





Inside of Automated Factory

# Factory[n]Certainty

The factory that breathes with its people.

This project emerges from a simple yet radical question: Can a factory be more than a machine for production? Can it instead become an evolving cultural landscape, where work, life, and community merge fluidly, without rigid boundaries?

The project challenges the outdated notion of an industrial complex as a fixed, alienating institution. Instead, it proposes a factory that can scale up, scale down, and continually transform, reflecting the dynamic nature of culture, technology, and human need. Here, nothing is permanent. Spaces shift, modules reorganize, and the architecture adapts with time. This project reimagines the textile factory as a dynamic and human-centered environment where the traditional boundaries between work, leisure, and home dissolve.

The foundation of the design is deeply rooted in craft culture and the existing social fabric of weaving communities. The ethos of traditional textile production, including collaboration, shared courtyards, intergenerational skill transfer, and collective identity, shapes the spatial DNA of the factory.

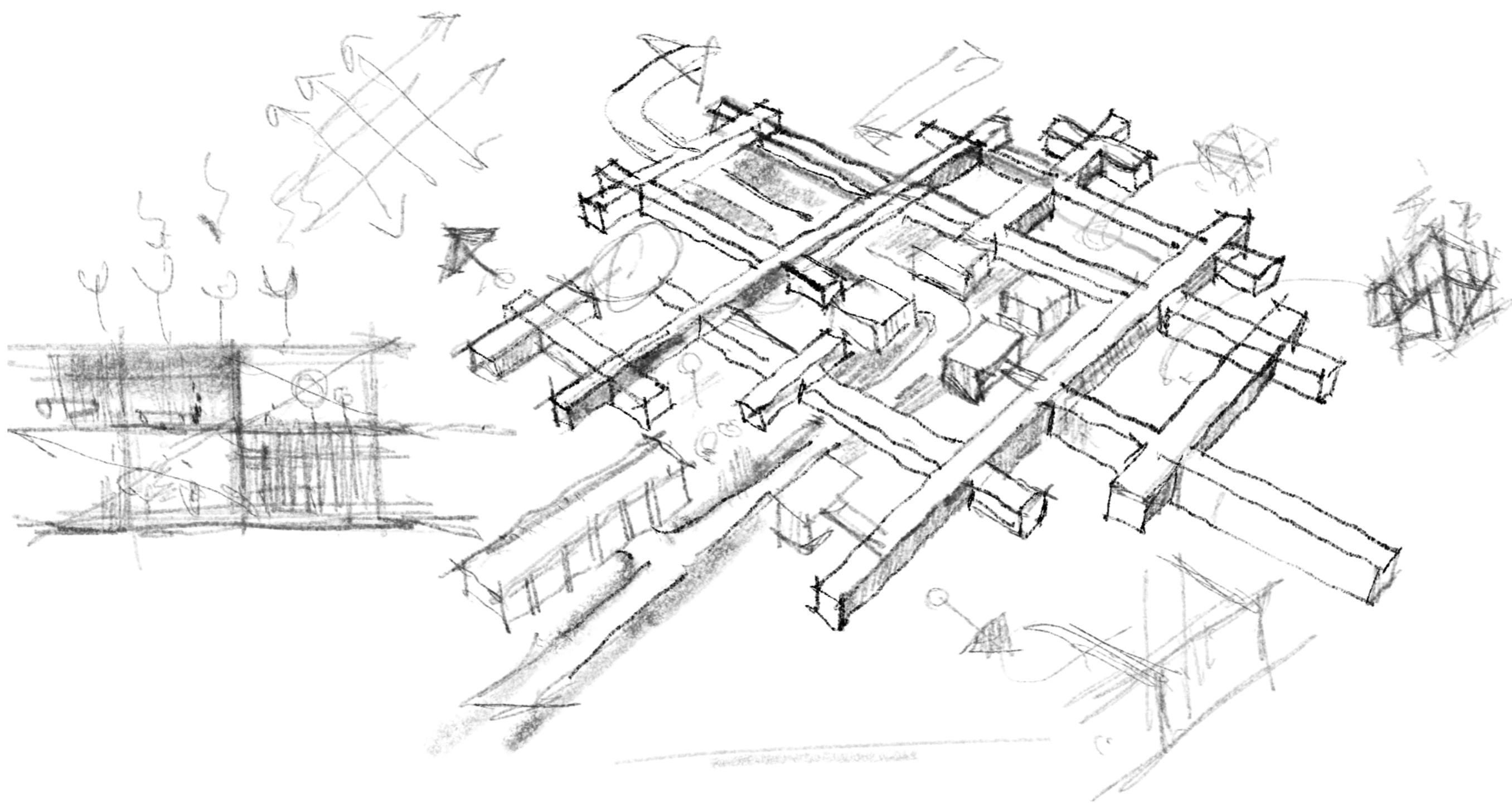
The project draws inspiration from craft theorists such as William Morris, who believed that meaningful work and humane environments are inseparable. Morris advocated for an architecture in which making, living, and socializing are intertwined. This principle is revived here, not as nostalgia, but as a forward-looking stance. The design respects the continuity of craft while embracing technological evolution, acknowledging that artisans, power-loom operators, and automated systems are not separate worlds but connected strands of the same cultural narrative. It also draws from Cedric Price's idea of adaptable, time-based architecture

and Constant Nieuwenhuys's vision of a flexible, ever-evolving spatial world shaped by human activity and creativity.

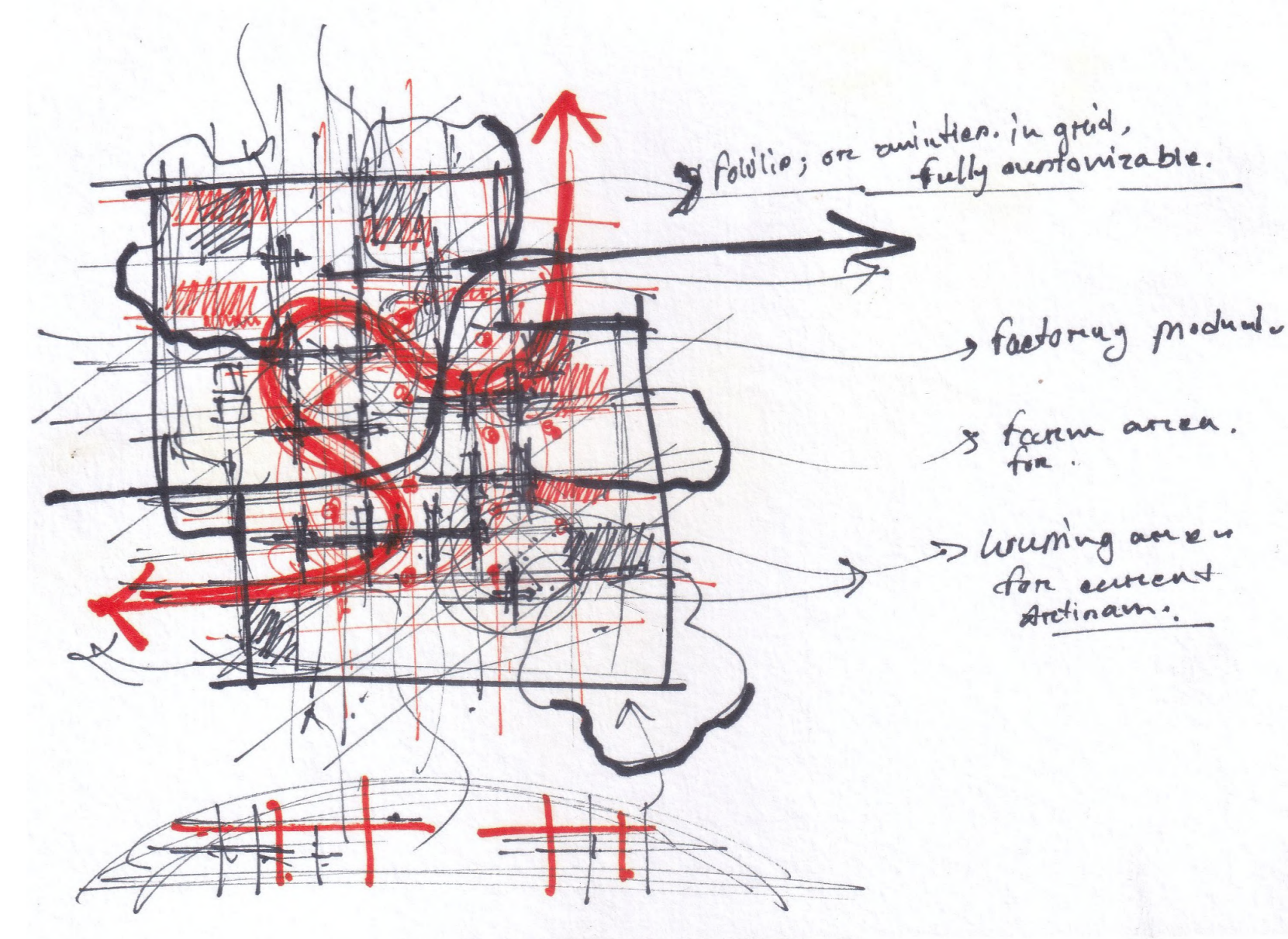
The design process began unconventionally, It did not start with a fixed form, but with theory, behavior, and environmental logic. The first step was to ground the concept in theoretical frameworks and then translate them into modular units. Each module is capable of recombining like living cells. These modules were iterated more than a thousand times, forming endless spatial possibilities. In every combination, courtyards naturally emerged as breathing voids, places of rest, exchange, and micro-climate stability. These courtyards became an essential component of the factory's identity, inspired by the way traditional weaving communities used open spaces for dyeing, drying, weaving support activities, and social gathering.

Courtyard fragments-pavilions, shaded decks, and cultural nodes activate communal life, while AR/VR and an Unreal Engine-based community game enable exploration and future adaptation.

“Ultimately, the project proposes a future factory as a living organism: adaptable, socially connected, and deeply human.”



conceptual sketch



## Challenges in Factory[n]Certainty

01



### The rapid rise of AI and automation is reshaping the global textile industry.

Automation is creating uncertainty for Bangladesh's RMG workforce, which employs over 4 million people, nearly 60 percent of whom are women. Studies suggest that 60 to 70 percent of repetitive production tasks could be automated through robotics and AI. For a sector contributing around 11 percent of GDP and over 80 percent of export earnings, this transition presents both opportunity and risk.

02



### Generational Shift.

Despite the craft receiving recognition as an intangible cultural heritage, low wages and physically demanding work are pushing younger generations away from the ancestral trade. The number of handlooms and active weavers in the Tangail region has dropped by over two thirds compared to the 1990s as artisans are forced to switch professions.

03



### Preserving heritage Craft

Bangladesh's Tangail saree fought a long way into global recognition through a story of migration, memory, craft, and cultural ownership. On December 9, 2024 UNESCO announced that Tangail's traditional handloom weaving had been added to the Intangible Cultural Heritage of Humanity list. Preserving their craft was one of the greatest challenge in age of automation.

04



### Grueling, Unsafe Working Environments

Weavers endure long, physically taxing hours hunched over traditional manual looms to hit production quotas, which often leads to severe back, joint, and vision problems. The localized workshops frequently lack proper ventilation, adequate lighting, and ergonomic setups, directly endangering the health and safety of the artisans over time.

05



### Spatial Belonging

Courtyard as social core of traditional weaver households — shade, gathering, ventilation, drying. The factory had no wall from the street nor any definite boundary wall. New factory should have those characteristics.

# Story



I still remember the factory from my childhood. There was no boundary wall. It wasn't separate from us - it was part of our neighborhood, part of our life. My father used to take me there, and I would watch the colors of the threads move through the looms like flowing rivers. The sounds, the rhythm, the people it all felt alive. The factory wasn't just a workplace. It was family.

### Years passed. The world changed...

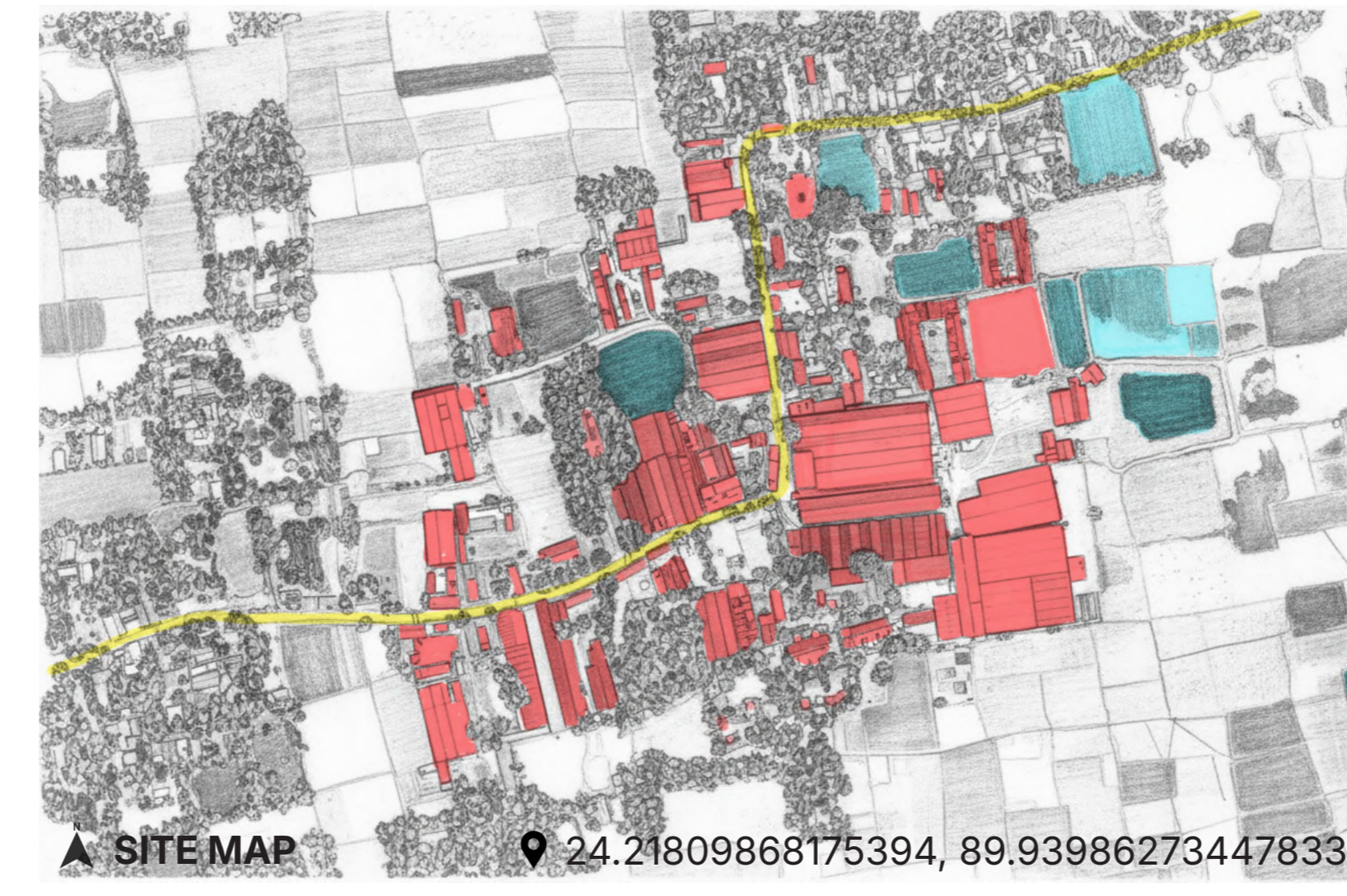
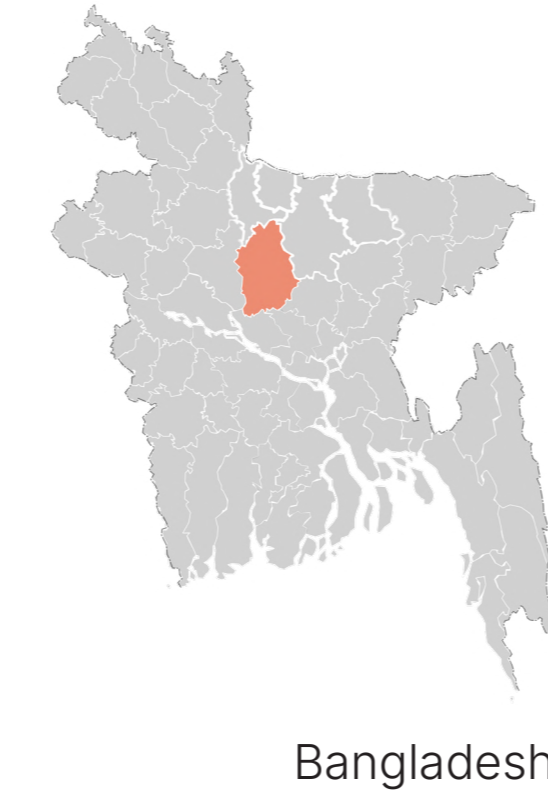
One day I saw the headlines: AI. Robots. Automation taking over. The market demanding faster delivery, fewer hands. People whispered that our hands could no longer compete. I saw the worry in the workers' faces. If machines take over, what will happen to them? If weaving is our life, what happens when the loom no longer needs us?

