. However, it’s essential to acknowledge certain challenges that warrant attention. To me, one prominent issue revolves around infrastructure and accessibility. The market might benefit from improved infrastructure, such as better sanitation facilities, waste management systems, and upgraded vendor spaces, to enhance the overall experience for both sellers and visitors. Additionally, there’s a need for thoughtful urban design interventions to optimize the layout, creating inviting public spaces that foster social interaction and community engagement. I think the key here is strategically planned pedestrian zones and efficient transportation links, that would significantly contribute to the market’s accessibil ity. Nonetheless, Eliava Market is teeming with opportunities.”

“Shopping there (at Eliava Market) is like stepping into a maze where every turn feels like a gamble. You start off with a sense of ex citement, but soon, it’s a struggle to keep your bearings. The corridors seem to overlap, dead ends pop up out of nowhere, and before you know it, you’re right back where you started. It’s a cycle that loops endlessly. The place, let’s be honest, is a bit of a mess. Dust and garbage scatter the paths, making the whole experience more challenging. And those patched-up pathways? Some paths are patched with uneven metal sheets. They’re a wobbly hazard waiting to happen; you’re constantly watching your step, trying not to stumble. What really gets to me, though, is the lack of places to take a breather. No pockets of space to rest your feet or even grab a seat for a minute. It’s like walking a never-ending circle, hoping for a moment to catch your breath. But the reason we return time and again? It’s because within that maze, you can get everything you need in one spot. You don’t have to navigate through the entire city; it’s all con veniently here.”

The survey reveals that Eliava Bazaar faces a complex mix of environmental, spatial, and social challenges that must be addressed in any design proposal. Physically, the market suffers from harsh environmental conditions — excessive dust, noise, and pollution — severely impacting both vendors and nearby residents. The open-air structure exposes traders to extreme weather, while decades of industrial activity have left the land contaminated with petroleum residues. Spatially, the market's disorganized, maze-like layout creates confusion and discomfort; narrow, uneven paths and a lack of resting spaces make navigation difficult and unsafe. These infrastructural deficiencies are compounded by inadequate sanitation and waste management, contributing to a generally degraded atmosphere. Urbanistically, Eliava remains poorly connected to its surroundings despite its central location; weak pedestrian links and an absence of integration with nearby landmarks like the Mtkvari River and Mushtaidi Park prevent it from functioning as a coherent part of the city's public realm. Socially, while the market thrives on its dense network of small-scale vendors and artisans — forming a unique ecosystem of trade and creativity — the lack of organization and infrastructure undermines this vitality. Overall, the challenge for design lies in balancing the preservation of Eliava's authentic, self-organized character with the introduction of better environmental quality, spatial clarity, and urban connectivity to transform it into a healthier, more inclusive, and sustainable marketplace.

## 4.3 Contextual analysis recap

figure43, contextual analysis maps

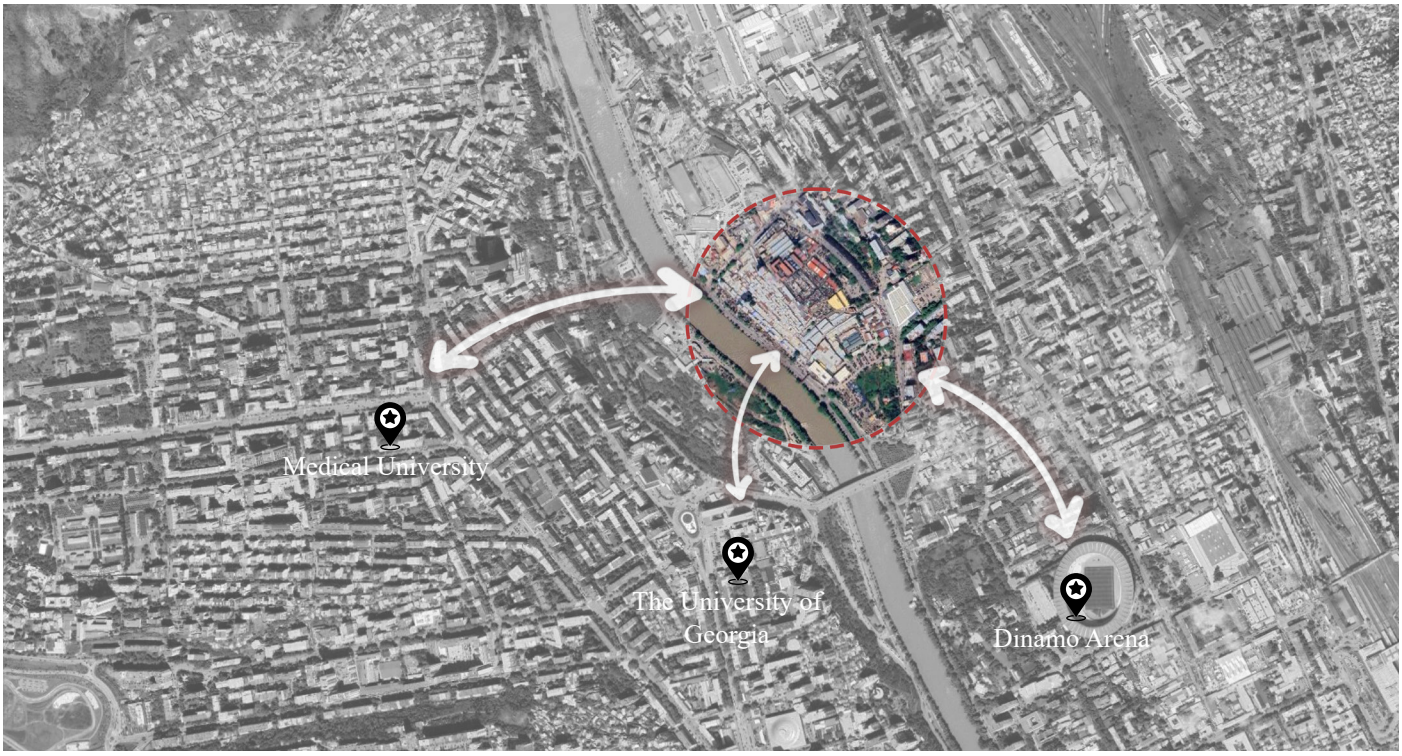



figure44, map of 3 important nodes to the project

## 4.3 Research Questions Derived from Survey and Site Analysis

Considering the results of the survey and site analysis, several critical insights emerged regarding the spatial, social, and environmental dynamics of the Eliava Bazaar. The site analysis revealed complex layers of informal spatial organization—dense stall clustering, conflicting pedestrian and vehicular movements, limited environmental comfort, and insufficient infrastructural order. In parallel, the survey findings provided valuable perspectives from users and vendors, highlighting issues of accessibility, safety, and service quality, while also emphasizing the strong sense of community and adaptability that characterizes the bazaar's self-organized structure.

Together, these findings expose both the strengths of Eliava Bazaar's informal resilience and the challenges of its unregulated growth. Building upon this combined understanding, the design research aims to transform these empirical observations into key guiding questions that will direct the parametric regeneration process. These questions seek to explore how the bazaar's existing patterns of activity, circulation, and adaptation can be reinterpreted through computational design methods—allowing for more efficient, responsive, and inclusive spatial solutions while maintaining the flexibility that defines its informal identity.

In particular, the following inquiries frame the direction of the design proposal:

> **How can air and noise pollution be mitigated through spatial, material, and environmental design strategies, integrating natural and artificial systems within the bazaar's fabric?**
>
> **What spatial and programmatic interventions could attract a wider public to the area, transforming the bazaar into a more inclusive urban destination while retaining its cultural authenticity?**
>
> **How can essential infrastructures such as waste management, sanitation facilities, and extra functions be integrated into the existing framework, improving functionality without disrupting the self-organized logic of the market?**
>
> **In what ways can parametric tools support the reorganization of the bazaar's chaotic layout, introducing order, legibility, and efficiency while preserving the adaptive flexibility that defines its informal identity?**

These are the main questions in the design have to be answered to.

Building upon these guiding questions, the early design proposals were developed as exploratory responses to the spatial and operational challenges revealed through the survey and site analysis. Each proposal functions as a methodological translation of the bazaar's observed informal dynamics into structured design experiments, aiming to test how parametric strategies could reorganize the market without erasing its intrinsic logic. The design iterations therefore move from abstract pattern generation toward increasingly context-specific configurations, addressing issues such as navigability, environmental comfort, infrastructural insufficiency, and excessive spatial density. These proposals served as preliminary frameworks through which different organizational logics—modularity, clustering, grid alignment, and density gradients—were evaluated for their capacity to enhance accessibility, clarify circulation, structure commercial clusters, and integrate social and public spaces. In this way, the early proposals embody the first step in transforming empirical findings into spatial strategies, providing a foundation for refining the design toward a coherent regeneration model for Eliava Bazaar.

## 4.4 Early stage design

In order to preserve the distinctive spirit and cultural identity of the Eliava Bazaar while simultaneously introducing greater spatial organization, modular architecture emerged as the most appropriate design strategy. A modular system allows for flexibility, incremental growth, and adaptation—qualities that mirror the bazaar's existing self-organized dynamics—while providing a coherent structural framework capable of improving circulation, safety, and legibility. This approach made it possible to respect the bazaar's characteristic informality rather than replace it with a rigid, top-down configuration. Consequently, the design process involved testing and implementing various modular patterns across the site, evaluating how different configurations could accommodate existing activities, enhance environmental performance, and facilitate clearer zoning. Through iterative experimentation, the modular framework became a tool for balancing continuity with transformation: retaining the bazaar's lived atmosphere while introducing a more organized and manageable spatial structure.

### First proposal

The proposal builds upon a detailed analysis of the existing spatial logic of Eliava Bazaar, where shop units are arranged through incremental, self-organized occupation rather than predetermined planning. By examining the average square meter area of current vendor stalls and mapping their spatial distribution, we identified a characteristic informal pattern that defines the bazaar's operational identity. This pattern—fragmented, adaptive, and organically clustered—served as the foundation for generating a more controlled and legible configuration using a parametric workflow in Grasshopper. Through computational modeling, the irregular logic of the existing market was translated into a structured typology that retains its granular scale while improving circulation, clarity, and functional organization. The resulting configuration, illustrated above, is not a departure from the bazaar's identity but a refined continuation of it: a system that preserves the productive irregularity of informal commerce while embedding it within a coherent spatial framework capable of supporting accessibility, safety, and long-term adaptability.

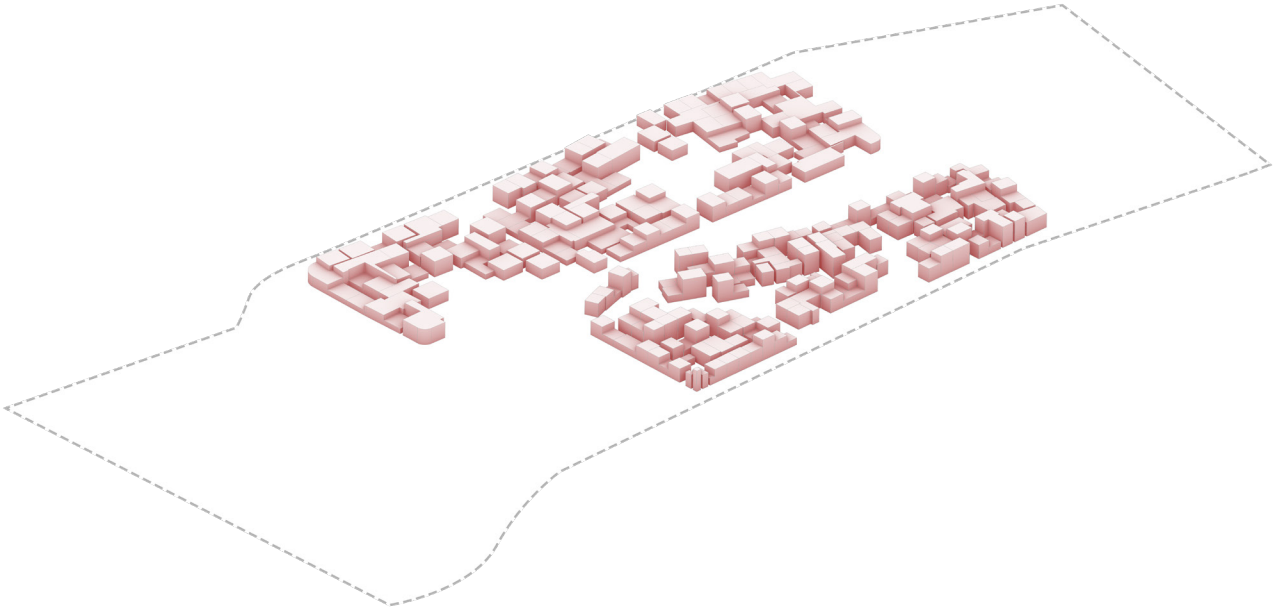


figure45, illustration of early stage design proposal-1

While the proposed strategy successfully retains the spatial language of the existing bazaar, it also presents several challenges that must be critically acknowledged. One of the primary limitations is the persistence of a certain level of spatial complexity within the modular pattern. Similar to the current condition of Eliava Bazaar, the generated layout risked becoming labyrinthine, making wayfinding difficult for visitors and reducing overall legibility. As highlighted in the community survey, one of the most frequently reported issues of the existing market is that it "feels like a maze," where navigating between stalls is confusing and time-consuming. This indicates that any design intervention must significantly improve organizational clarity without compromising the bazaar's inherent vibrancy.