### I couldn't accept that the story would end there...

So I searched for answers - not for profit, but for people. I began to imagine something different. What if technology didn't replace workers... but uplifted them? What if machines carried the burden of repetition, while humans focused on creativity, care, and connection? Factories have always changed. Tools evolve. Play evolves. Work evolves. But humanity - our curiosity, our collaboration, our imagination that must remain.

*"The future of the factory is not a battle between humans and machines. It is a dialogue. And in that dialogue, humanity must remain our strongest technology."*

# Site



Site : Tangail, Bangladesh  
Position : 24.21809868175394 N, 89.93986273447833 E

Tangail's rich handloom heritage is globally celebrated. The traditional weaving of the Tangail saree was officially recognized by UNESCO as an Intangible Cultural Heritage of Humanity. The site is a semi-rural textile production cluster located along a primary road spine (highlighted in yellow), with dense factory sheds (red) embedded directly within the village fabric. There is no strict zoning-industrial buildings, artisan homes, ponds (blue), and agricultural fields coexist organically. The factory complex has grown incrementally, creating a tight network of narrow internal paths and mixed-use edges. Current conditions show aging industrial sheds with low environmental performance and informal artisan workspaces integrated into residential areas. The spatial pattern reflects an unplanned yet socially connected ecosystem where production, living, and community life overlap without clear boundaries.

## Current scenario of factory



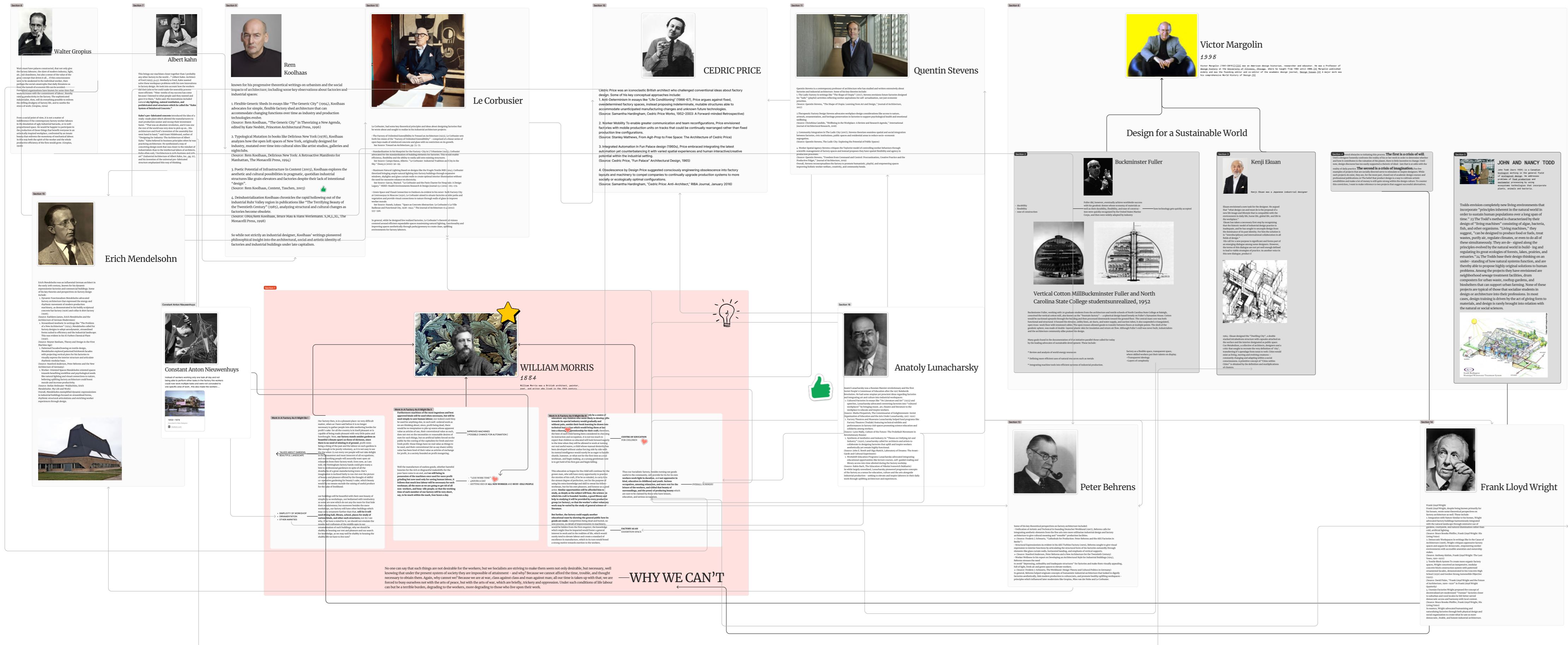
The existing factory environment reflects the conventional industrial model, characterized by overcrowded production floors. Workspaces are densely packed, leaving little room for movement, flexibility, or future adaptation. Poor daylight penetration and inadequate ventilation.

## Current scenario of artisans

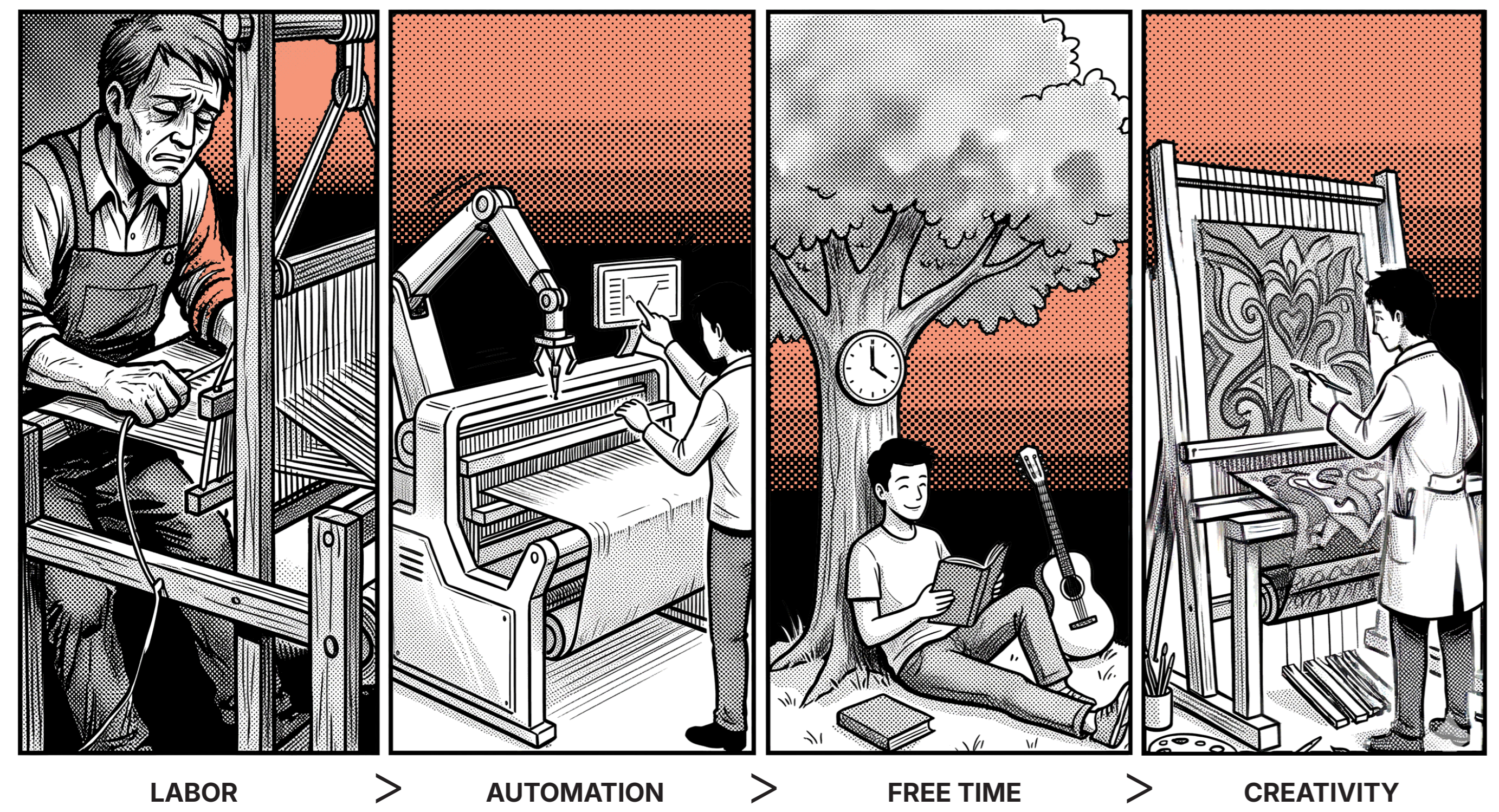
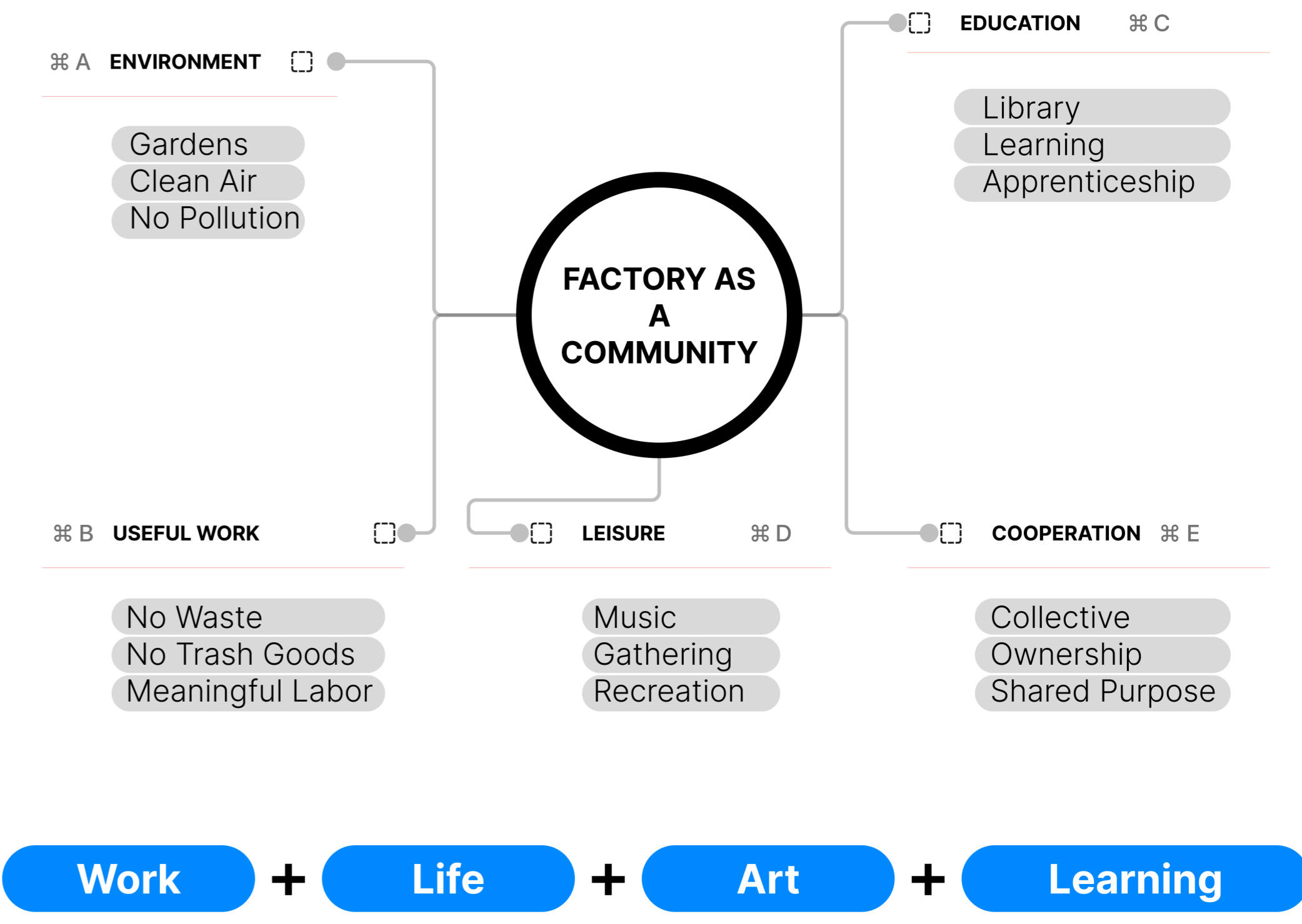


The current condition of artisans reflects the integration of work and daily life within modest home-based settings, shaped by limited infrastructure and informal workspaces. Despite these challenges, strong social bonds and intergenerational knowledge continue to sustain their craft and community.

# Mapping of theories



## SUMMARY OF ALL THEORIES

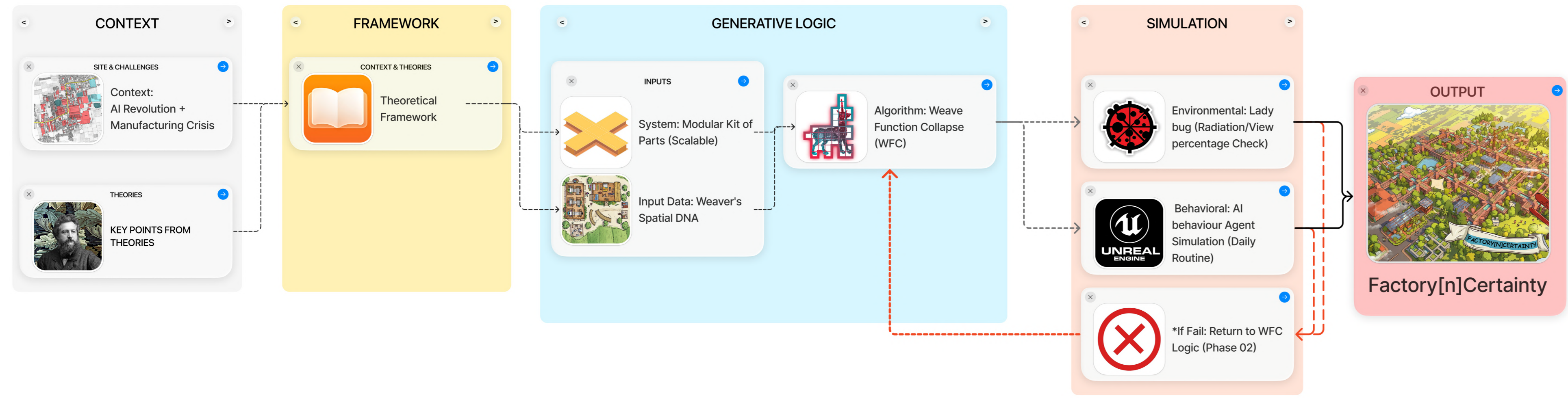


"The ideas of William Morris, Cedric Price, and Constant Nieuwenhuys collectively challenge conventional notions of industrial production and architecture. Morris envisioned a factory where work, beauty, nature, and community coexist, restoring dignity and creativity to labor. Price argued that architecture should not be static but adaptable, enabling people and activities to evolve over time. Constant extended this vision further, imagining a society liberated from repetitive work through automation, where creativity, play, and collective imagination become central to daily life. Together, their theories suggest a future in which factories are no longer isolated machines of production but dynamic cultural landscapes that integrate work, leisure, learning, and social interaction."

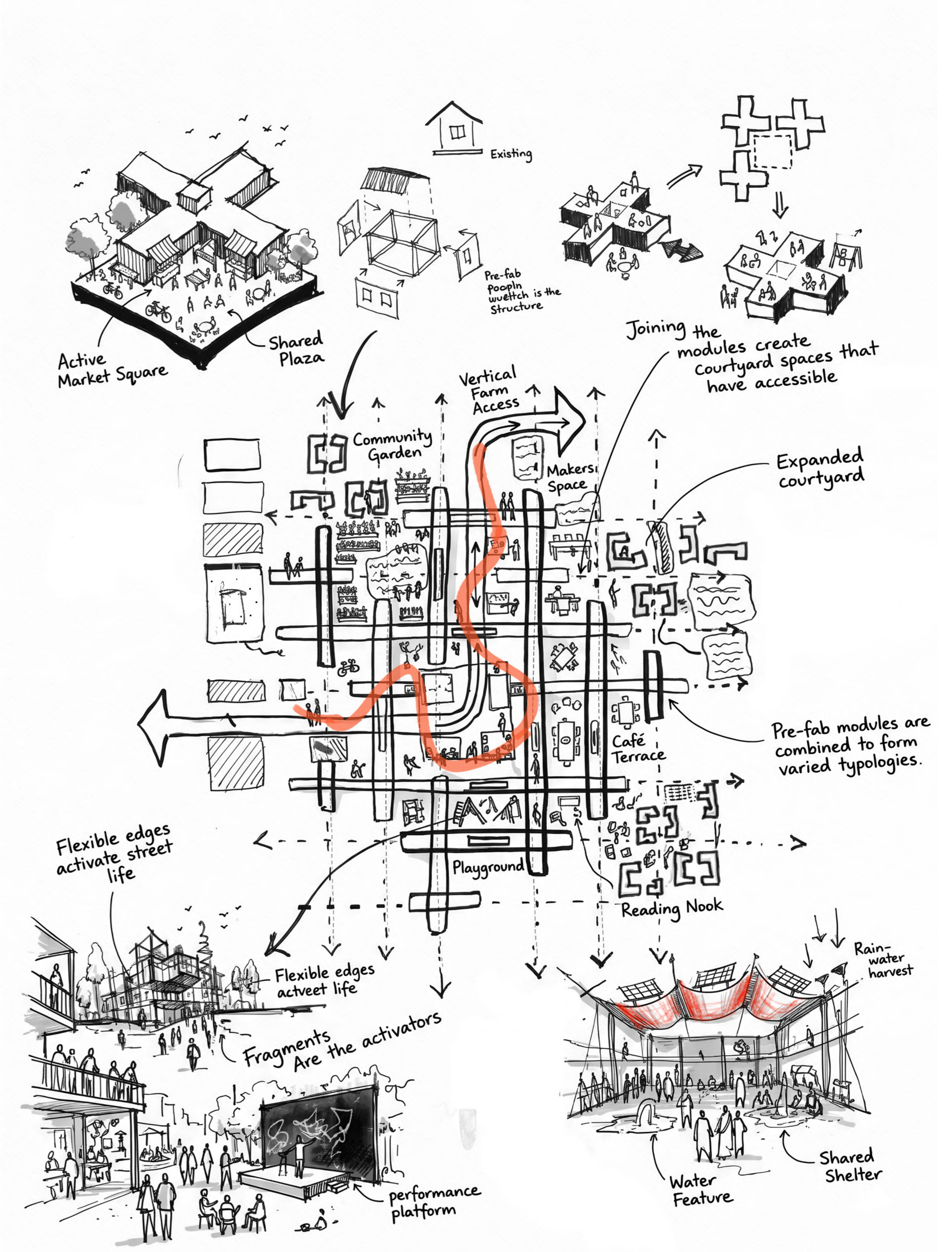
# CONCEPT



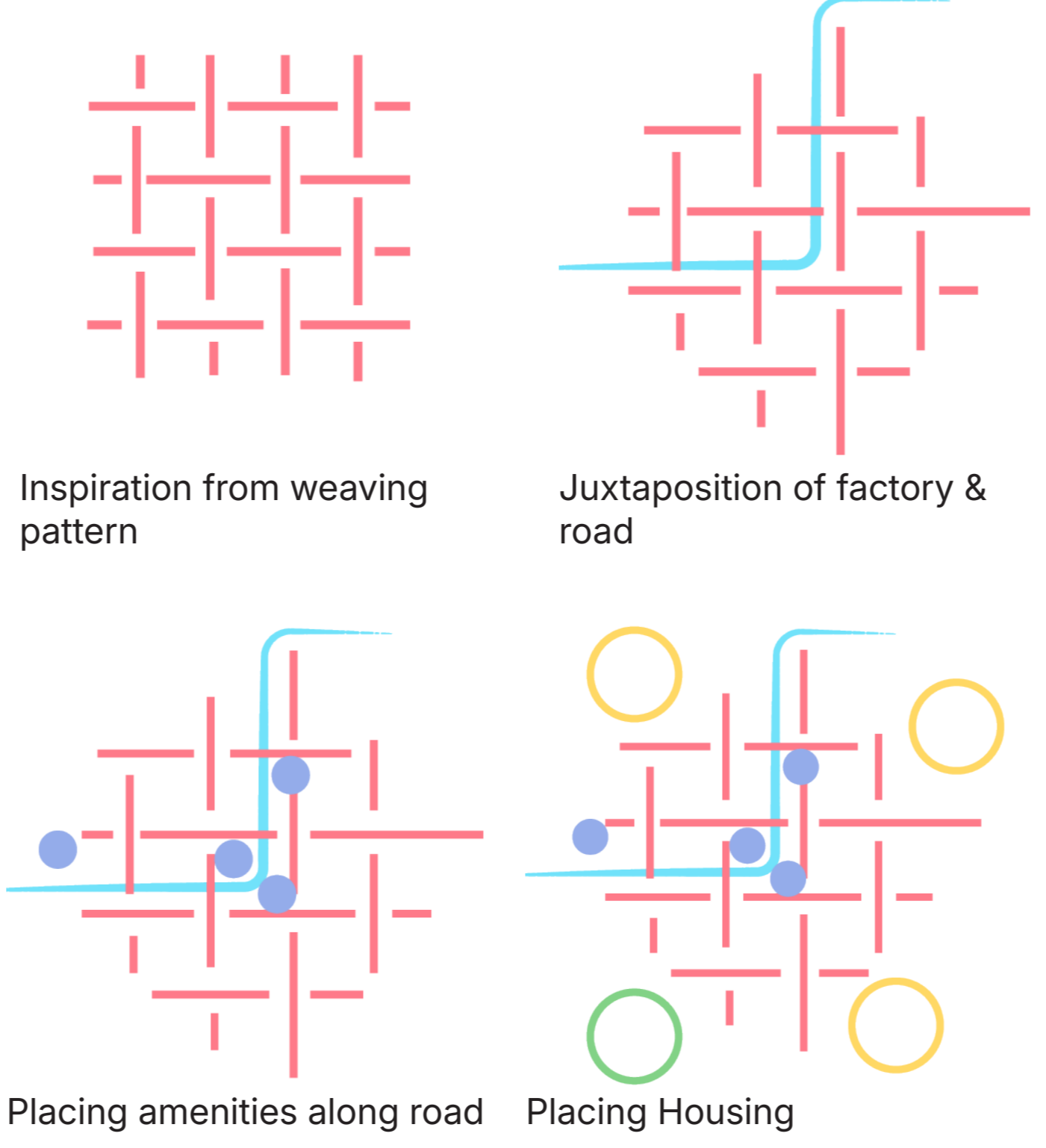
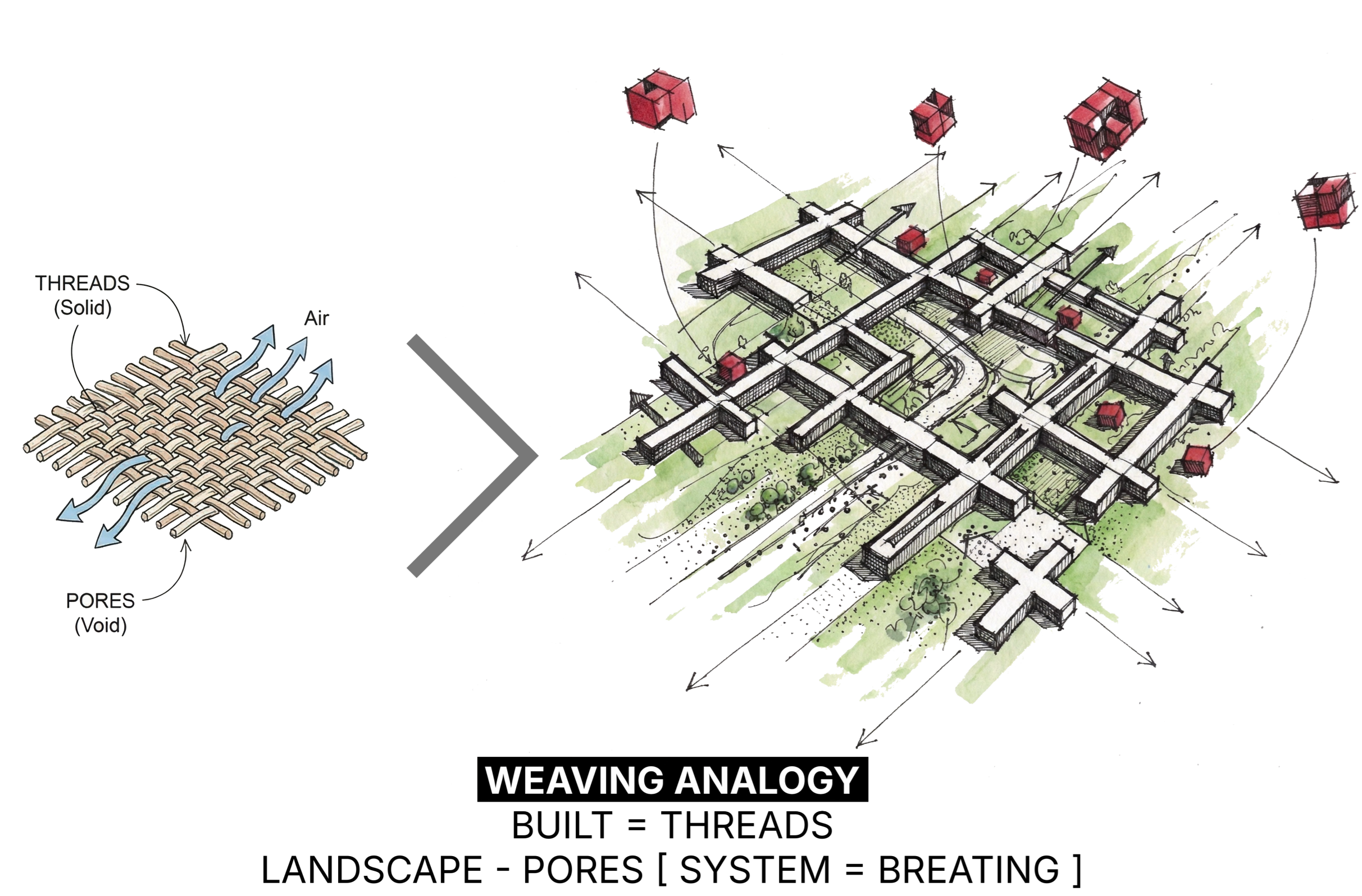
# Design Process