A second challenge emerged in the vertical development of the prototype. While the modular system functioned efficiently at the ground level, extending the same logic into a second floor proved structurally and spatially complex. The geometry and connectivity that worked at one level did not seamlessly translate to multi-story configurations, posing constraints for future densification. These issues underscore the importance of balancing authenticity with functionality, ensuring that the regenerated bazaar remains both intuitive and adaptable as it evolves.

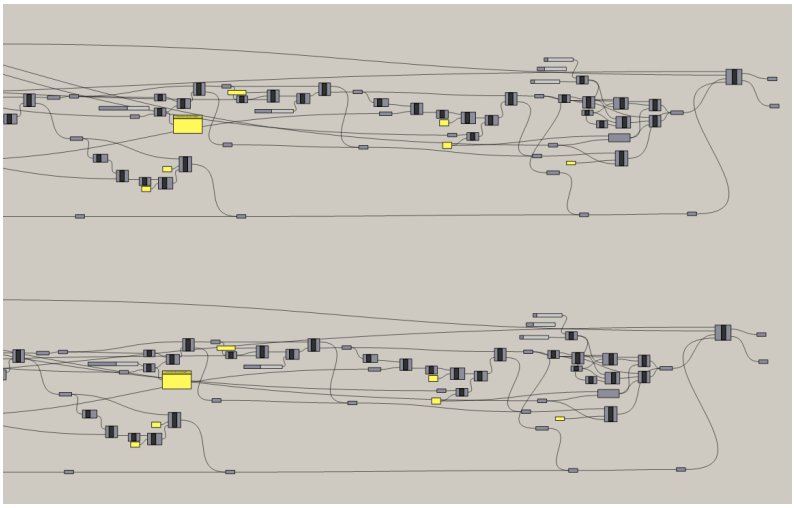


figure46, grasshopper workflow

**Second proposal**

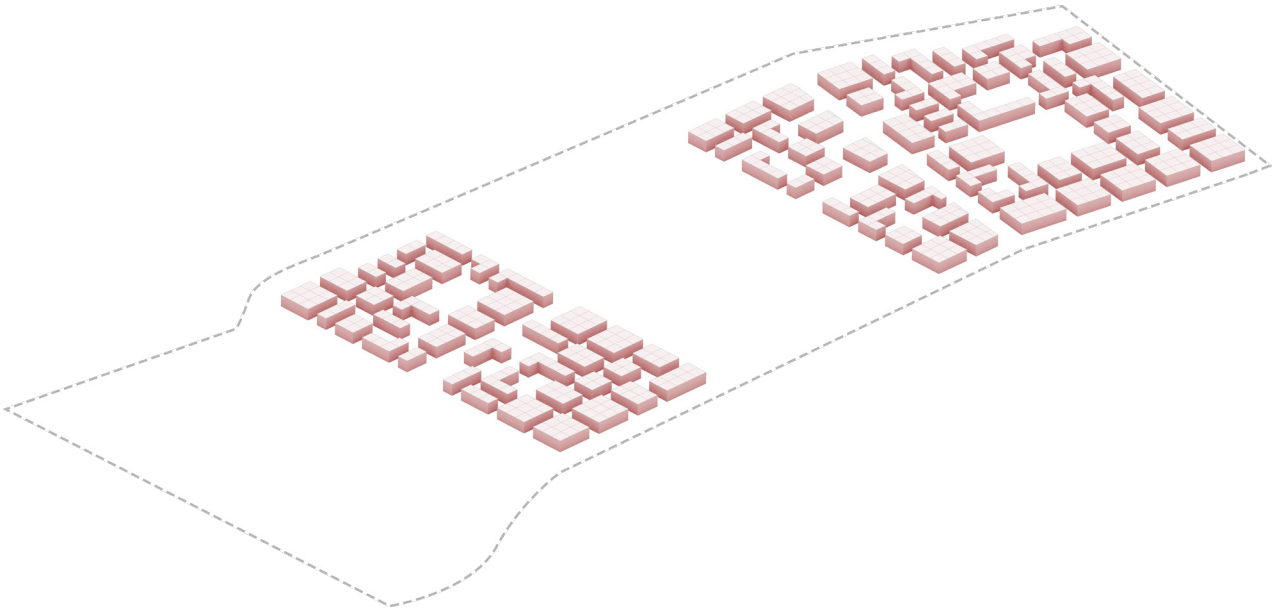


figure47, illustration of early stage design proposal-2

The second proposal advances the modular strategy by introducing a more structured and legible organizational system, responding directly to the need for clarity and spatial hierarchy within the regenerated bazaar. In this iteration, a regularized grid was overlaid onto the site, serving as a guiding framework from which diverse modular configurations could be generated.

These modules—varying in size, proportion, and combination—were arranged into coherent clusters, producing a pattern that remains rooted in the bazaar's informal typologies while achieving a significantly higher degree of order. A deliberate central void was preserved to accommodate a public plaza, conceived as a social anchor capable of attracting visitors, improving accessibility, and strengthening the market's integration with its surroundings. This plaza responds to one of the project's core objectives: to bring more people into the area and enhance its role as a community destination rather than a solely transactional space. Despite these improvements, the system still presented challenges.

The reliance on a rigid grid, although effective for organization, occasionally resulted in repetitive or overly regular patterns that risked diluting the bazaar's characteristic spontaneity. Nonetheless, the proposal demonstrates how modular architecture, when guided by a parametric grid-based framework, can balance order and adaptability while generating opportunities for public life and spatial coherence within a previously chaotic environment.

**Third proposal**

The third proposal builds upon the logic of the earlier iterations while introducing a more refined and strategically differentiated modular organization. Although it maintains conceptual similarities with the previous proposal—particularly in its use of modular units and a parametric grid as the primary generative framework—it advances the design by redistributing density across the site in a more intentional way. In this configuration, the number and concentration of modules are highest along both ends of the site, where commercial activity is expected to intensify, while density gradually decreases toward the center. This calibrated gradient not only enhances legibility and circulation but also creates a clear spatial hierarchy that responds to functional patterns observed during site analysis. The reduced density at the core of the site opens up a substantial central void, envisioned as a public plaza that serves as a key social and spatial anchor. This plaza addresses one of the core objectives of the regeneration project: attracting more people to the area by providing a flexible, accessible gathering space that supports community activity beyond commerce. The resulting arrangement produces a modular field that remains rooted in the bazaar's informal typologies but becomes more structured, navigable, and contextually responsive.

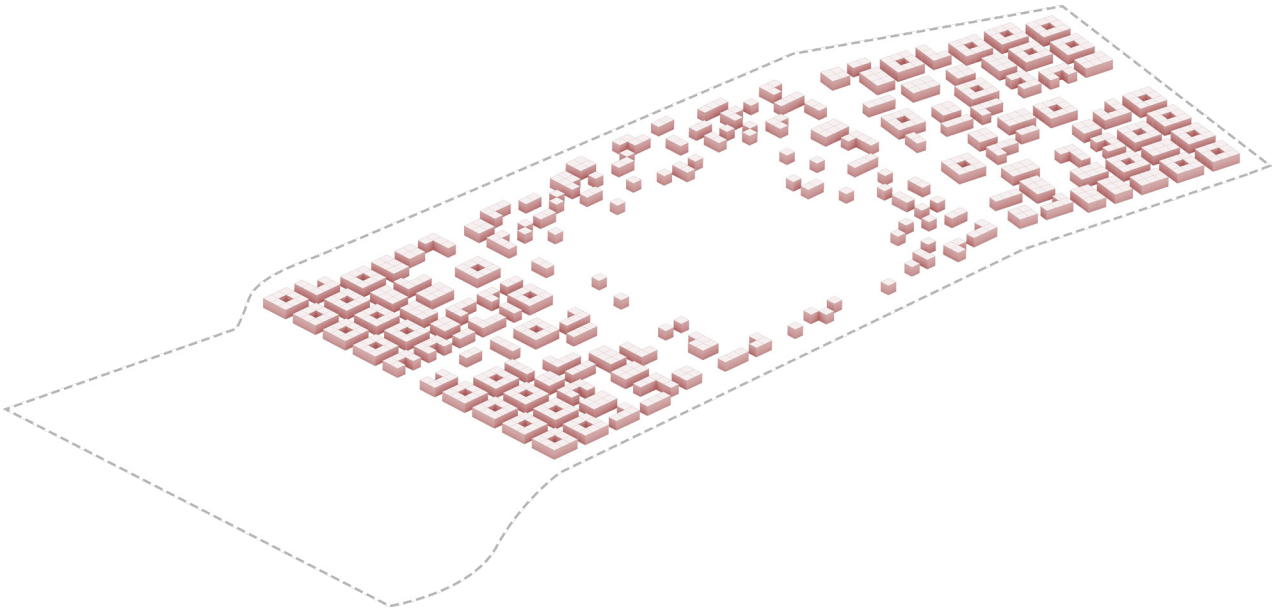


figure48, illustration of early stage design proposal-3

## 4.5 Final dessign phase

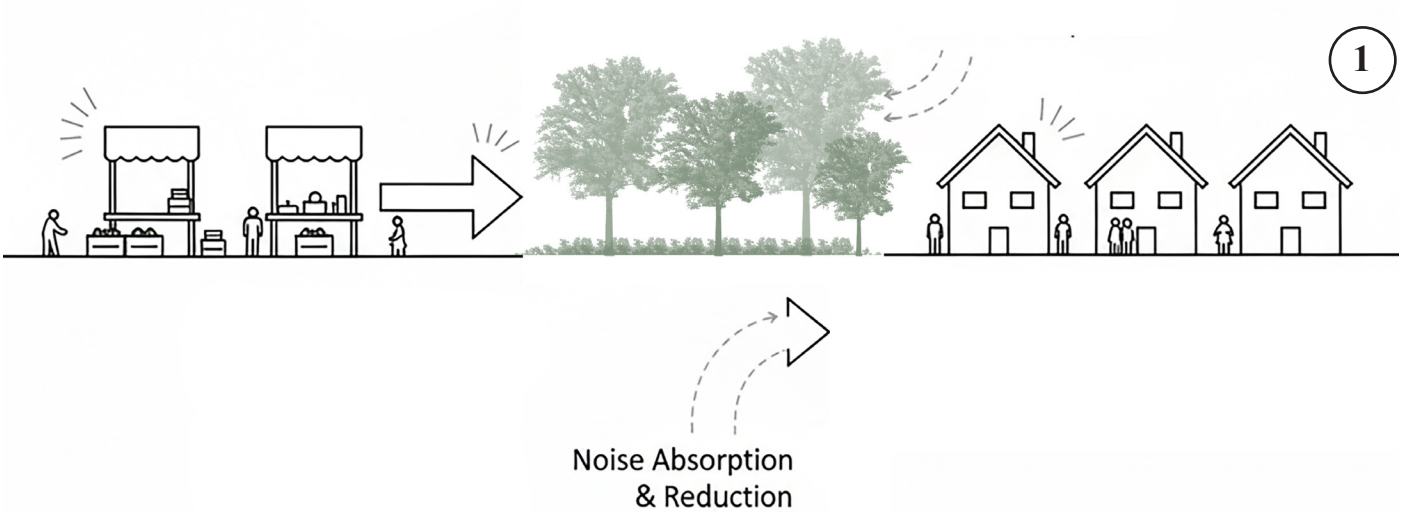
Building upon the insights generated through the early-stage design proposals, the project then progressed into the final design phase, guided directly by the key questions and needs identified through site analysis and user surveys. The earlier iterations served as exploratory frameworks—testing spatial patterns, modular logics, and organizational strategies—while revealing both the potentials and limitations of different configurations. With a clearer understanding of the bazaar's environmental challenges, infrastructural gaps, circulation conflicts, and socio-economic dynamics, the final design phase shifted toward a more targeted and evidence-based methodology. This stage synthesized the analytical findings into concrete design criteria, ensuring that each intervention—whether addressing pollution mitigation, public attraction, infrastructural integration, or spatial reorganization—responded explicitly to the lived realities and operational logics of the Eliava Bazaar. In this way, the transition from conceptual proposals to a resolved design framework reflects a move from experimentation toward strategic, data-informed decision-making aligned with the project's core objectives.