# Ideation sketches

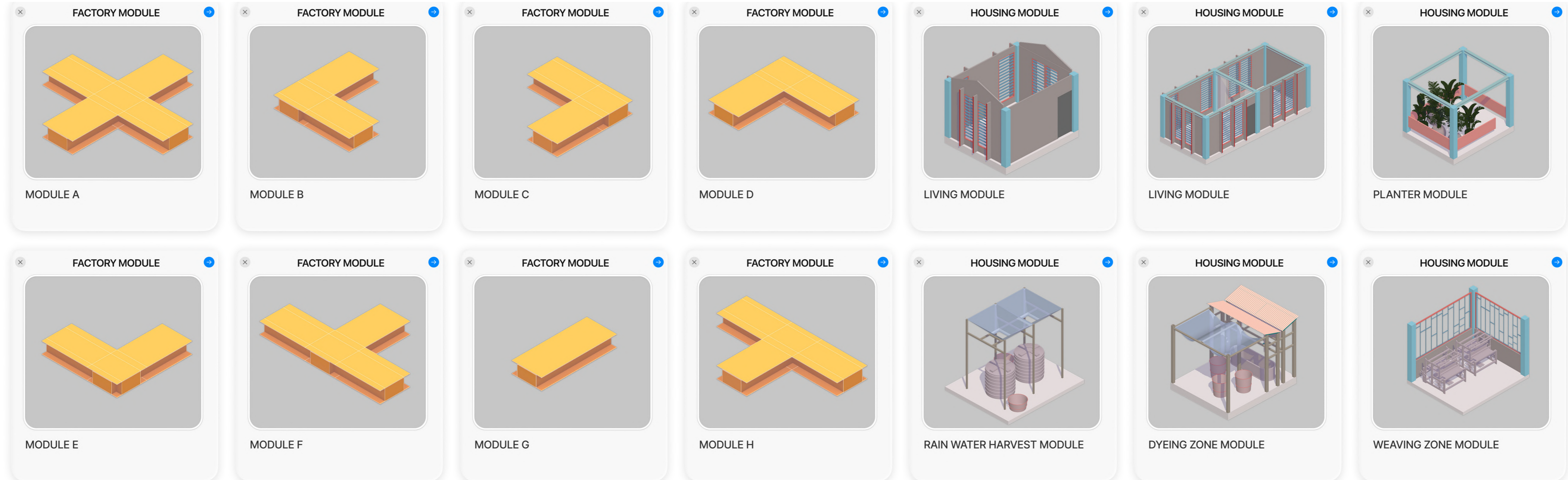


# Design Concept

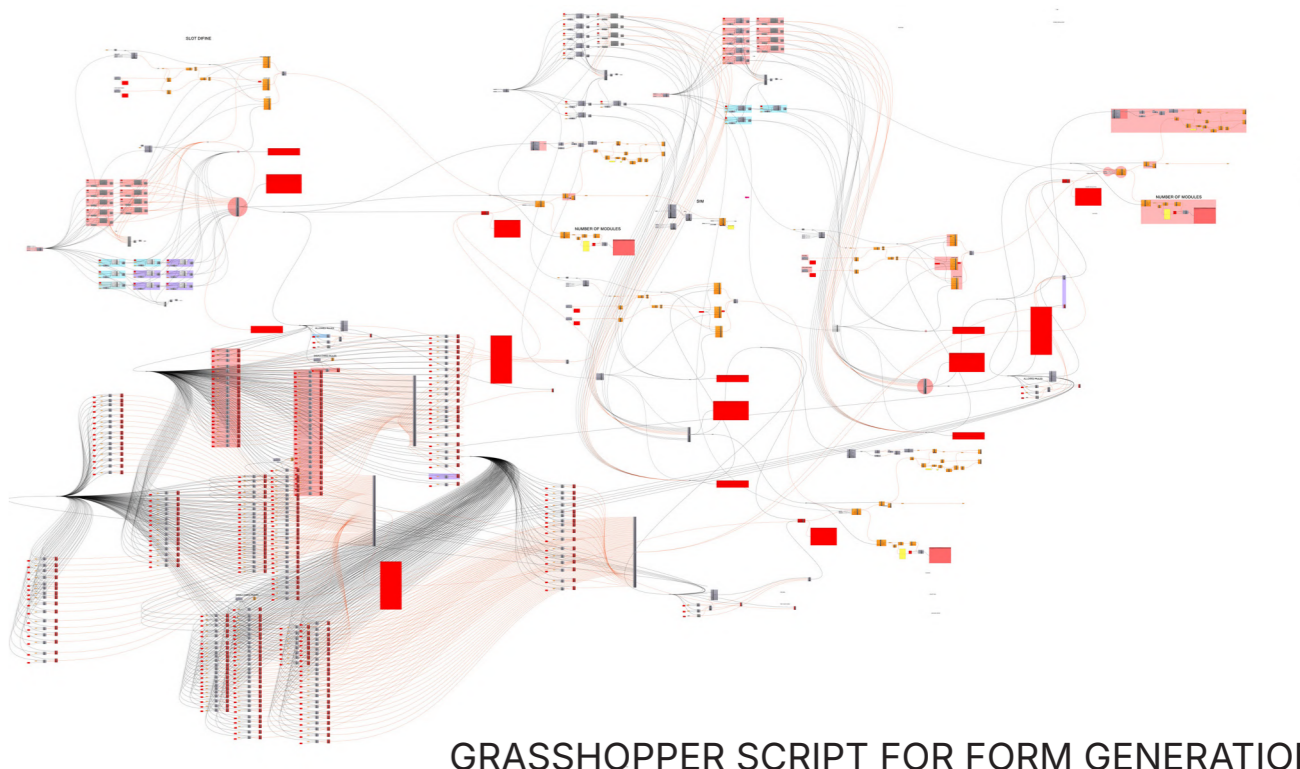
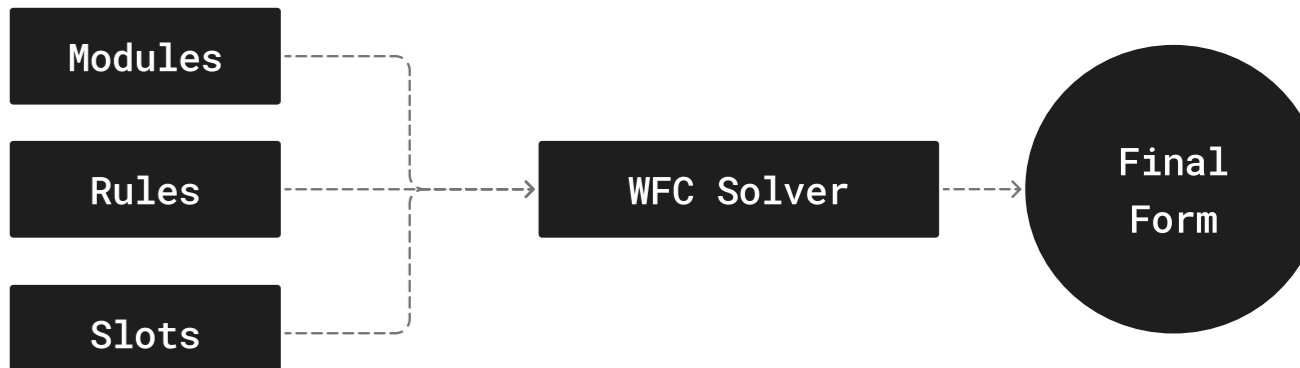


# Not a Building, but an Organism

Environmental performance became a primary design driver. Using Ladybug radiation analysis, all modular arrangements were tested to ensure thermal comfort and reduced heat gain, which are critical factors for large industrial floors. From over a thousand simulations, twenty-five low-radiation iterations were shortlisted. Environmental logic alone, however, was not sufficient.



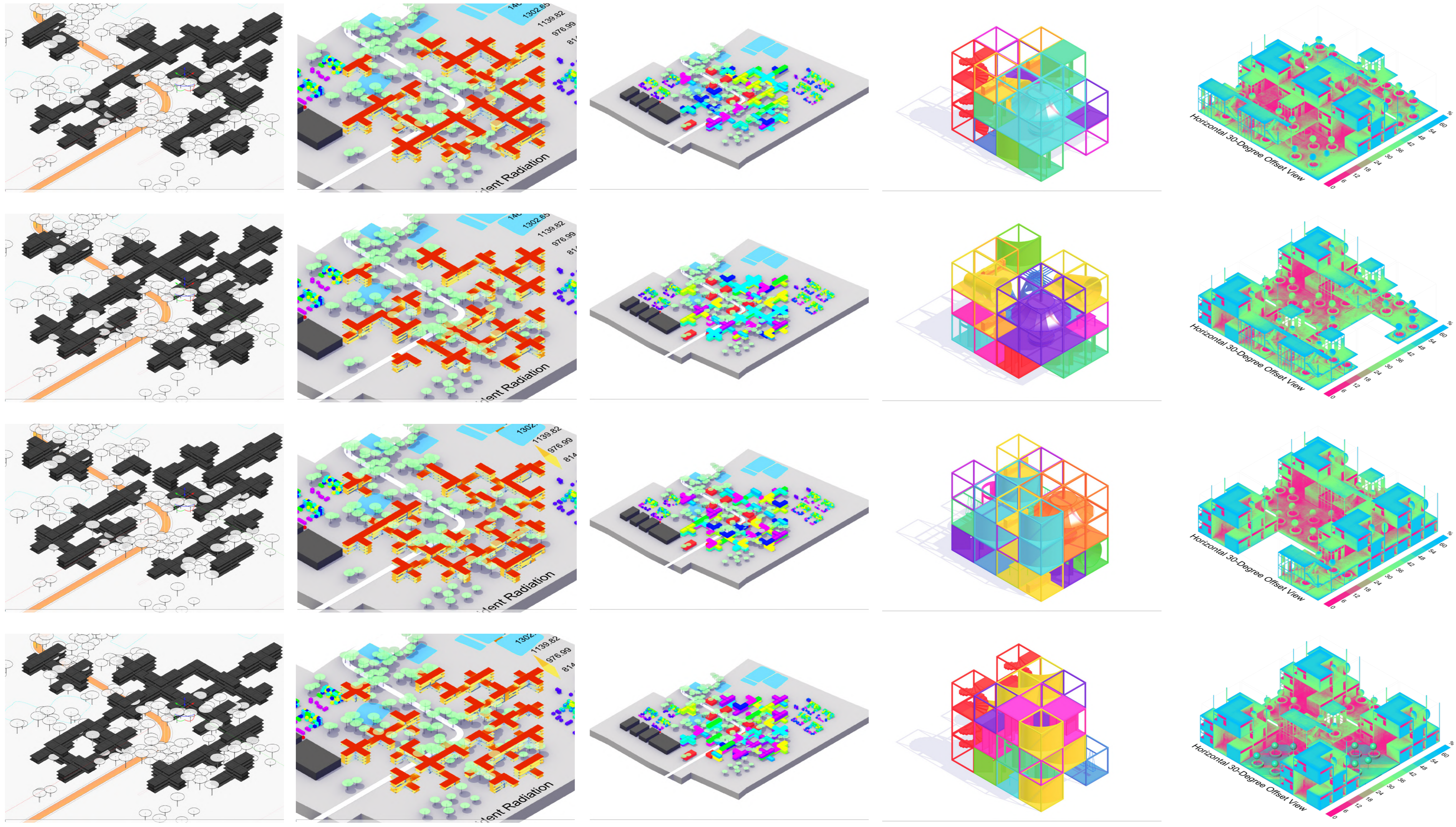
The "code" for the factory is derived from the "code" of the weavers' daily lives. The algorithm generates forms that feel familiar, ensuring the spatial configuration matches how the community naturally



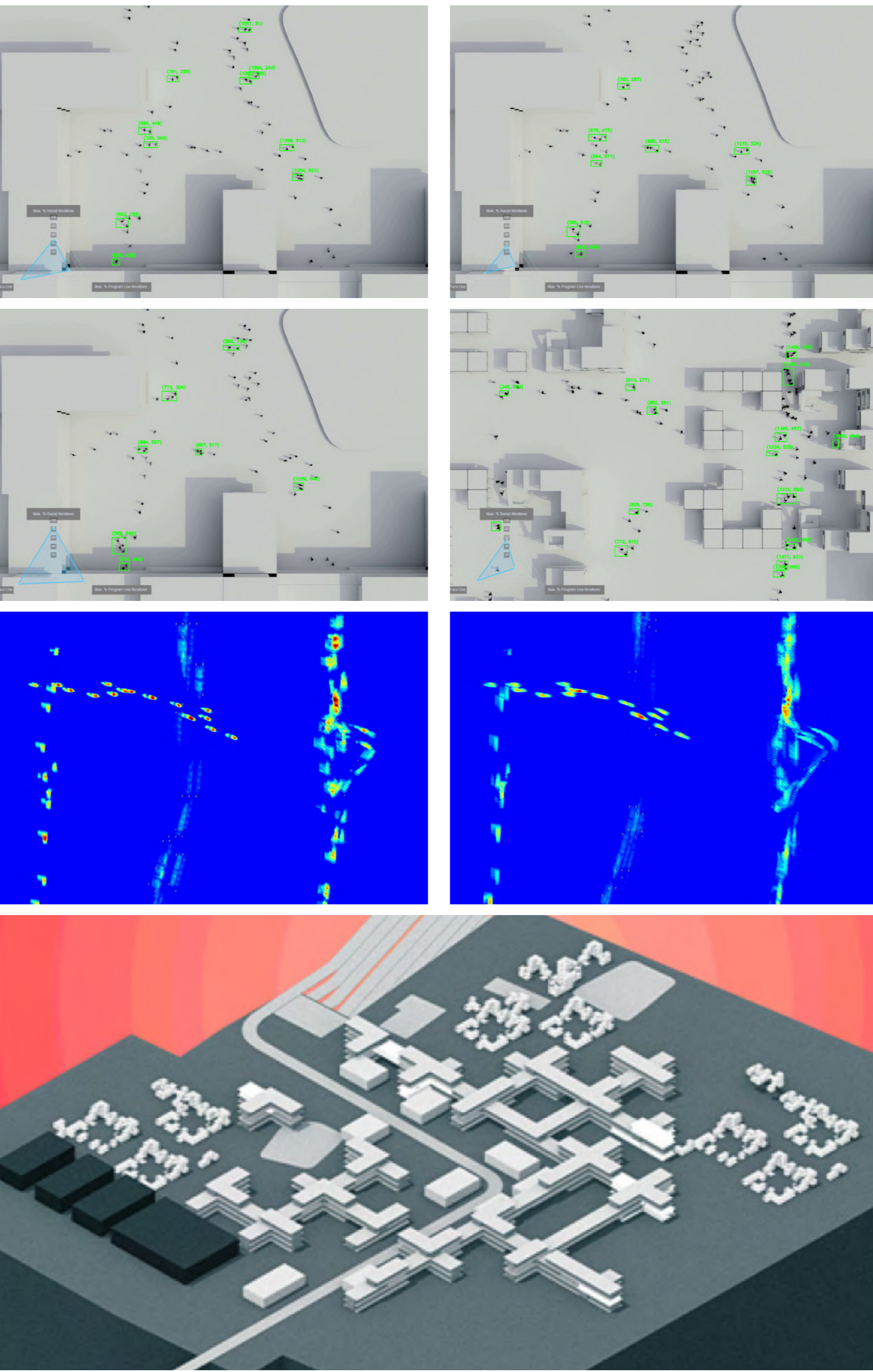
GRASSHOPPER SCRIPT FOR FORM GENERATION

To integrate human behavior into the design, the project employed AI-driven virtual agents inside Unreal Engine. These AI agents were crafted with diverse daily schedules representing handloom weavers, power-loom workers, and fully automated system supervisors. Each Agents performed activities such as working, resting, chatting, commuting, sleeping, and eating. This allowed the design to be tested socially, not just environmentally. Their movement patterns revealed how courtyards acted as social condensers, how proximity between work and housing influenced rest cycles, and how circulation was shaped by rhythms of production.

Through this rigorous process, the final iteration, identified as Iteration 542, emerged as the optimal configuration. It aligned around climate-responsive courtyards, and balanced between housing on the east and work modules on the west.