**Green Infrastructure as a Filter and Buffer**

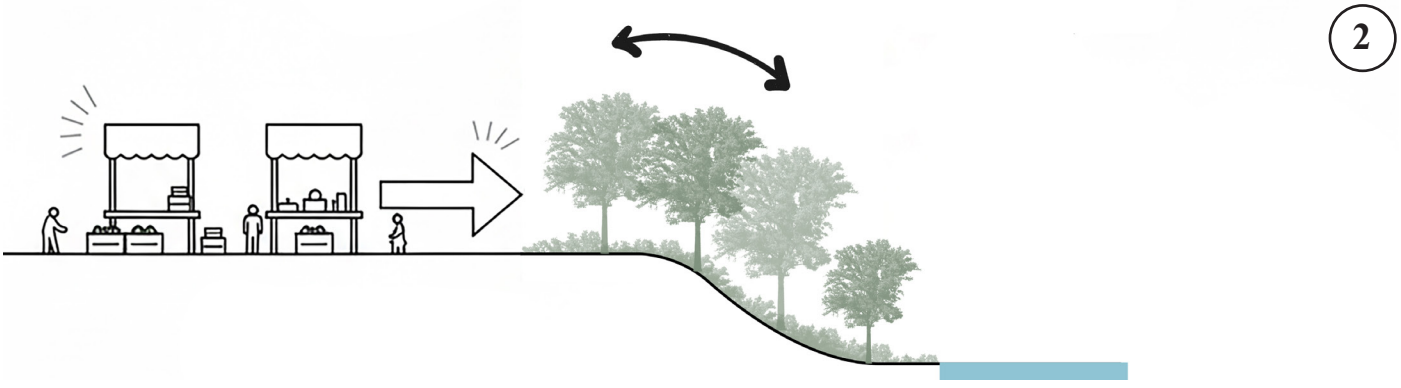
**How to control air and noise polution in a sustainable way?**

In response to the identified issue of air and noise pollution, the design adopts a green infrastructure strategy as an integral component of the regeneration framework. The introduction of greenery is not merely aesthetic but functions as an ecological and spatial mediator between the different urban zones of the site. In particular, the linear park along the north-eastern edge of the bazaar has been designed as a multi-functional green corridor. This green belt performs several key roles: it acts as a natural buffer between the vibrant, high-activity zone of the multifunctional market and the adjacent residential neighborhood, thereby reducing acoustic disturbance and improving air quality through natural filtration.

From a sustainability perspective, the inclusion of extensive vegetation supports the absorption of particulate matter and $CO_2$, while contributing to the microclimatic regulation of the area by providing shade and enhancing evapotranspiration. The park's design integrates native and drought-tolerant plant species, ensuring low maintenance and ecological resilience. Additionally, the linear park serves as a public recreational spine, promoting social interaction, pedestrian connectivity, and visual continuity within the urban fabric. This approach aligns with sustainable urban design principles, demonstrating how green spaces can simultaneously function as ecological filters, social catalysts, and spatial organizers in the regeneration of informal urban environments such as Eliava Bazaar.




**Using greenery and trees is a sustainable way to control noise and air polution from the Eliava to the residential area.**




**Creating a green connection from the Market to the river can provide many positive points.**

figure49, schematic illustration of the green approaches

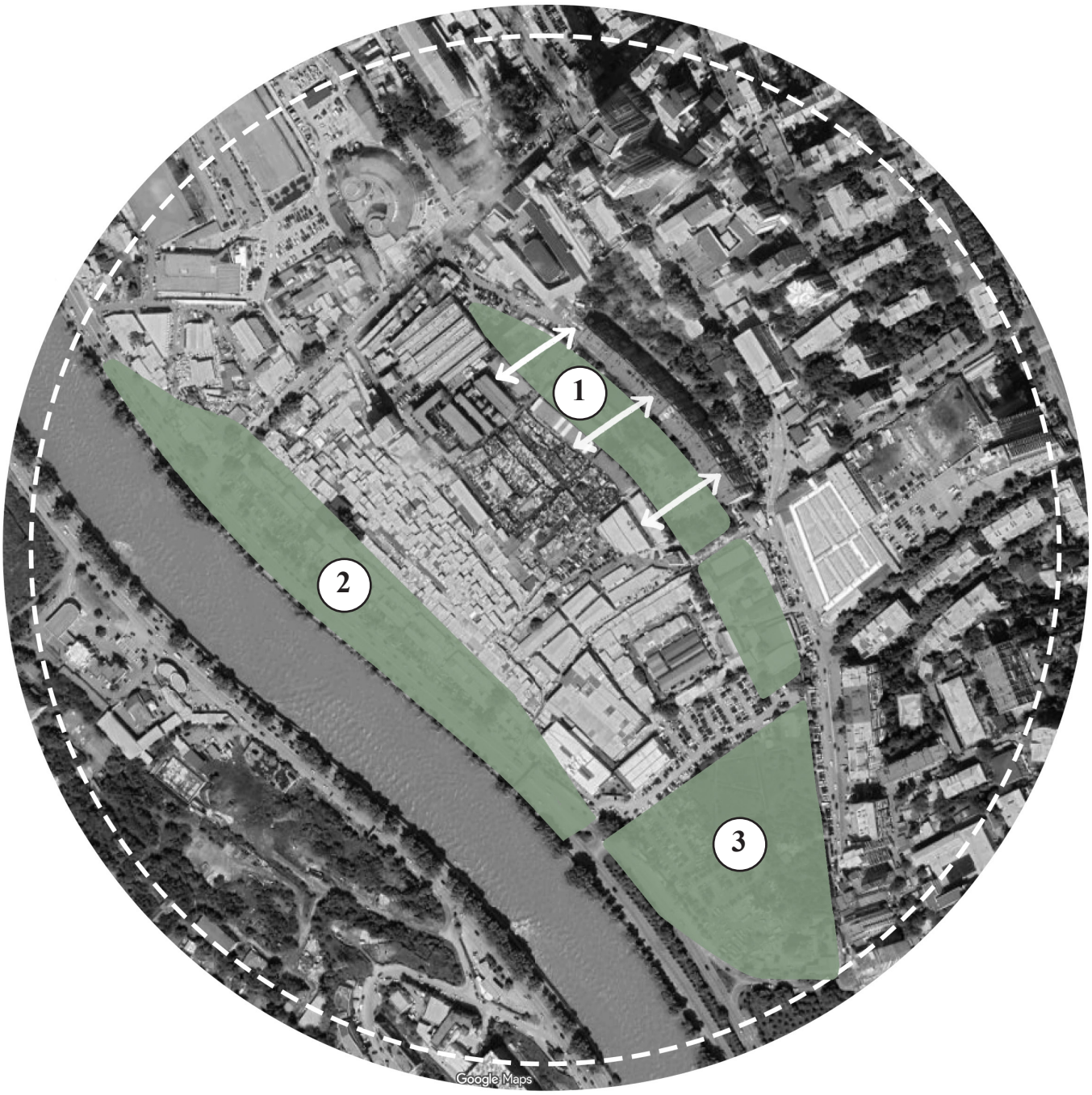



figure50, map of the main green areas of the project

**In the third main green area there will be playgrounds, sport facilities and in general all sort of spaces for serving and attracting people to the area, specialy students from the universities close to our project site.**

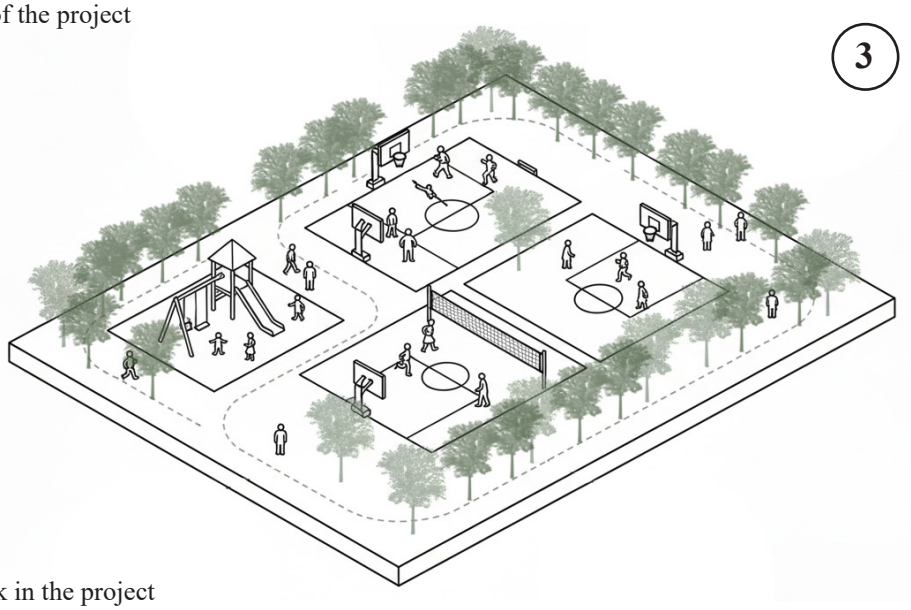



figure51, schematic illustration of the park in the project

## Circulation Framework

Moving forward, the design phase focused on establishing a clear circulation framework that organizes and enhances the existing movement patterns within the Eliava Bazaar. The main routes and streets were defined based on the existing circulation network, maintaining the logic of the site's self-organized pathways while introducing a more legible and efficient structure. By retaining the key axes of pedestrian and vehicular movement already present, the proposal ensures continuity with the bazaar's daily operations and preserves its spatial identity.

At the same time, the new street hierarchy introduces a system of primary and secondary routes, allowing for better division and management of the overall area. This subdivision not only improves accessibility and navigation but also creates a framework for defining distinct functional zones—such as commercial areas, service corridors, and public open spaces. Through this controlled structuring, the design enhances safety, visibility, and spatial coherence, addressing the previous disorder of the bazaar while maintaining its dynamic character. The parametric approach facilitated this process by allowing routes and boundaries to adapt to functional and environmental parameters, ensuring that circulation remains both efficient and contextually responsive.


figure52, map of the main connections of the project

**Spatial Structure: Formation of Functional Districts**

Following the definition of the main circulation network, the site was naturally subdivided into a series of distinct spatial zones that respond to both functional requirements and contextual relationships. The newly introduced routes act as structural lines of organization, delineating boundaries that define the emerging districts within the regenerated bazaar. This spatial separation facilitates a more controlled distribution of activities, enabling each zone to accommodate specific functions—such as market areas, service spaces, recreational zones, and green buffers—while maintaining their interconnectivity through the established street hierarchy.