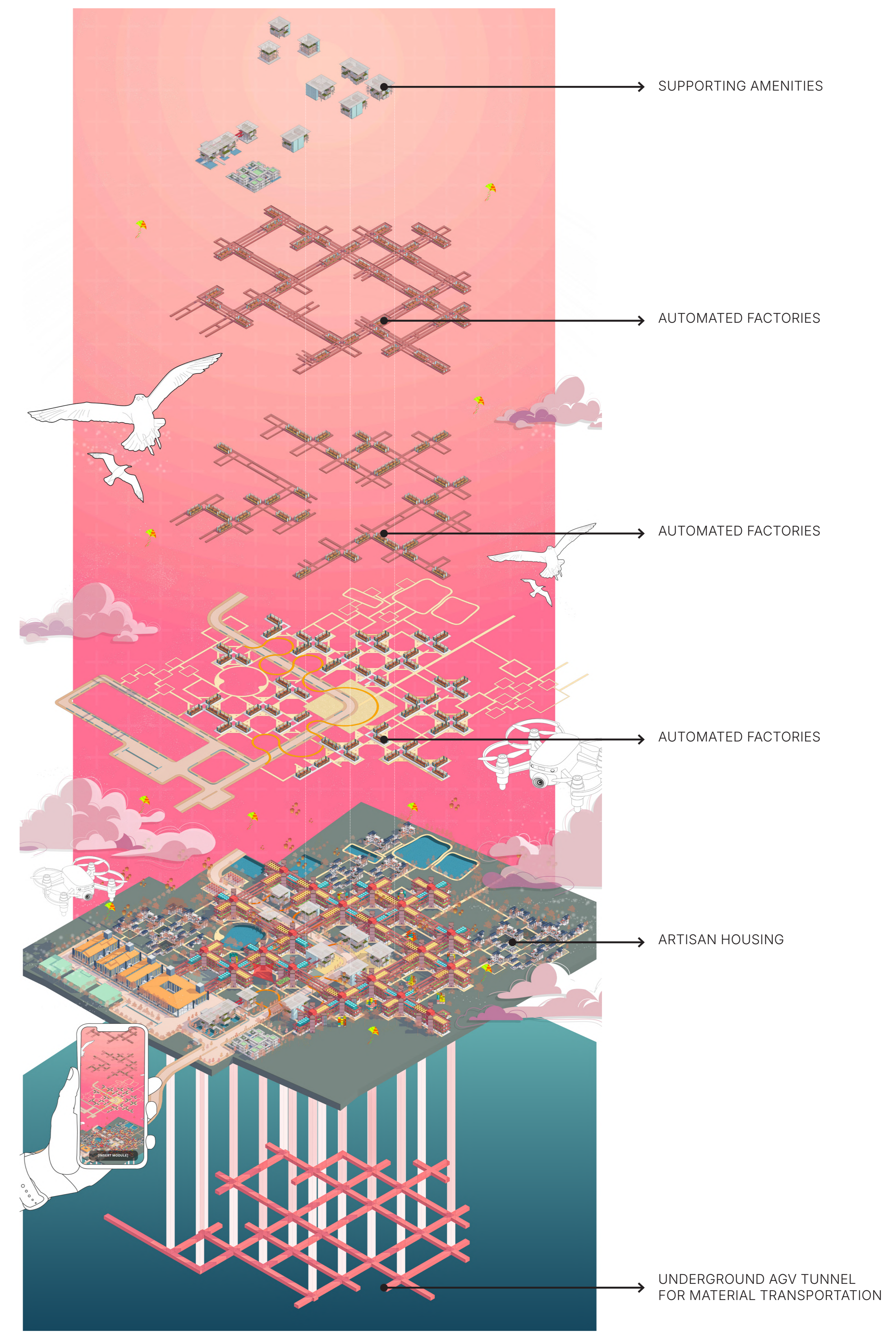
FACTORY ITERATIONS      RADIATION ANALYSE      MASTERPLAN ITERATIONS      FRAGMENTS ITERATIONS      HOUSING ITERATIONS





**MASTER PLAN**

- |                     |                    |
|---------------------|--------------------|
| 1. LOGISTICS CENTER | 6. RESTUREANT      |
| 2. WRAPING SHEDS    | 7. CLINIC          |
| 3. ADMIN AND R&D    | 8. WEAVER'S MARKET |
| 4. TRAINING CENTER  | 9. BAZAR           |
|                     | 10. CENTRAL PLAZA  |

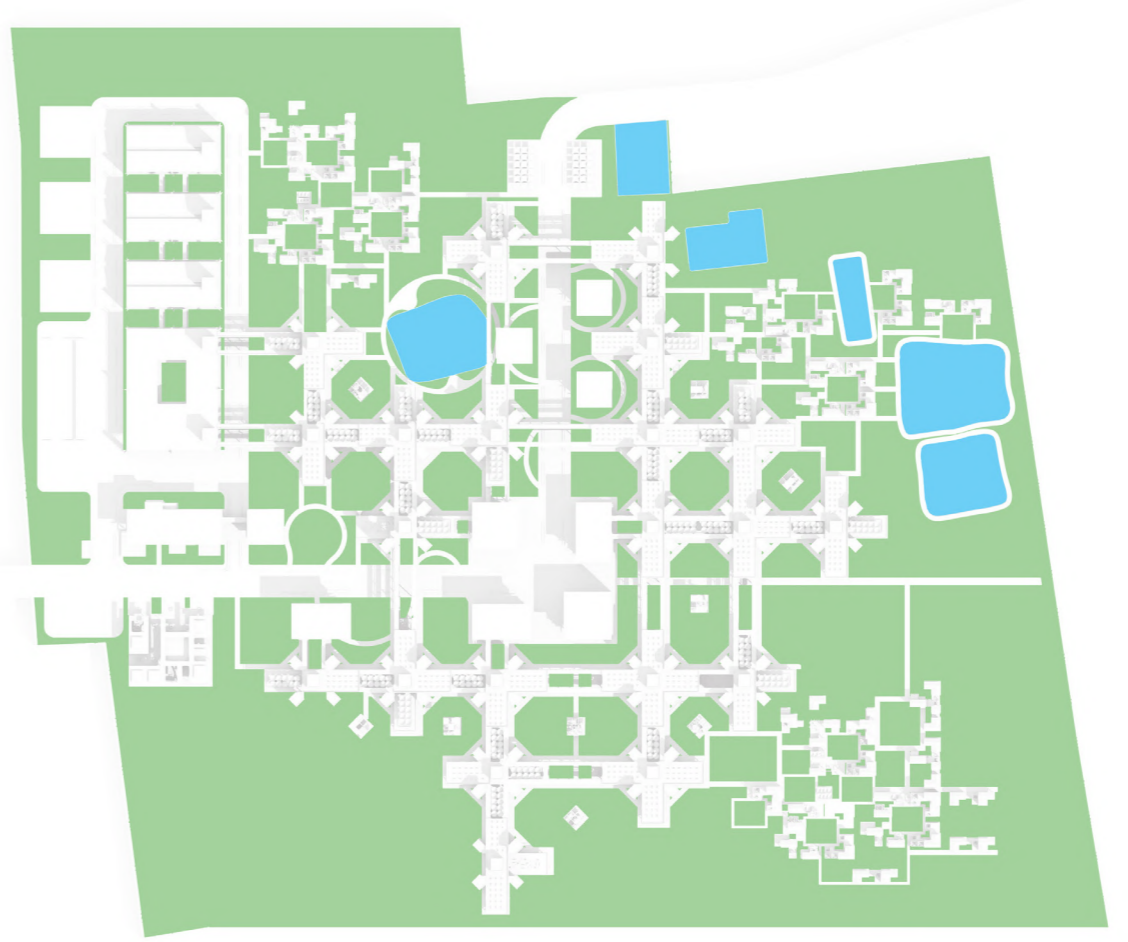


- SUPPORTING AMENITIES
- AUTOMATED FACTORIES
- AUTOMATED FACTORIES
- AUTOMATED FACTORIES
- ARTISAN HOUSING
- UNDERGROUND AGV TUNNEL FOR MATERIAL TRANSPORTATION

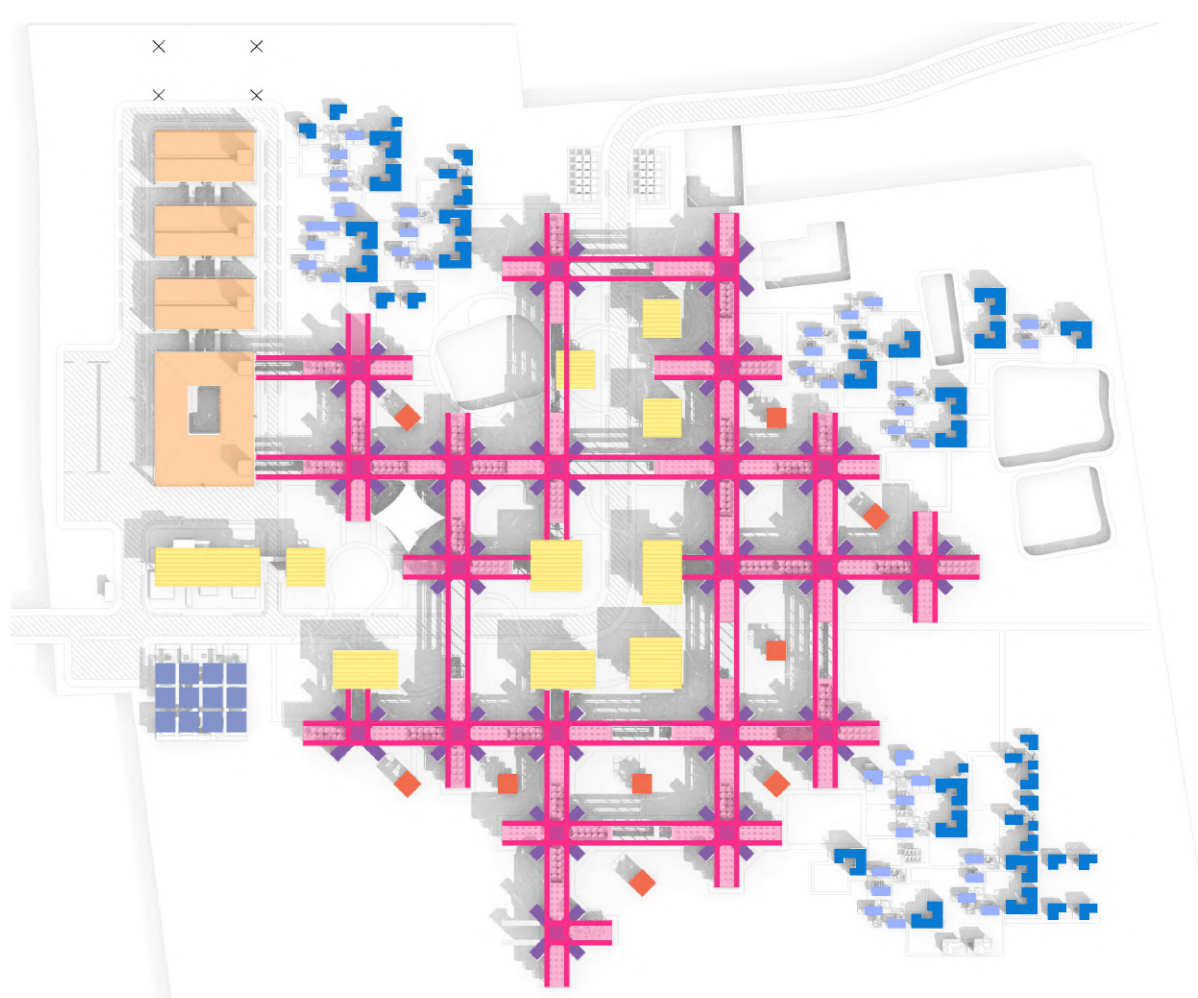
# ACTIVITIES IN THE COURTYARD



Preserving order through clear zoning, the masterplan organizes production, living, recreation, and communal functions into a coherent spatial framework while maintaining strong connections between them. Rooted in traditional artisan housing, the courtyard is placed at the center of the design and honored as a timeless space of informal activity, social exchange, and cultural continuity. More than an open void, it functions as the social heart of the community, where daily life unfolds through gathering, learning, storytelling, craft-making, and celebration. These shared spaces encourage interaction between workers, families, artisans, and visitors, fostering a sense of belonging and collective identity.