As illustrated in the diagram above, the interplay between movement corridors and open spaces generates a balanced urban composition that supports legibility and accessibility. The parametric design logic applied here ensured that the subdivision was not arbitrary but rather guided by existing flows, environmental constraints, and proximity factors derived from the earlier stages of site analysis. This approach allows for a more adaptive and scalable spatial framework, one that can evolve in response to future needs while preserving coherence between built and unbuilt areas. The resulting structure transforms the once chaotic fabric of the bazaar into a system of organized, interrelated spatial entities, capable of supporting both functional efficiency and social vibrancy.


figure53 , map of the main connections of the project

## 4.6 Creatation of the modular master plan

After dividing the whole project area to smaller zones, as it is mentioned before a study was done regarding the spirit of the Eliava market and in general, traditional markets. Considering Eliava, and the previous data collection and analysis we understood the fact that that one of the most important factors of a bazaar is the modularity. So we made a research on the typology and the dimensions of individual units in the current situation and we reached to an average number between 12-20 meters.

Overlapping a huge grid of 4x4 meters on the difined areas was the first step of our parametric framework.

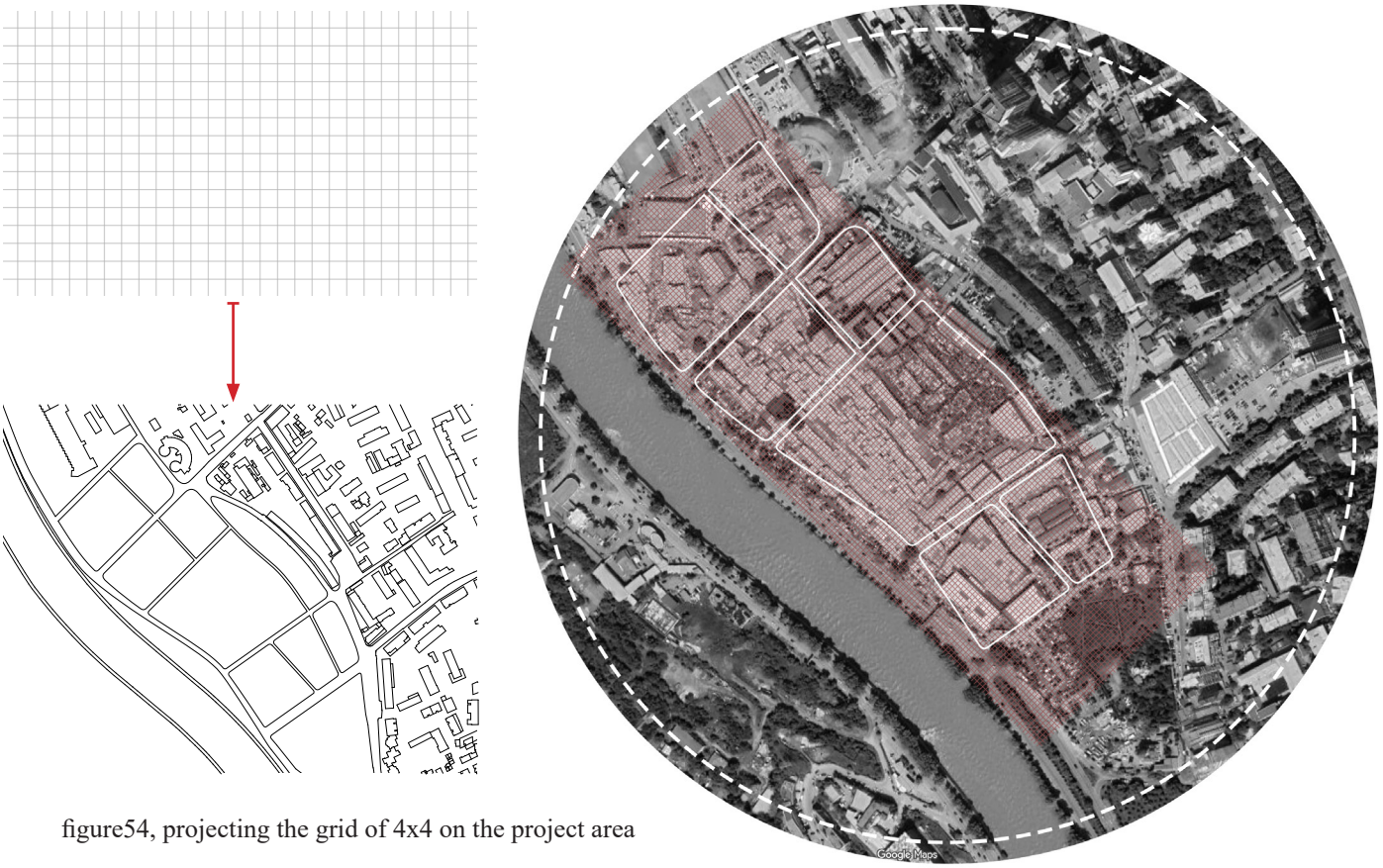


figure54, projecting the grid of 4x4 on the project area

The next step after projecting the grid on the zones, was to difine the pattern we prefer to implement on our grid. So with grasshopper we tested different factors in order to difine different patterns and several factors were involve like density, randomness, passages, and of course the geometry.

Here we can reveiw some of the many square patterns that we tested during the process of design

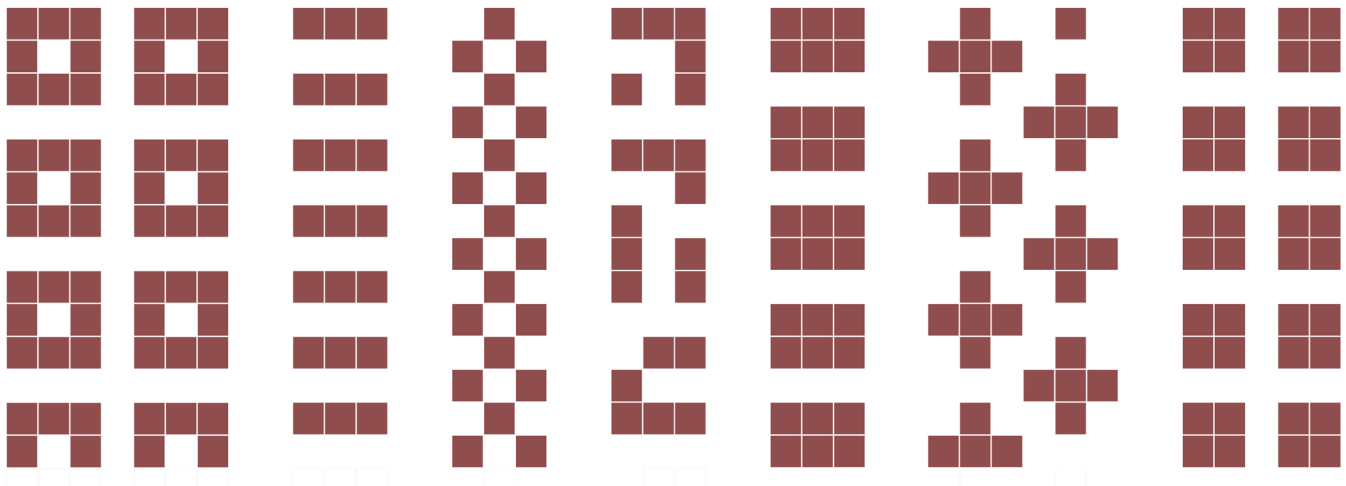
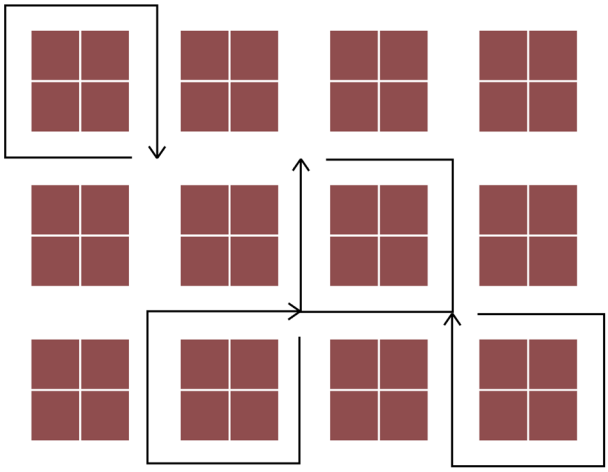


figure55, different patterns defined by the script

**Spatial Structure: Formation of Functional Districts**

Among the differenet varriations, a group of 4 squares with the dimension of 4x4 meters was chosen to generate our master plan. And we understood that if we create a some sort of rotating circulation amoung the modules we can reach to more than one floor without losing the connection in each individual level.



The next phase was trying a set of datas related to density and randomness, which is not the usual term “random” that we hear, but using some attractors and factors in order to recieve the best results. So we imagined our project area as a ractangle with the same length and width of the area and then we difined our attractors, for example our main connections, a plazza in the middle zone and our greenery areas. As we can see in the following matrix with 4 different percentage of density and a jitter value which introduces randomness into the order of elements in a list. It reassigns the sequence of items based on a given random seed and jitter strength, without changing the list’s content. This is useful for creating variation or irregularity in patterns while maintaining the same dataset.

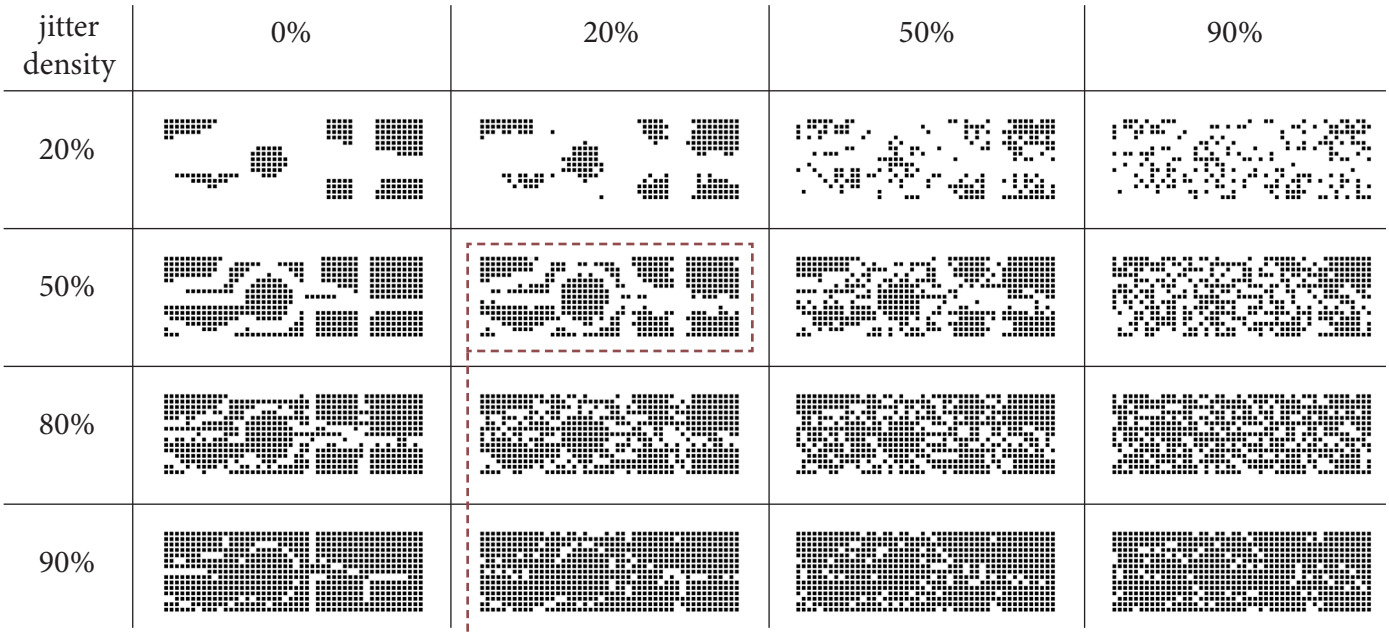



figure56, matrix of density/ jitter

In the following illustration the simplified logic of attractors and how the moduls are located in the whole area is being showed.

The middle part as mentioned before is dedicated to a public plazza.

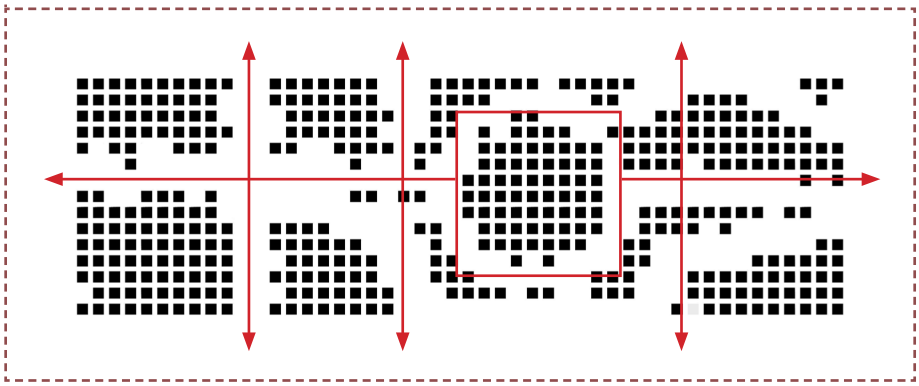


figure57, Diagram of the rule and attractors for masterplan

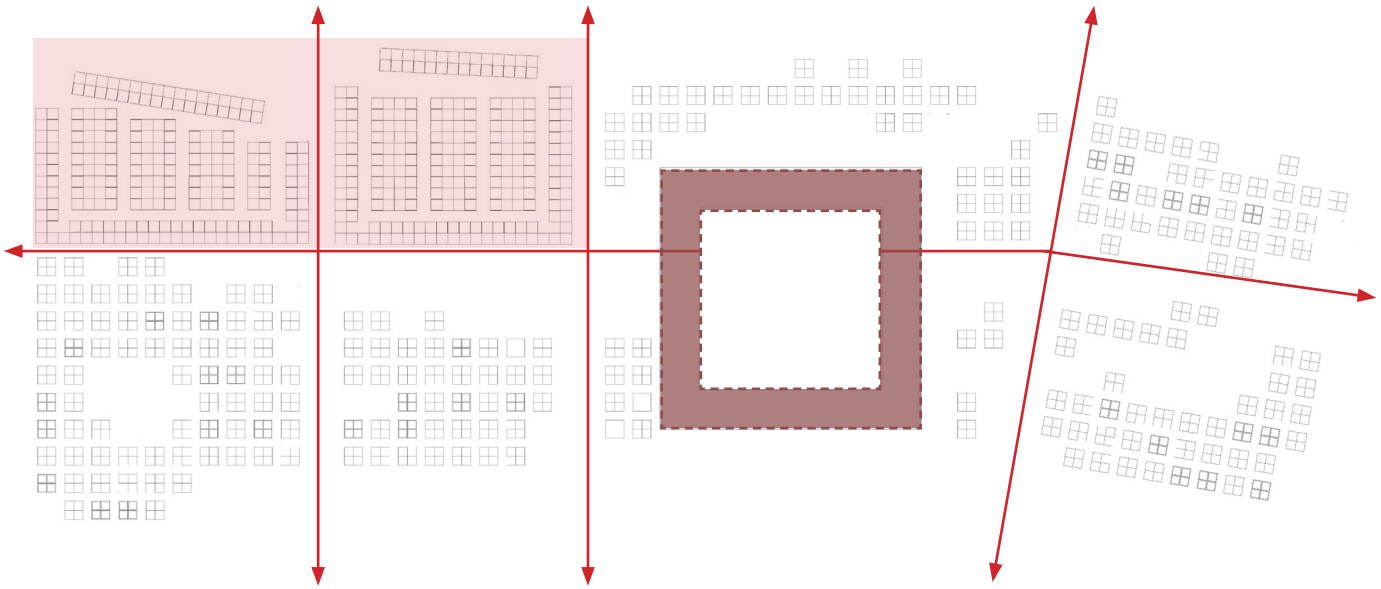
## Functional allocation: Integrating existing economic activities


figure58, Ilustration of variety of functions in Eliava market

According to the map above almost 20% of the area is dedicated to car repair and car used part selling so, after defining the modular system and establishing how it adapts within the various spatial zones, the next stage of the design focused on aligning programmatic distribution with the site's existing functional patterns. Rather than displacing these long-standing activities—which constitute a significant part of Eliava Bazaar's economic identity—the design strategically incorporates them into the new spatial framework.

Two zones within the masterplan were therefore designated specifically for automotive repair and maintenance, positioned to ensure accessibility for vehicles while maintaining a clear separation from pedestrian-oriented areas. These zones introduce a new typology of workshop space, designed with modular adaptability that accommodates varying scales of operation—from small individual garages to collective repair units. The modular configuration allows flexibility in spatial arrangement, enabling units to expand, merge, or adapt according to future demand.

This approach not only preserves the socio-economic continuity of the bazaar but also elevates the environmental and spatial quality of these activities. By organizing the workshops within a coherent typological framework and integrating proper waste management, ventilation, and circulation systems, the design transforms what was previously a dispersed and chaotic pattern into a controlled, sustainable, and productive urban cluster. This strategy exemplifies how regeneration can build upon existing economies rather than replacing them, ensuring that local livelihoods remain integral to the renewed urban fabric.



Looking above, in this illustration the 2 zones that are highlighted are dedicated to the car part trade shops and car repair workshops.

In parallel with the programmatic placement of the automotive zones, the spatial configuration of the modular system underwent further refinement to enhance porosity, environmental comfort, and spatial legibility within the bazaar. Select modules were intentionally removed to create a sequence of open courtyards, internal yards, and pedestrian pockets, ensuring that the overall fabric does not become overly dense or monotonous. These openings serve multiple functions: they improve natural ventilation, introduce daylight into deeper sections of the market, and provide social gathering spaces that support the bazaar's communal life. Additionally, they act as micro-breaks within the commercial grid, improving wayfinding and reducing congestion in high-intensity zones. Also a rectangular area in the middle of the district is dedicated for a public plaza .

**Vertical expansion of Eliava**

Another important factor to consider is the fact that in the most part of the area buildings have only 1 floor, this matter of course is because of the informality of the architecture of Eliava bazaar and the type of the materials which have been used. In the map below it is evident that only the type of the buildings that have changed during this period only have more than 1 floor.

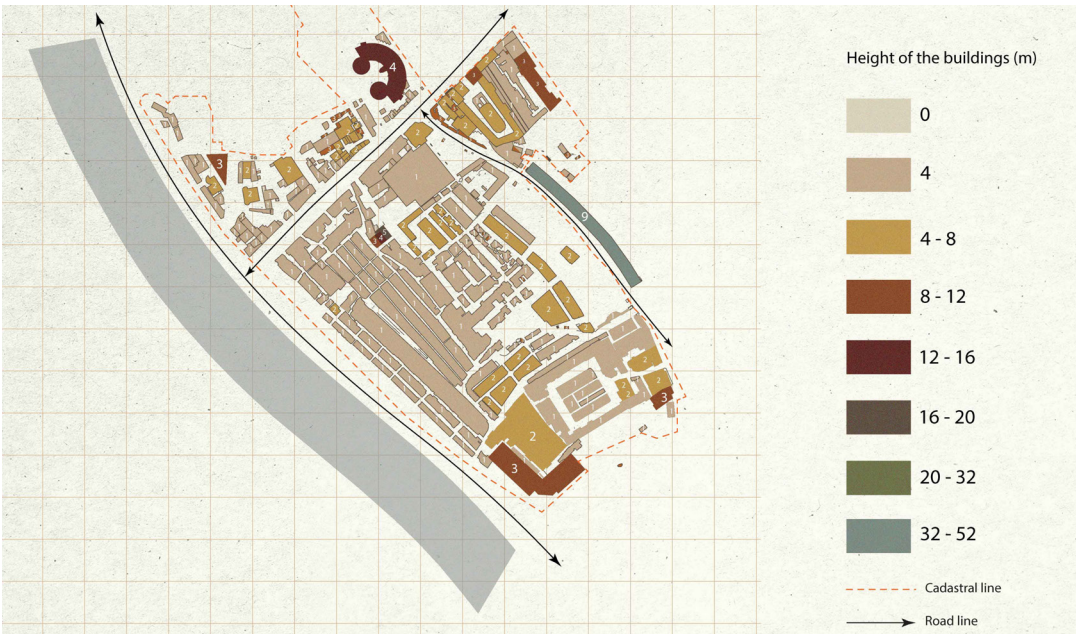



figure59, map of number of floors of the buildings in Eliava

## Vertical expansion opportunity

Building on this observation, the predominance of single-story structures within the bazaar presents not only a constraint but also a significant opportunity for strategic vertical expansion. The limited height of existing buildings means that adding additional layers through a modular system can be achieved with minimal disruption to the surrounding urban fabric. By introducing lightweight, stackable modules, the design is able to increase usable floor area without enlarging the footprint, thereby addressing the high spatial demand and density requirements identified in the analysis. Vertical extension allows the bazaar to accommodate more shops, services, and communal spaces while preserving permeability and ground-level circulation. This approach also supports future adaptability: modules can be added incrementally as economic conditions evolve, aligning with the bazaar's historically incremental, self-organized growth. Thus, the existing low-rise condition becomes a catalyst for a flexible and sustainable vertical development strategy that responds efficiently to spatial needs while maintaining the character of the site.

Looking at the diagram it is clear that the strategy of verical expansion of modular system is following an important rule. We put the maximum nuber of floors for the parts we have more distance from the boarders so in human perspecive we feel more welcomed to the area.

So near the streets and pedastrian paths we keep the bazaar one or maximum two floors and in the middle of the zone we put the three floors.