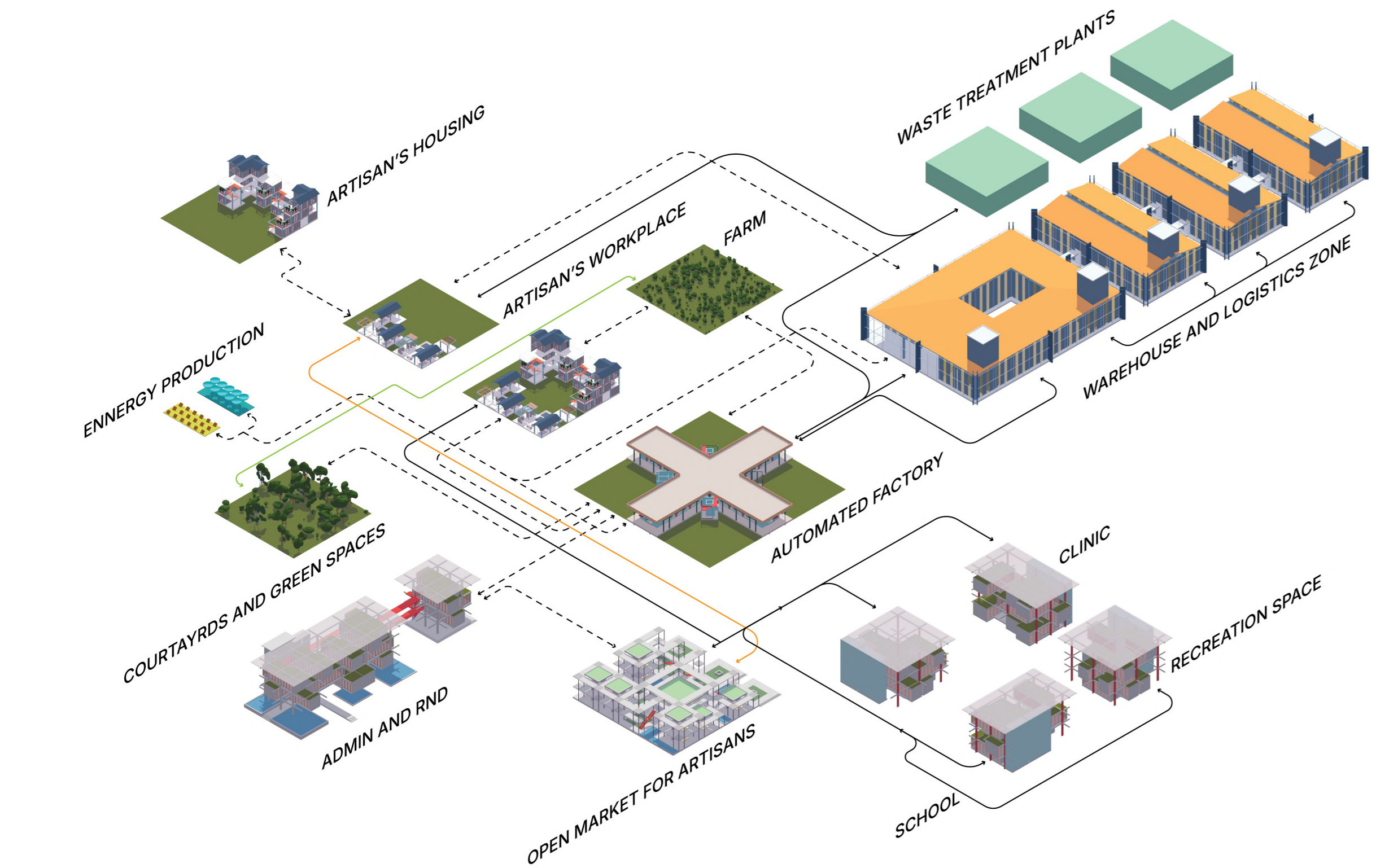


SURFACE GREEN 84%

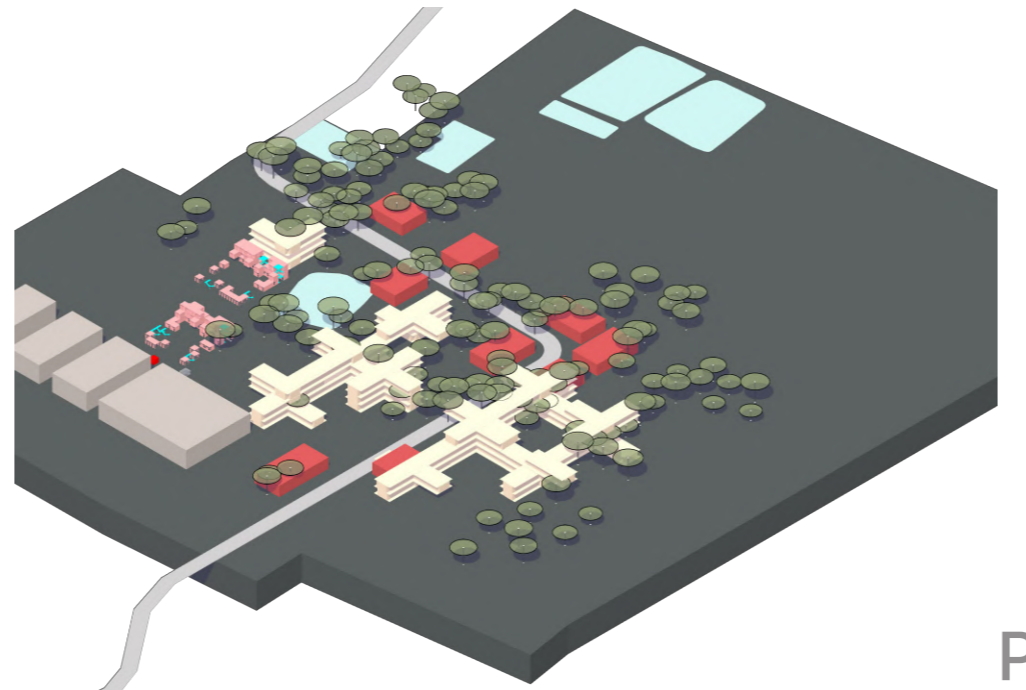


FUNCTIONS

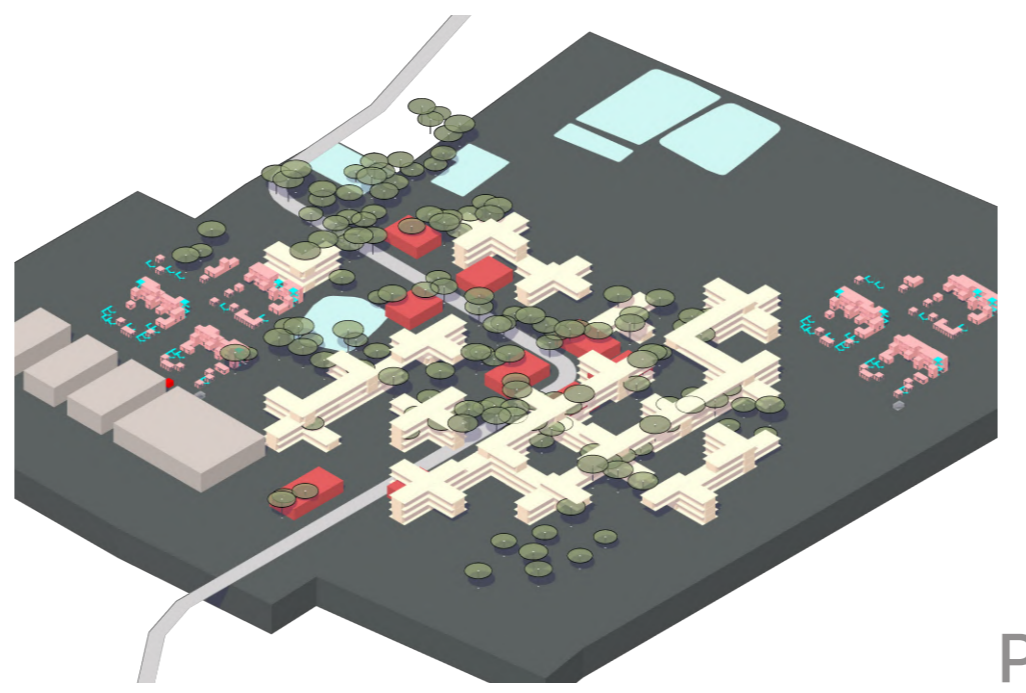
- Weaving zones
- Corridors
- Open market
- Central Core
- Amenities
- Warehouse & Logistics
- Artisan's living space
- Artisan's work space
- Fragments