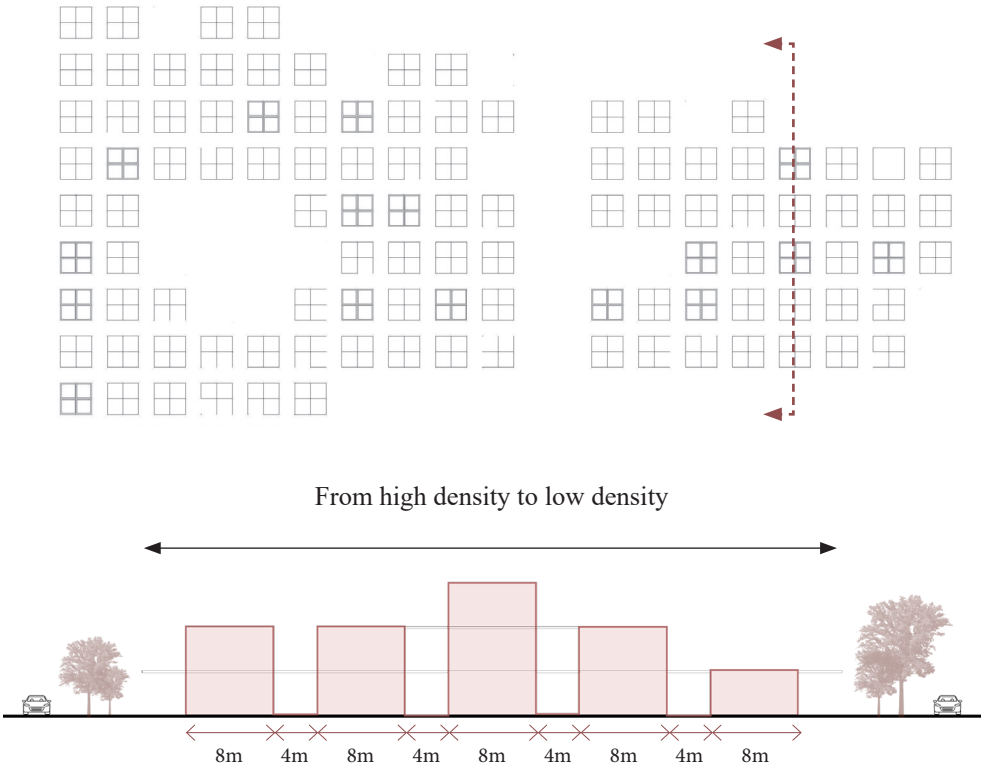



figure60, illustration of vertical expansion defined rule

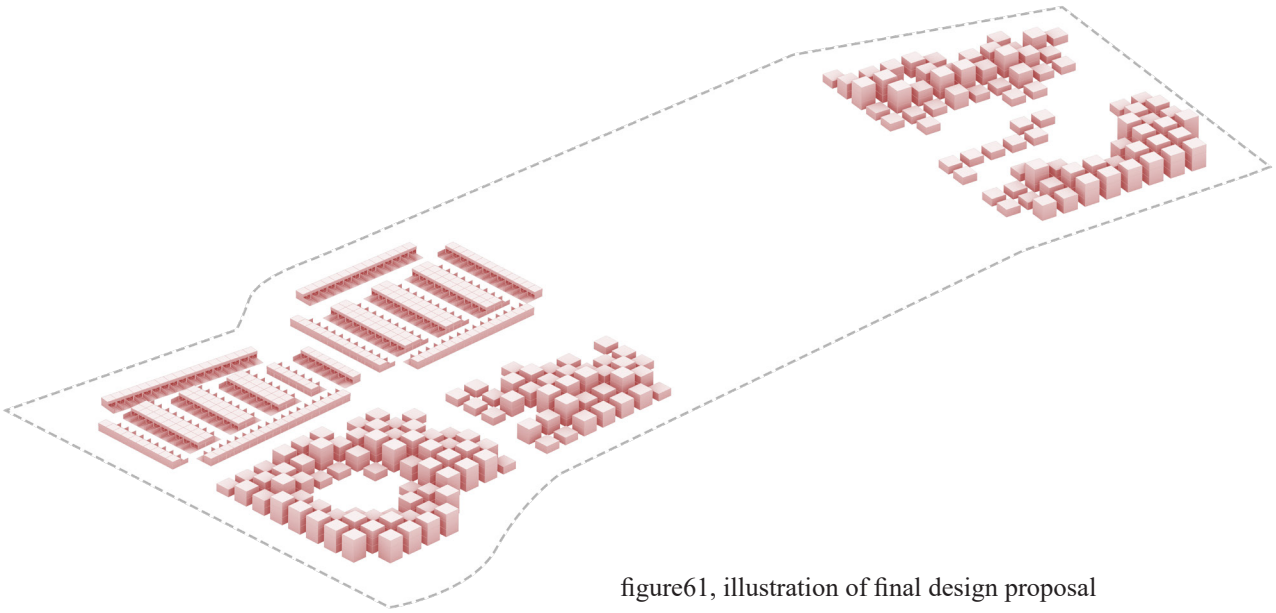


figure61, illustration of final design proposal

## 4.7 Modular system

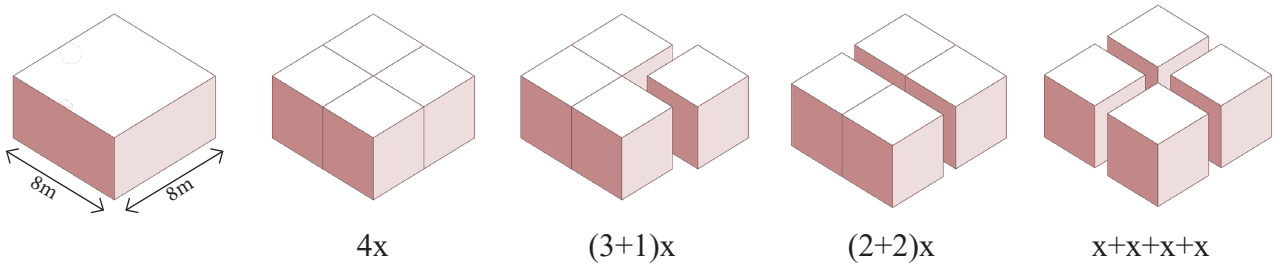



figure62, different type of module separation

As we discussed it before during the process of grid intersecting and module pattern creation, the first output of the grids intersections, was an 8x8 square footprint. the next step we extrude the plan by 4 meters to have our early stage cube, as we can see above in the diagram the positive point of moduarity is we can achive different variations even with one type of module.
This interesting function other than helping to have different variations, can be useful for dividing the square meters amoung vendors according to what they have in the current situation. So each person has the possibility to have a store between 16 and 64 square meters.

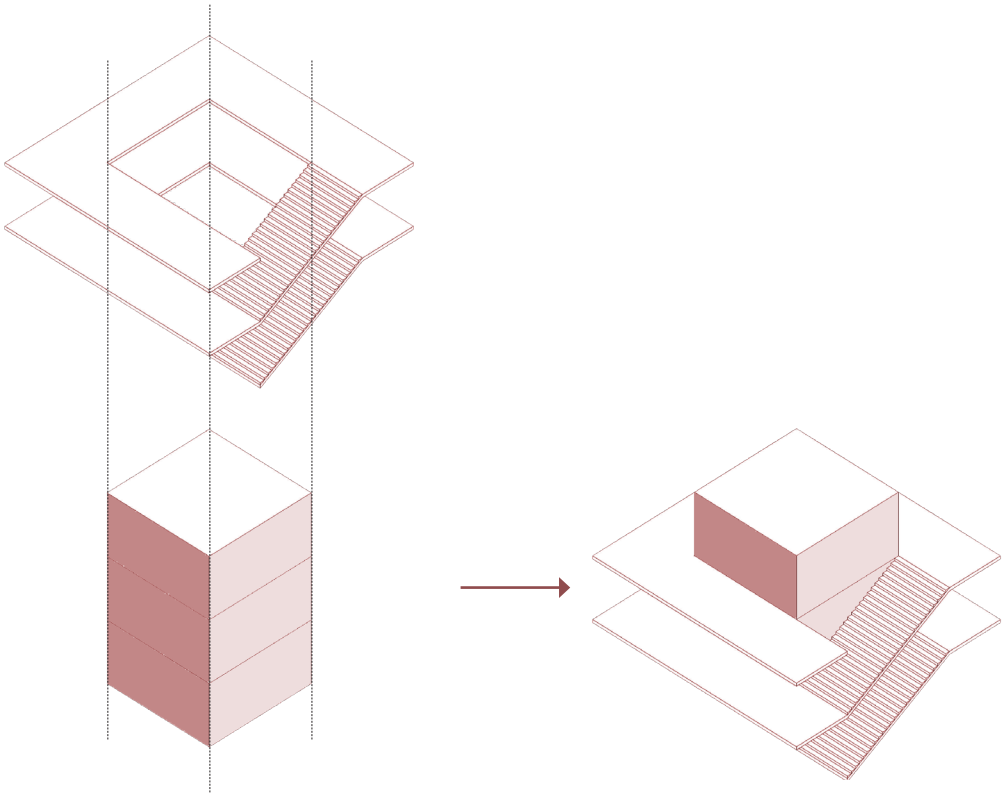


figure63, vertical connection around the module

Next step was stacking the cubes on top of each other. The diagram above illustrates how the vertical connection is working around the modules.

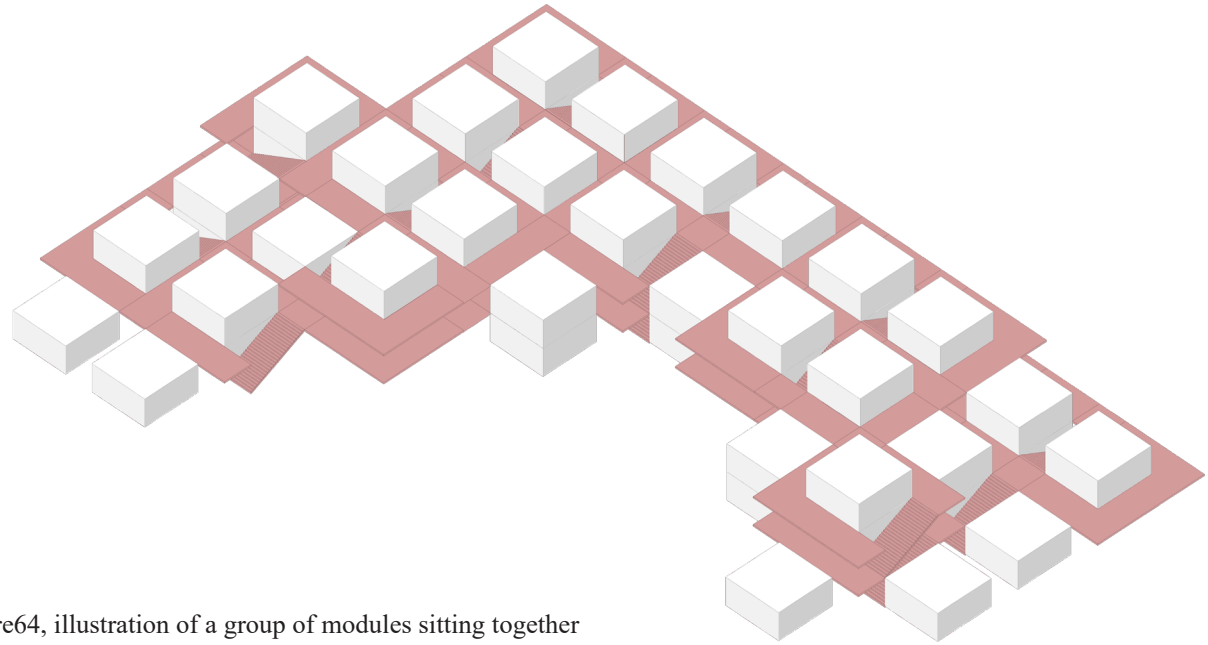
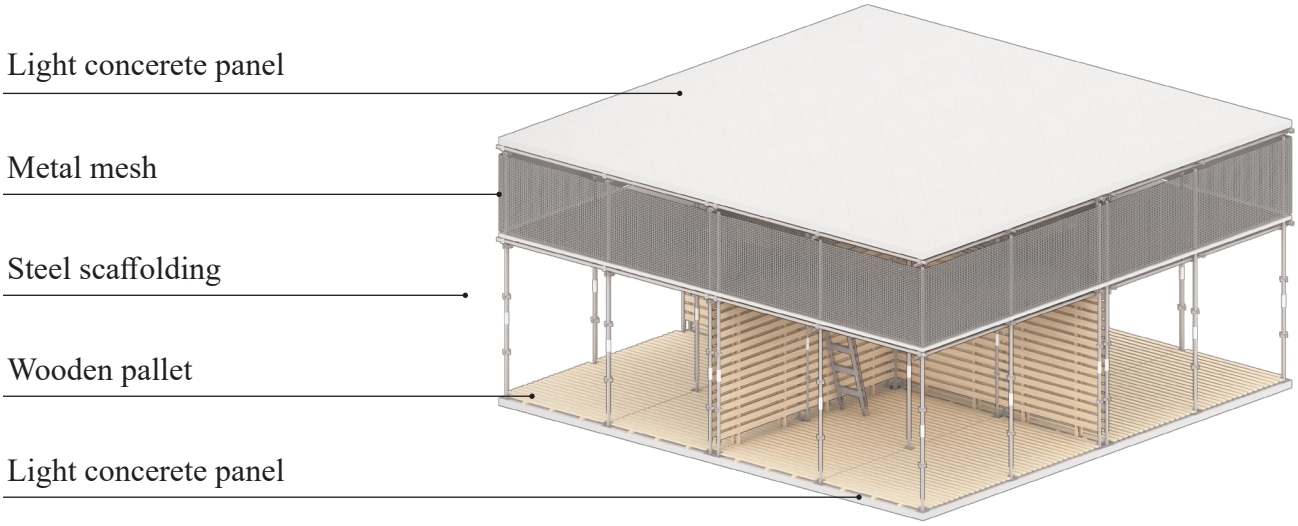


figure64, illustration of a group of modules sitting together

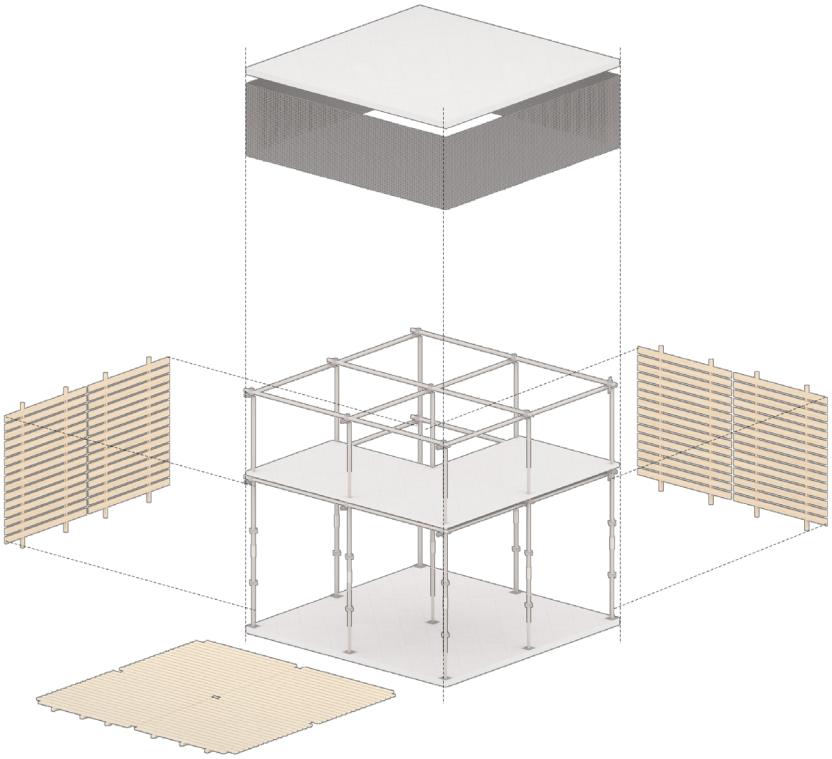
This diagram illustrates the spatial logic generated when individual modules are vertically stacked and grouped according to the organizational rules defined in the design framework. By elevating selected modules and connecting them through the previously introduced vertical circulation elements, a continuous ribbon-like platform is formed—an elevated belt that weaves through the clusters of volumes. This ribbon acts as both an infrastructural and spatial connector, linking each cube at multiple levels and enabling fluid pedestrian movement across the system. It creates opportunities for upper-level pathways, terraces, and shared spaces while reinforcing the modular identity of the complex. The resulting configuration maintains the bazaar's characteristic density and vibrancy, yet introduces a coherent structural hierarchy that organizes circulation, enhances visibility, and unifies the modules into an integrated architectural ecosystem.

**Module Construction Strategy: Materiality, Sustainability, and Adaptability**

The construction of each module is guided by a strategy that prioritizes sustainability, cost-efficiency, and ease of modification—three essential components when reimagining an informal market such as Eliava Bazaar. Each module is conceived as a lightweight, prefabricated system composed primarily of sustainable and recycled materials such as laminated wooden pallet, recycled steel scaffolding, and modular panels made from compressed recycled concerete. These materials ensure a low carbon footprint while maintaining structural durability and resistance to intensive daily use. The prefabrication approach allows modules to be produced off-site, reducing construction time, minimizing disruption to existing market activities, and significantly lowering labor costs—an important consideration within economically sensitive contexts.
The reason for choosing timber plates and steel scafolding bars for creating the modules other than their low cost and reusing them as recycled material is the fact in current situation there are several wood and metal workshops very close to the bazaar so it is even locally sustainable.




The modular system also supports long-term adaptability. Walls, facades, and storage elements can be easily reconfigured or expanded to respond to future functional needs, supporting the incremental nature of informal markets. The lightweight structural logic enables modules to be stacked or extended vertically with minimal additional support, allowing the market to grow without major reconstruction. Furthermore, passive environmental strategies—such as natural ventilation gaps, shaded overhangs, rooftop greenery, and optional photovoltaic panels—reinforce sustainability by reducing energy demand and improving user comfort.



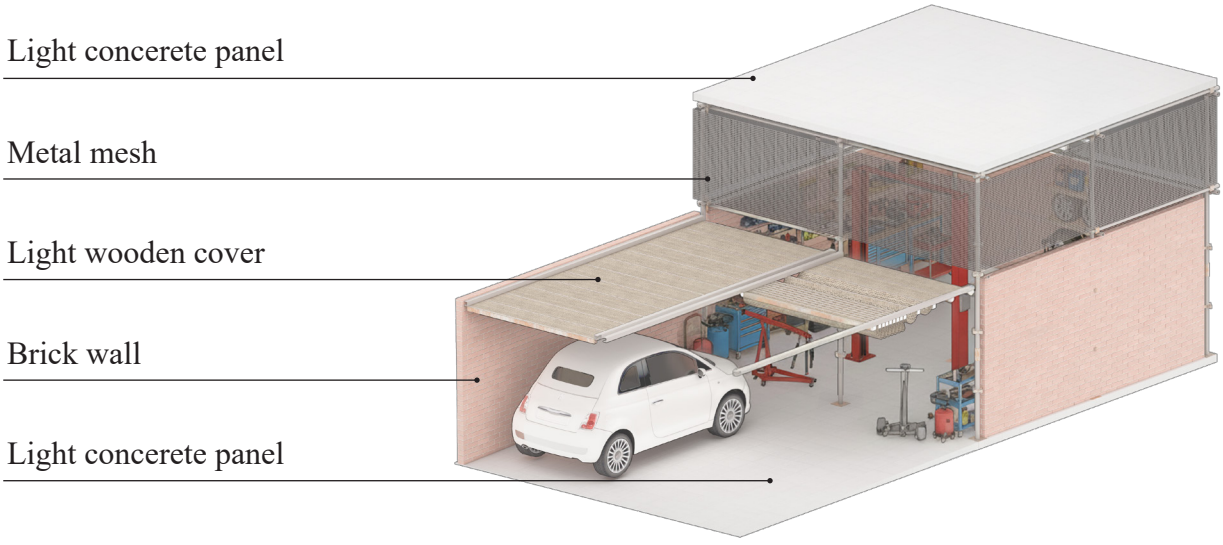
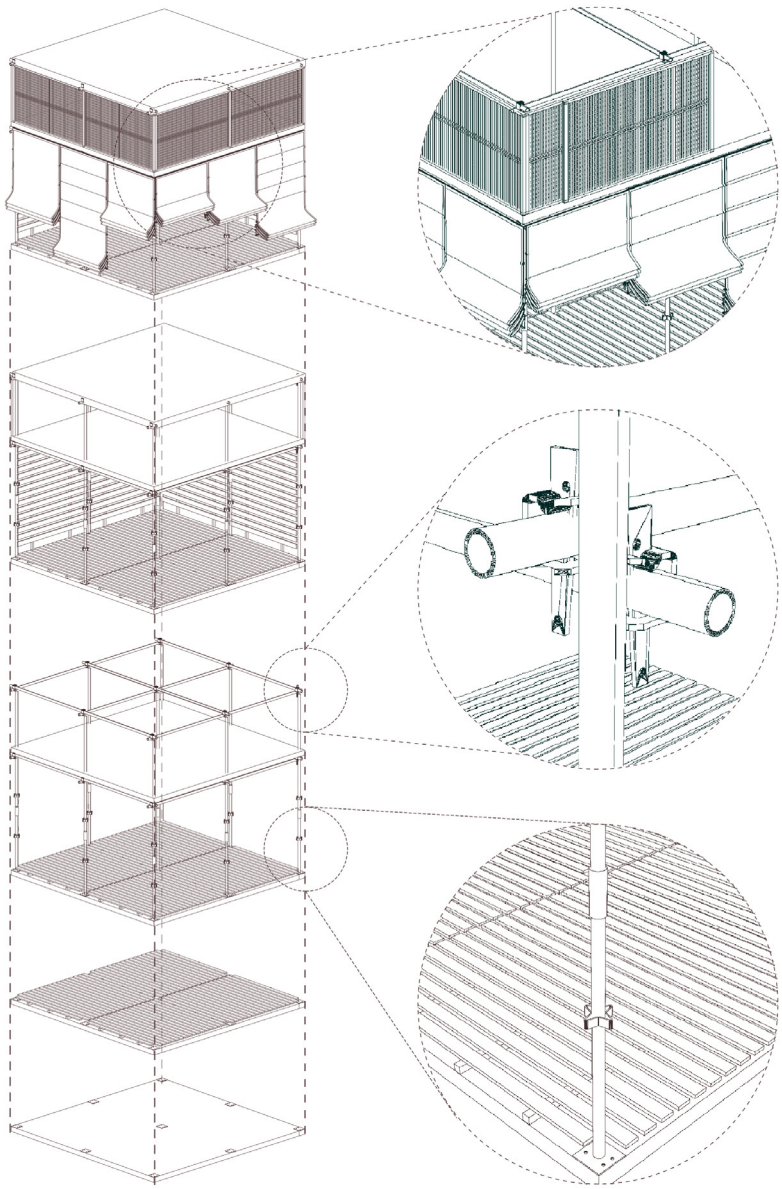



figure65, isometric illustration of modules



The upper part of each module can serve as a storage depending on the needs of its vendor. The idea came from the fact that in real time situation one of the issues is they just throw stuff on top of the roofs so the general view is so messy. they can access to this space both from outside and inside.

In this detail we can observe the structural node connection, which is very similar to general scaffolding structures.

Also along the steel bar there are holders for the time they want to close or roll down the shadings to keep them tight.

figure66, general module details

Overall, this material and construction approach creates a flexible, low-impact, and economically viable building system that aligns with the market's self-organized spirit while providing the structural clarity and environmental performance required for its regeneration