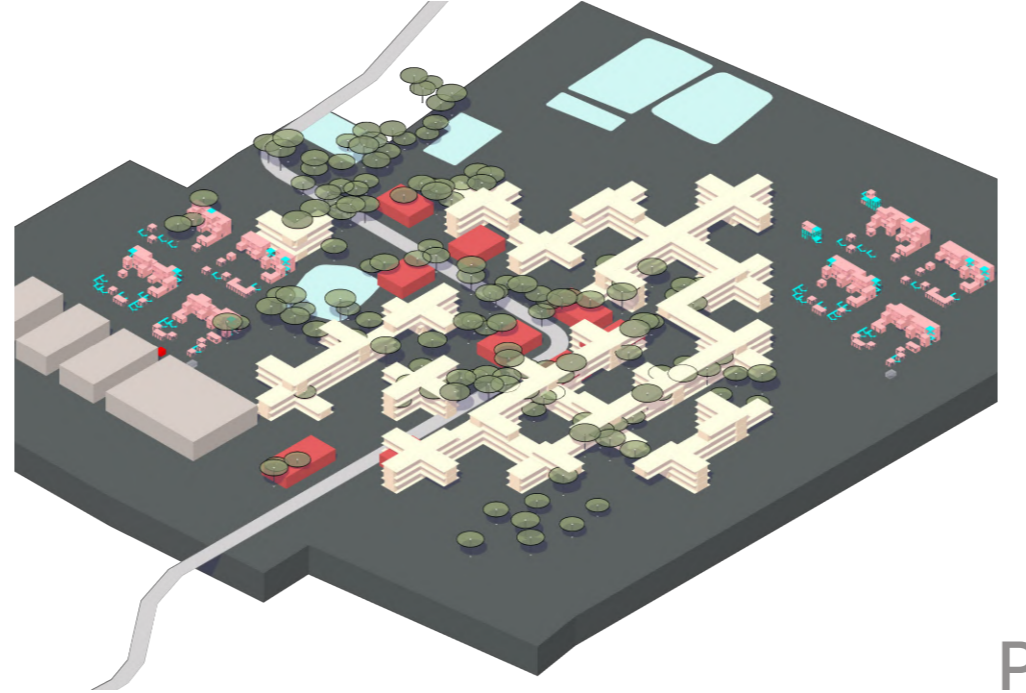
# ECOLOGICAL INTERDEPENDENCE



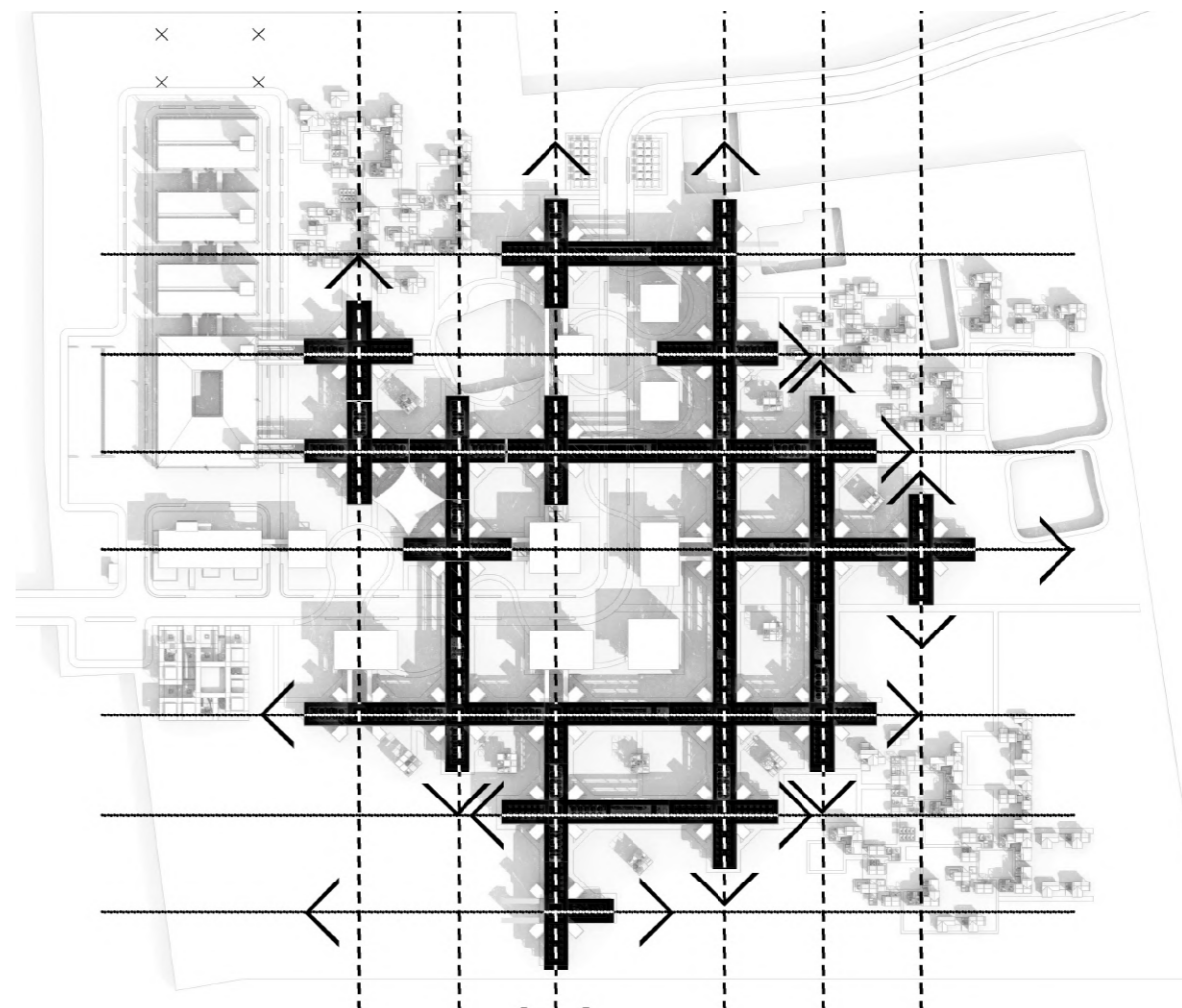
PHASE 1



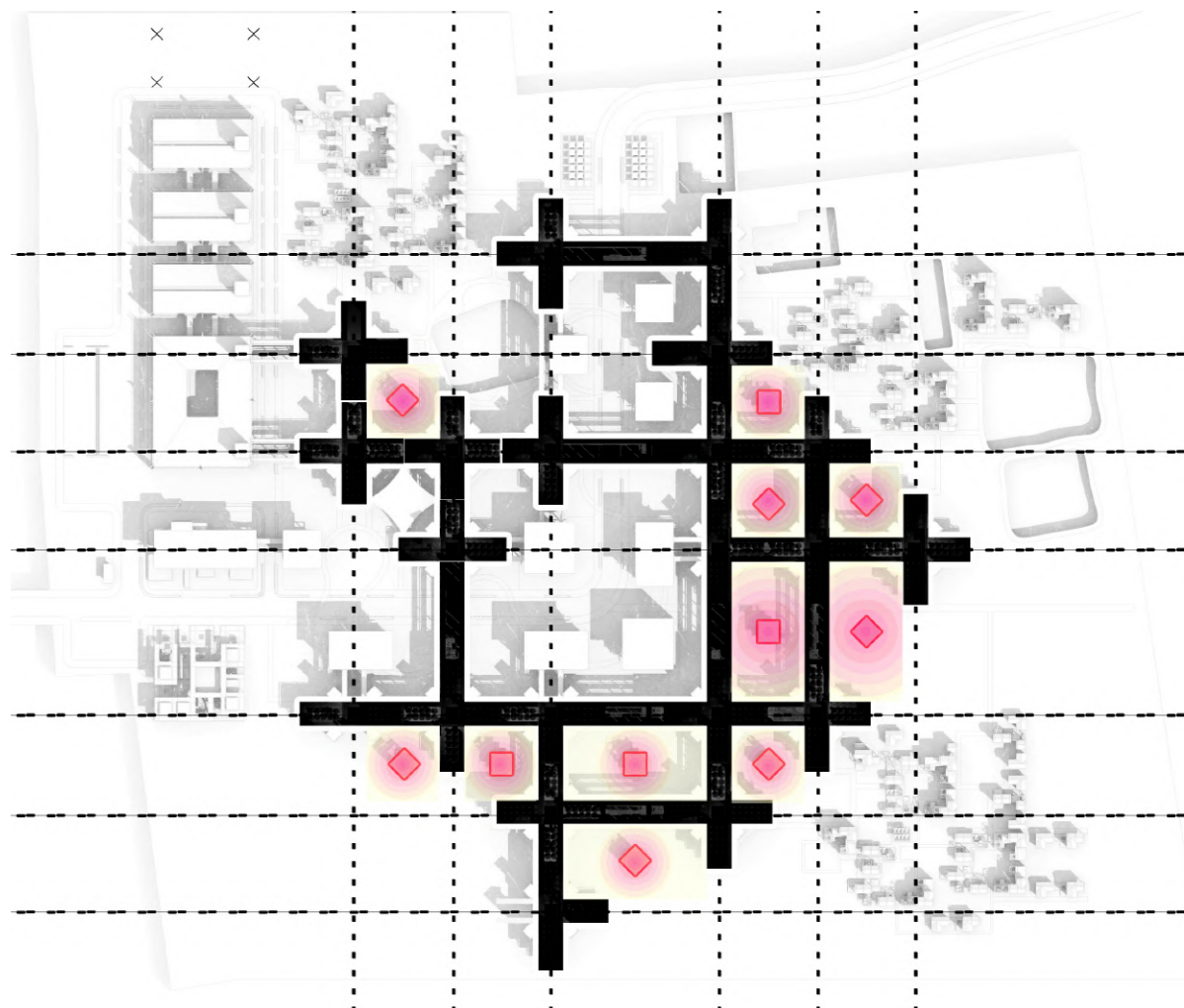
PHASE 2



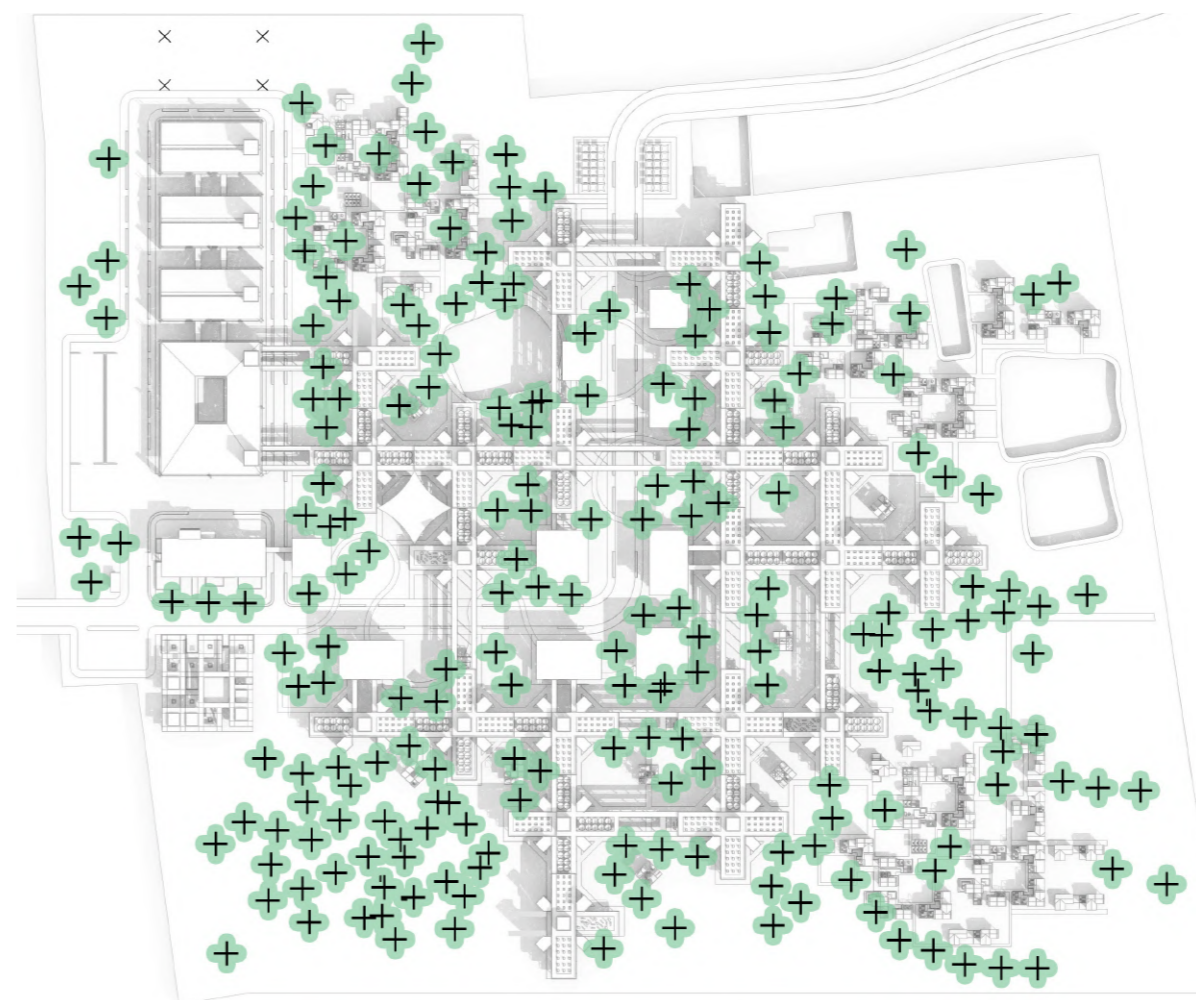
PHASE 3



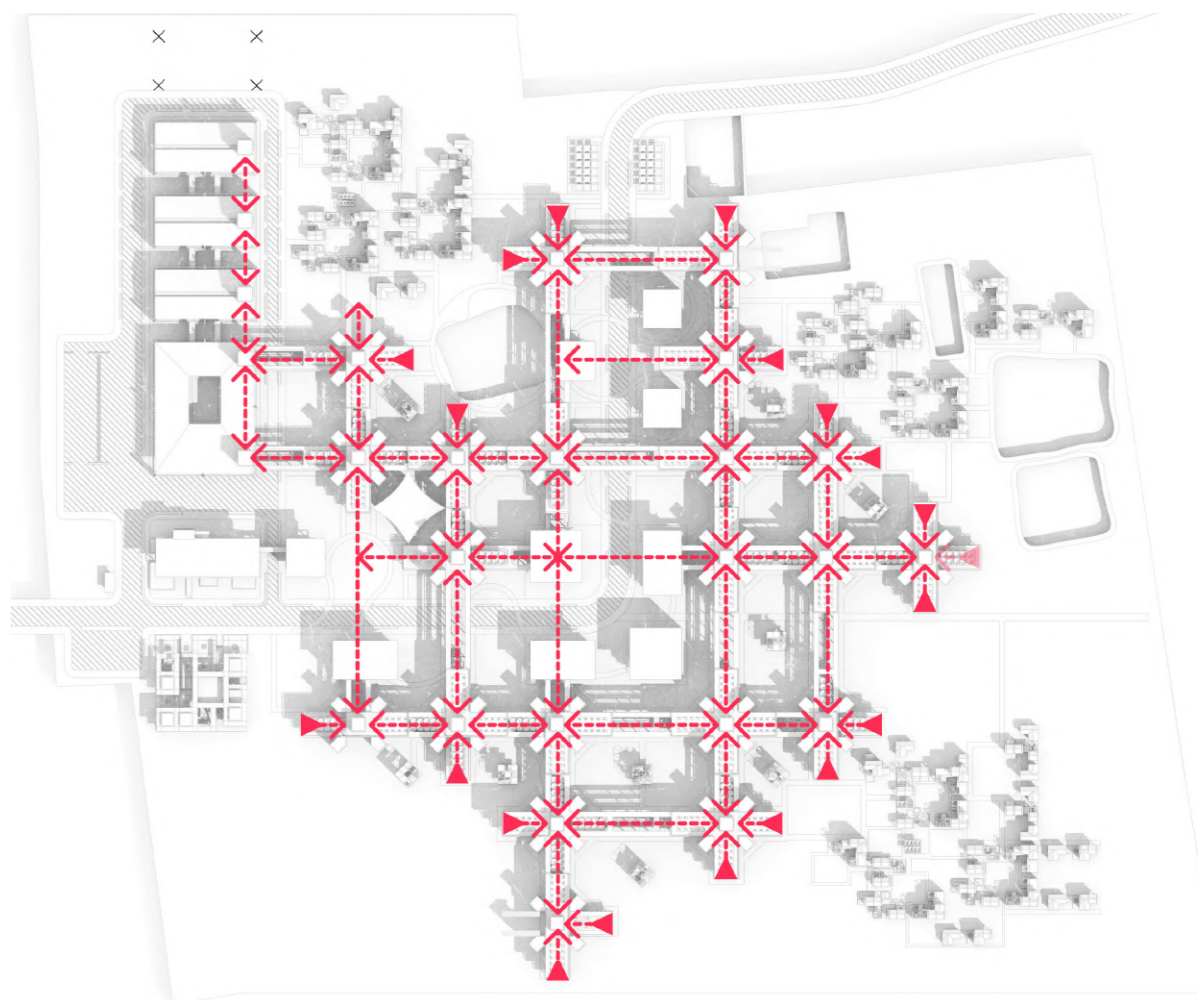
GROWTH



POINTS AND LINES



EXISTING TREES KEPT INTACT

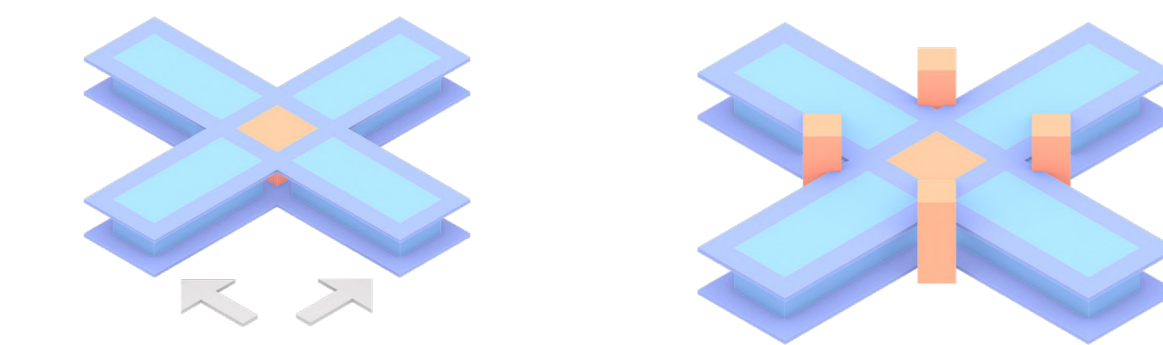


UNDERGROUND AUTOMATED GUIDED VEHICLE TUNNEL MAP

# Factory Details

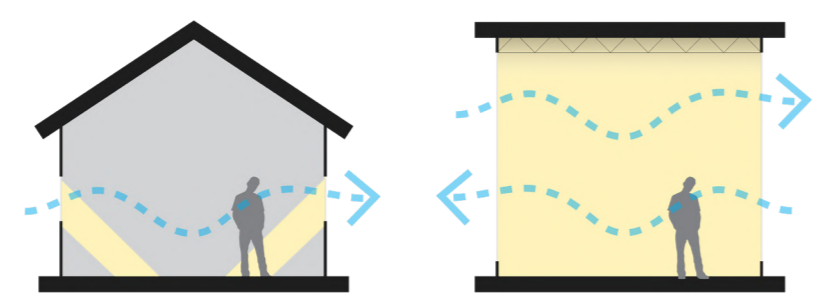


TRADITIONAL SHED      NEW FORMATION

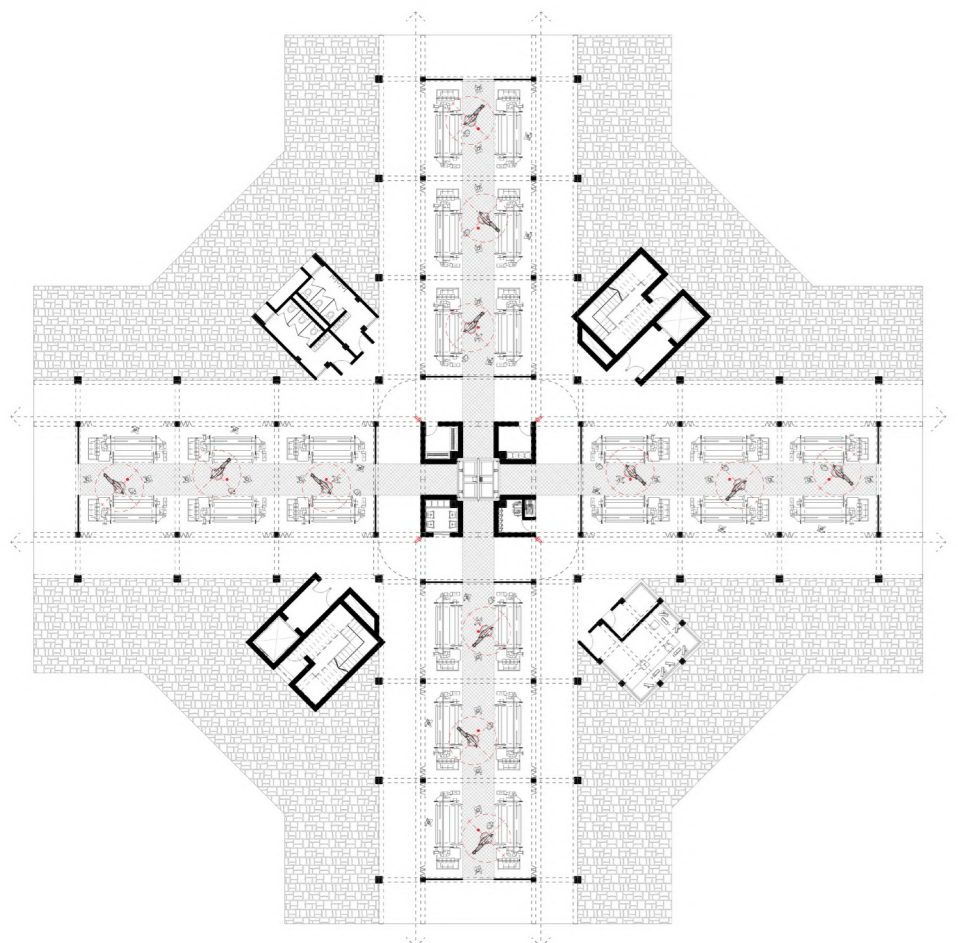


CORRIDOR ON EACH SIDE      CENTRAL CORE

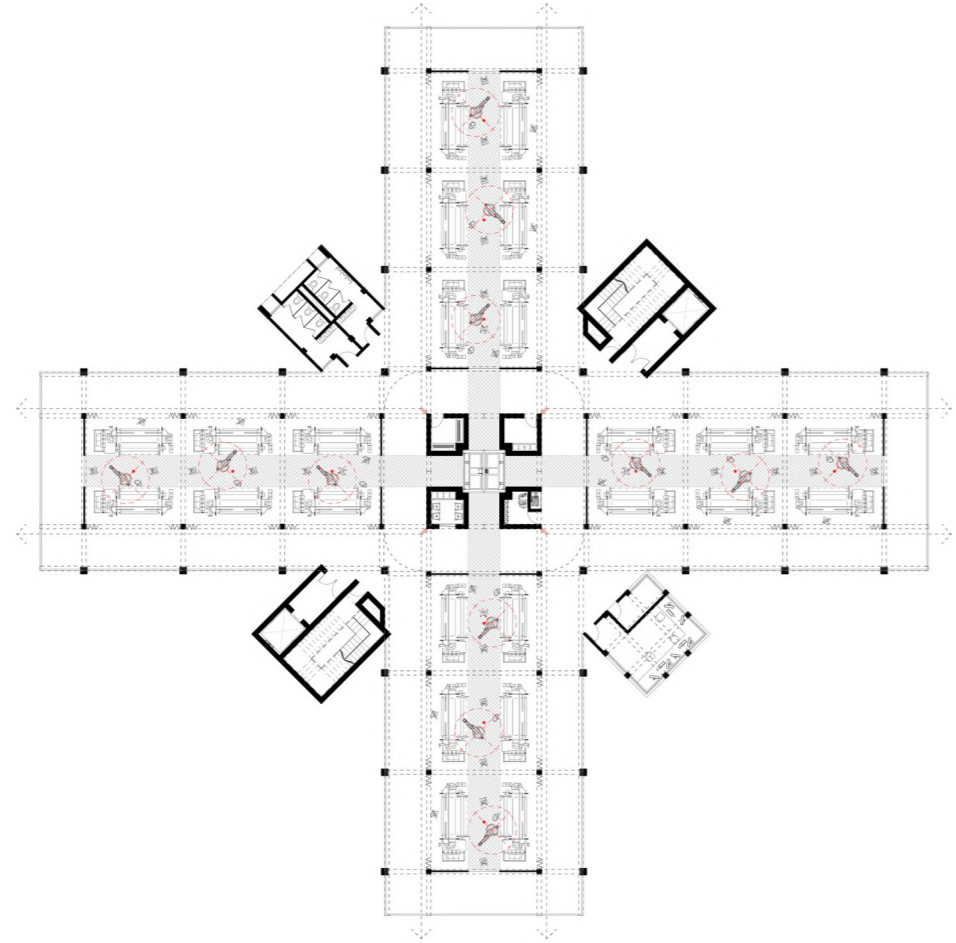
For maximum adaptability, instead of traditional factory shed. The core is placed in center for full scalability. When two or more modules joins they always creates a courtyard. Which hold maximum number of activities.