figure67, market module isometric view

## 4.8 Master Plan and Section


figure68,69, master plan, section

## 4.9 Bird eye overview of the project

figure70, bird eye perspecive view of the whole project

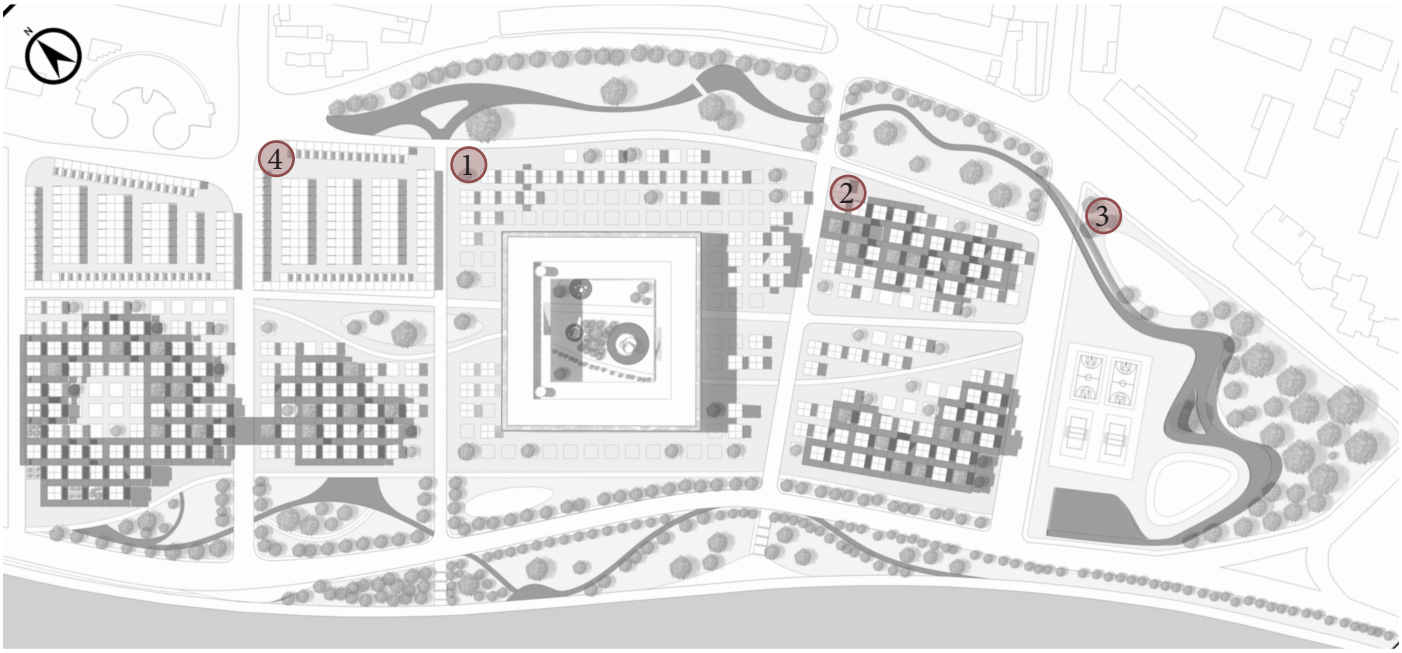



figure71, master plan with highlighted explaination points

**1- Public Plaza**

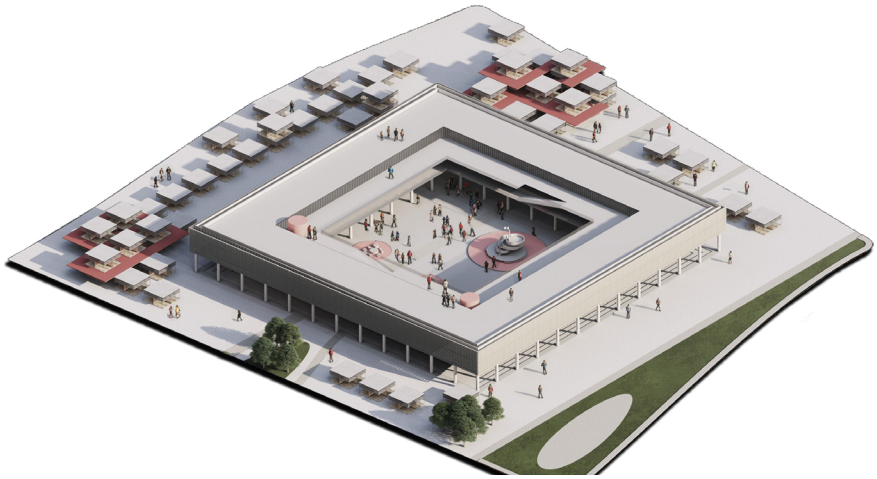


figure72, axonometric view of plaza

The multifunctional public plaza that serves as the social and spatial heart of the regenerated bazaar. Organized around a generous central courtyard, the design integrates a variety of public functions within a cohesive architectural envelope. The plaza is framed by a continuous elevated structure that provides shaded circulation and covered gathering areas, enhancing comfort and walkability throughout the space. At its core, the open courtyard accommodates flexible activities—markets, performances, communal seating, and informal gatherings—reinforced by strategically placed circular platforms that act as focal points for social interaction. Surrounding the main building, modular outdoor market units extend the commercial capacity of the plaza while maintaining visual openness and pedestrian permeability. These modules, arranged in layered clusters, continue the bazaar's characteristic informality but within a more organized and readable framework. The integration of greenery and pedestrian pathways further strengthens the plaza's role as a community destination, creating a multifunctional environment that brings together commerce, recreation, and collective life within a unified architectural proposal.

**2- Market zone**

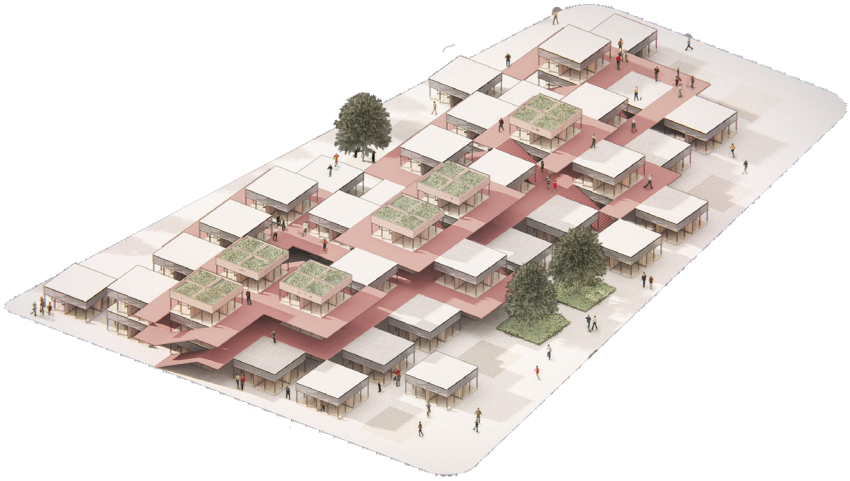


figure73, axonometric view of market zone

The modular mixed-use market proposal reinterprets the spirit of the bazaar through a more organized yet flexible architectural system. The design consists of clusters of modular units arranged across two levels, connected by a continuous elevated “red ribbon” that functions as both circulation and social platform. This ribbon creates terraces, walkways, and small gathering spots, adding vertical diversity while improving way-finding and accessibility. Integrated greenery is positioned between clusters to provide shade, environmental comfort, and softer transitions within the dense commercial fabric. Together, the modules, ribbon, and land-scape create a system that maintains the vibrancy, informality, and spontaneity of the traditional bazaar, while introducing clearer structure, improved movement, and enhanced spatial quality suitable for contemporary mixed-use needs.

**3- Park and sport fields**

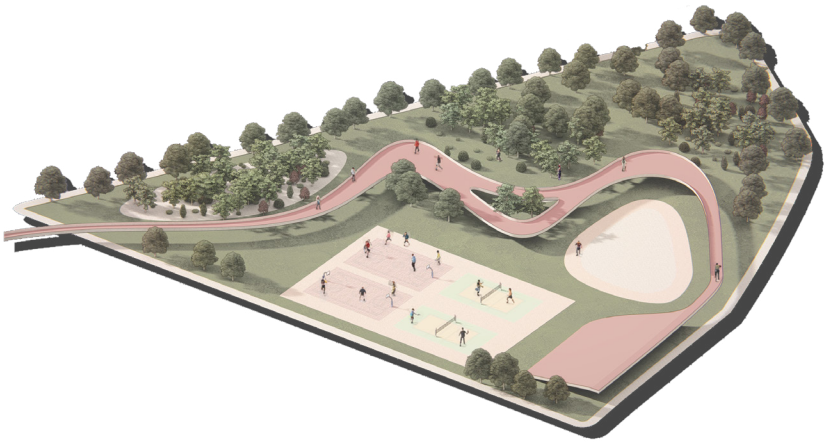


figure74, axonometric view of park and sport fields

The proposed park and sports zone functions as a key public attractor, combining greenery, recreation, and movement into a cohesive landscape. A continuous walking and running path flows through the site with soft elevations, creating engaging viewpoints and encouraging constant activity. This pathway links a series of outdoor sports facilities—basketball courts, multi-use play fields, and open exercise areas—making the park appealing for residents, visitors, and nearby students.

The abundant greenery enhances environmental quality by providing shade, improving air circulation, and reducing noise from surrounding streets. It also creates a more comfortable microclimate and strengthens the site’s ecological character. Altogether, the integration of sports, nature, and pedestrian movement transforms this area into a vibrant recreational hub that attracts people throughout the day while improving overall urban livability.

## 4- Car repair workshops and car part selling

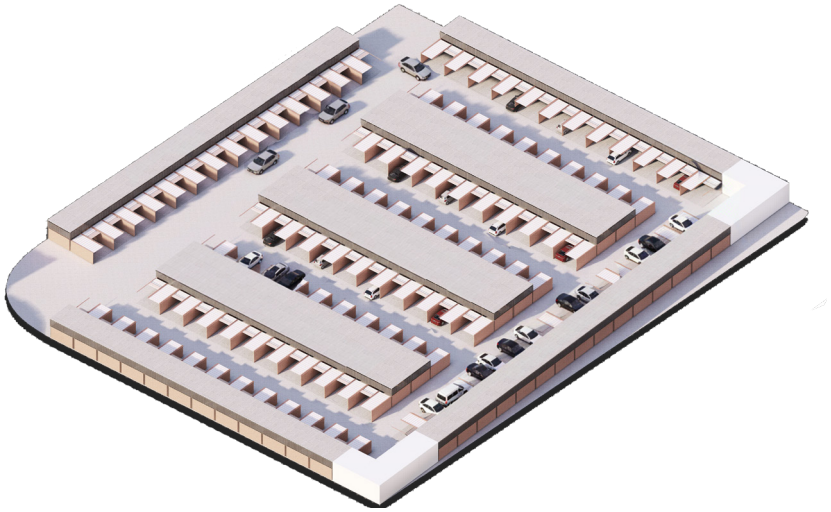


figure75, axonometric view of car mechanic zone

This illustration reimagines the automotive repair zone of the bazaar as a highly organized and purpose-built cluster of workshops, each equipped with its own dedicated garage and storage unit. The layout consolidates car-repair activities into parallel rows, allowing vehicles to enter directly into individual service bays while keeping circulation clear and efficient. By providing each shop with a private, enclosed garage, mechanics can work in safer and more controlled conditions, reducing the disorder that characterizes the existing bazaar. The addition of integrated storage areas also enables vendors to safely keep recycled or second-hand parts—an essential component of Eliava's economy—without spilling into public pathways. Overall, the design enhances operational efficiency, improves safety and accessibility, and supports the economic logic of the car-repair sector while maintaining its identity as a key component of the bazaar's ecosystem.

## 4.10 Human eye views

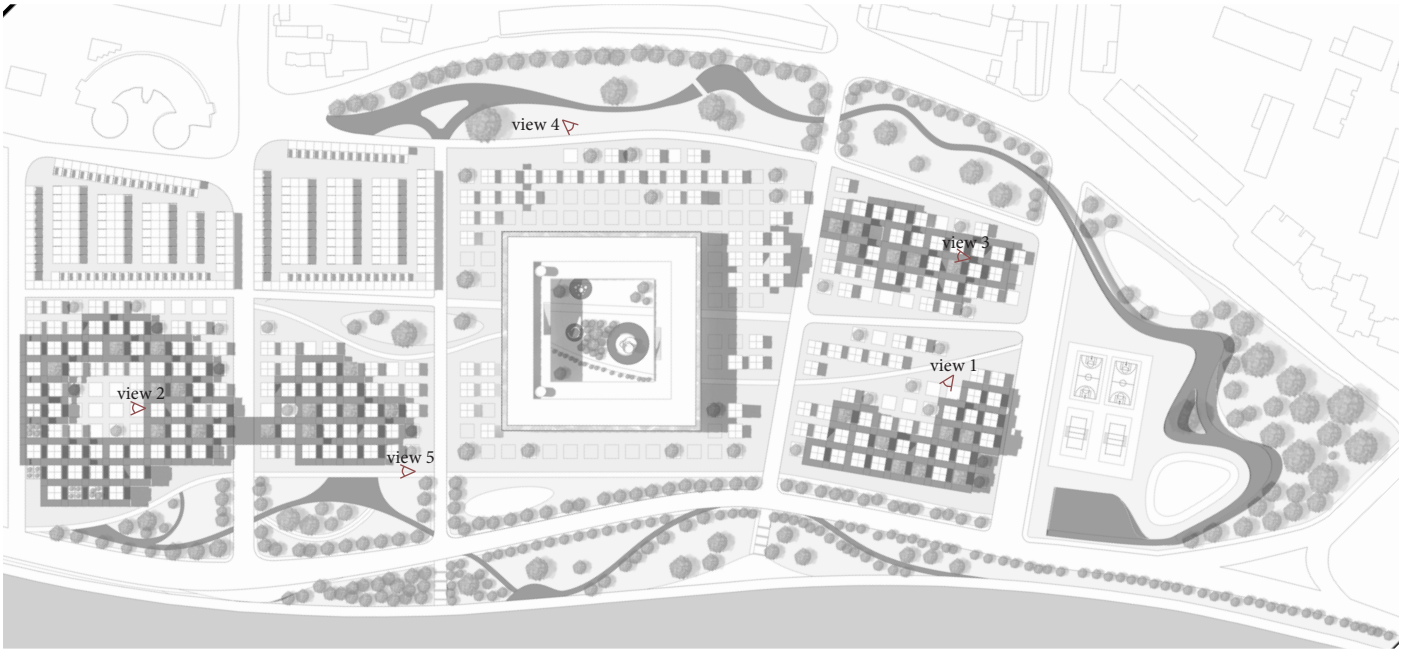



figure76, master plan with highlighted point of views

**1-**

figure77, human eye render from the market area

**2-**

figure78, human eye render from the opening inside market area

**3-**

figure79, human eye render from the closed bazaar( ground level)

**4-**

figure80, human eye render from the green path towards the bazaar

**5-**

figure81, human eye render from the side walk towards the modules

## Figures

## Figures

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