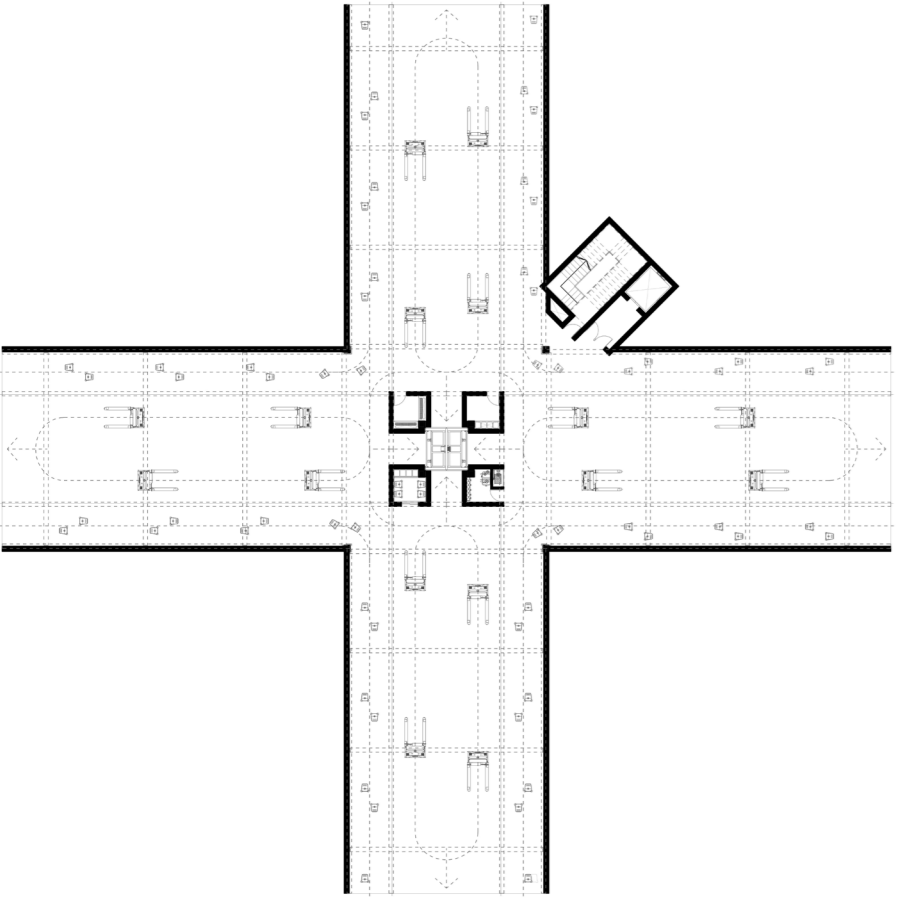
TRADITIONAL SHED  
 • LESS VENTILATION  
 • LESS SUN LIGHT  
 NEW FROMATION



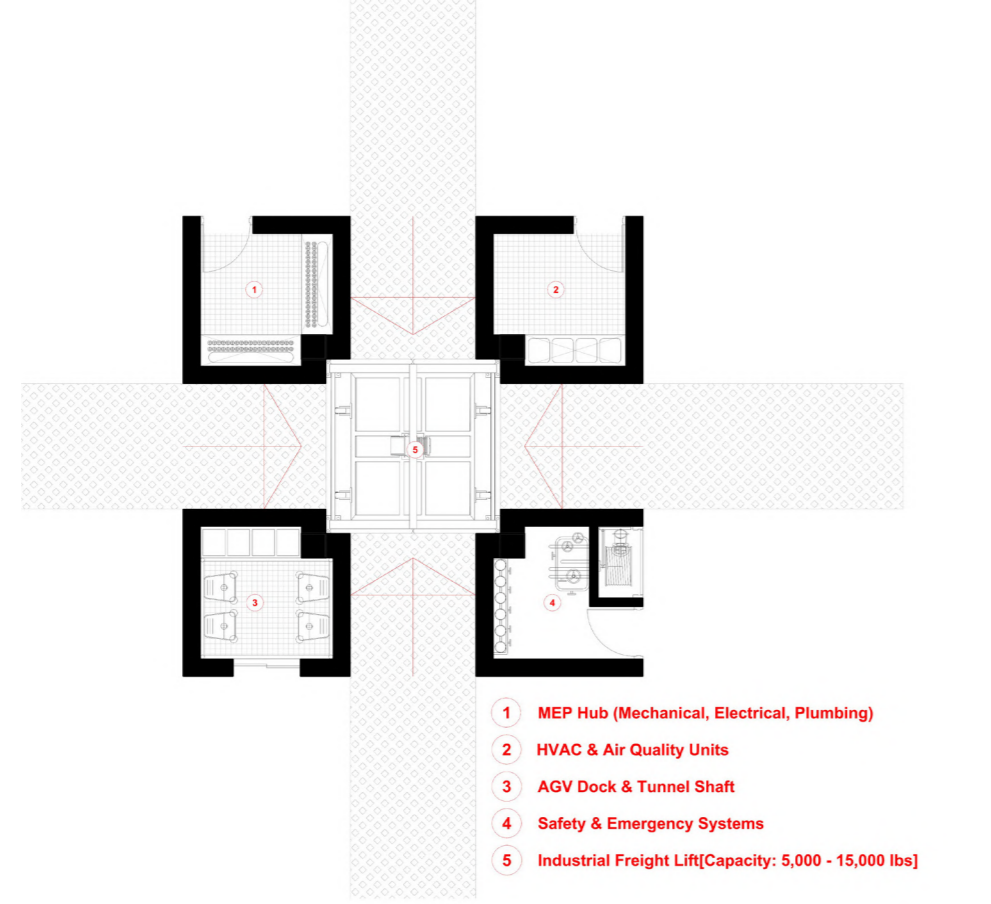
GROUND FLOOR PLAN PLAN



FIRST FLOOR PLAN



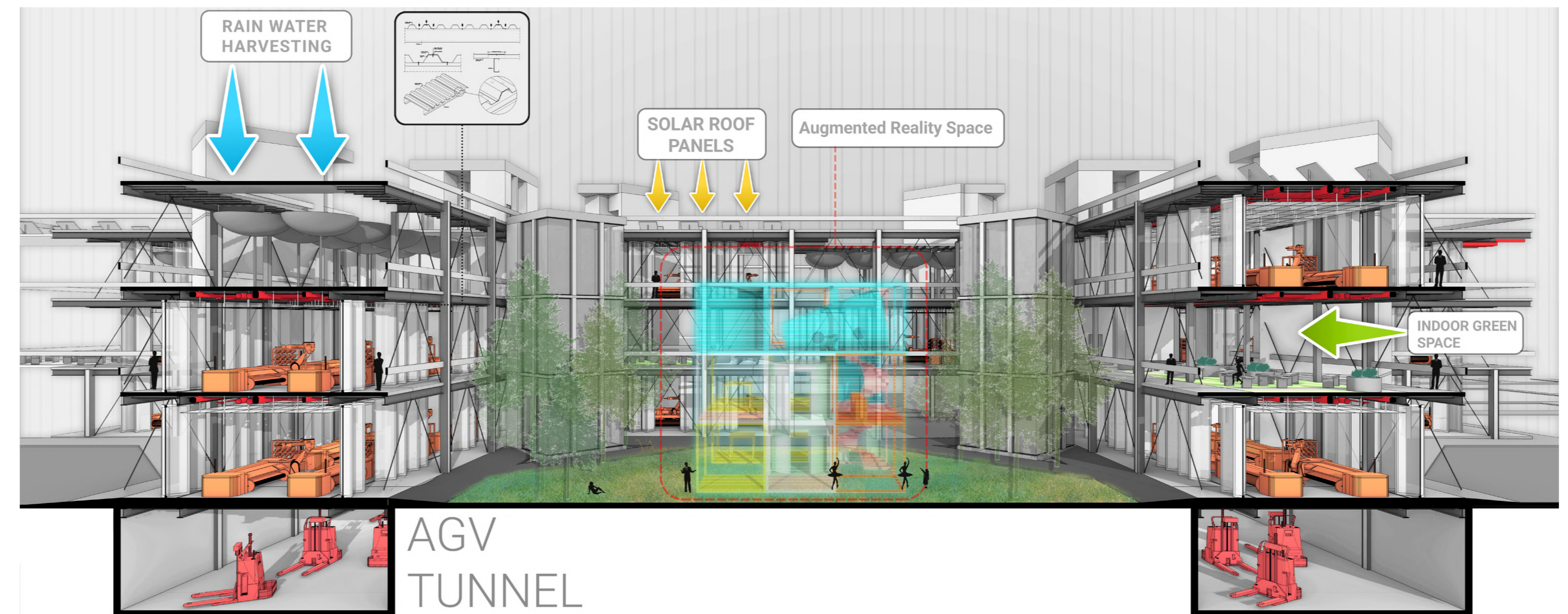
AGV PLAN



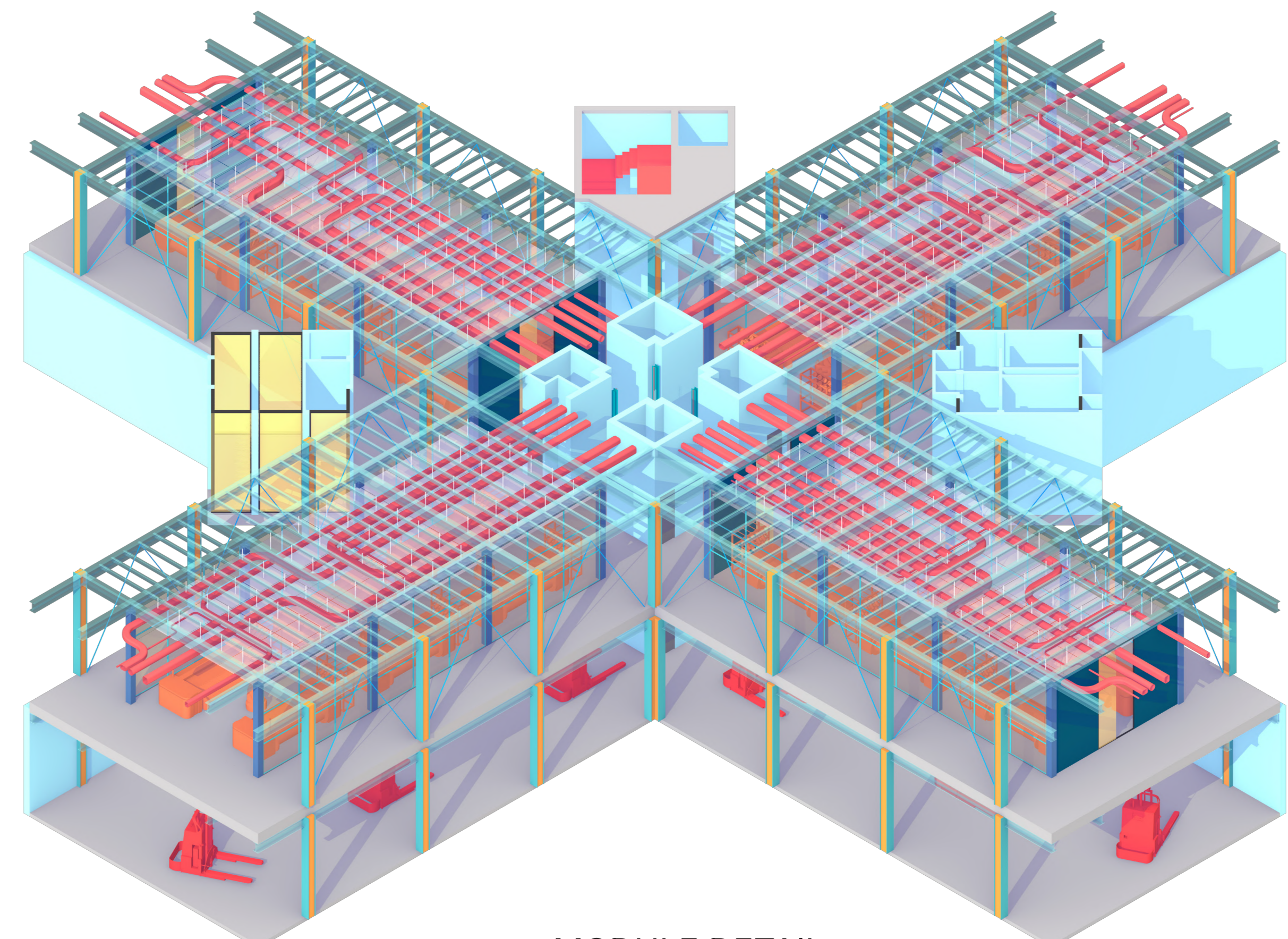
CORE PLAN

- 1 MEP Hub (Mechanical, Electrical, Plumbing)
- 2 HVAC & Air Quality Units
- 3 AGV Dock & Tunnel Shaft
- 4 Safety & Emergency Systems
- 5 Industrial Freight Lift(Capacity: 5,000 - 15,000 lbs)

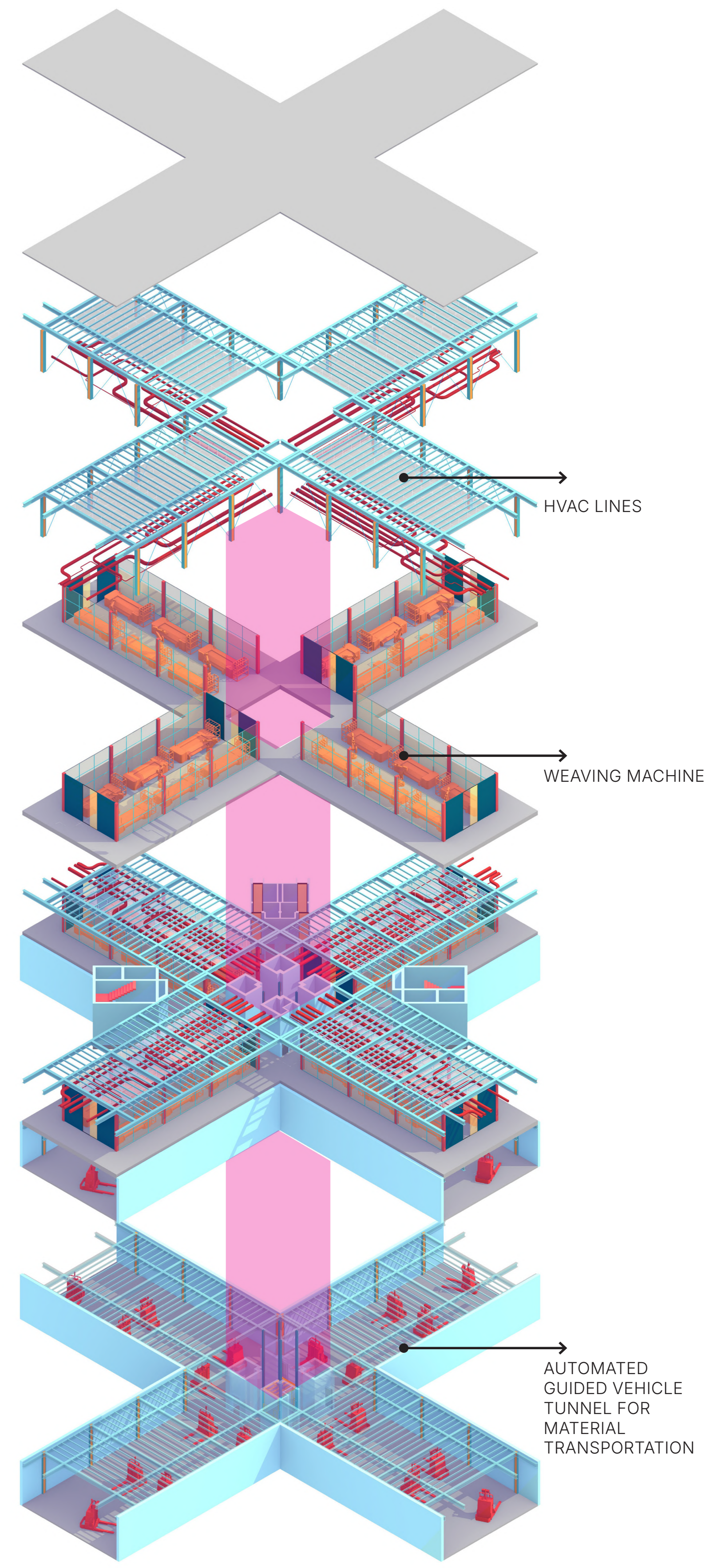
A centralized service core is positioned at the heart of each module, enabling infrastructure, utilities, and circulation networks to expand seamlessly as production demands evolve. When two or more modules connect, they inherently generate courtyards that function as active social and environmental spaces. Beneath this human-centered landscape, an AGV (Automated Guided Vehicle) network operates as the logistical backbone of the factory. Running through dedicated service corridors linked to the central cores, AGVs transport raw materials, finished products, and components efficiently between modules without disrupting pedestrian movement. This separation of human and automated circulation enhances safety, flexibility, and operational efficiency, allowing the factory to adapt over time while preserving spaces for social interaction, cultural exchange, and collective well-being.



SECTIONAL PERSPECTIVE



MODULE DETAIL



MODULE LAYERS

01

FACTORY SECTION



02

FACTORY & ARTISAN HOUSING



03

FACTORY & EXISTING LANDSCAPE



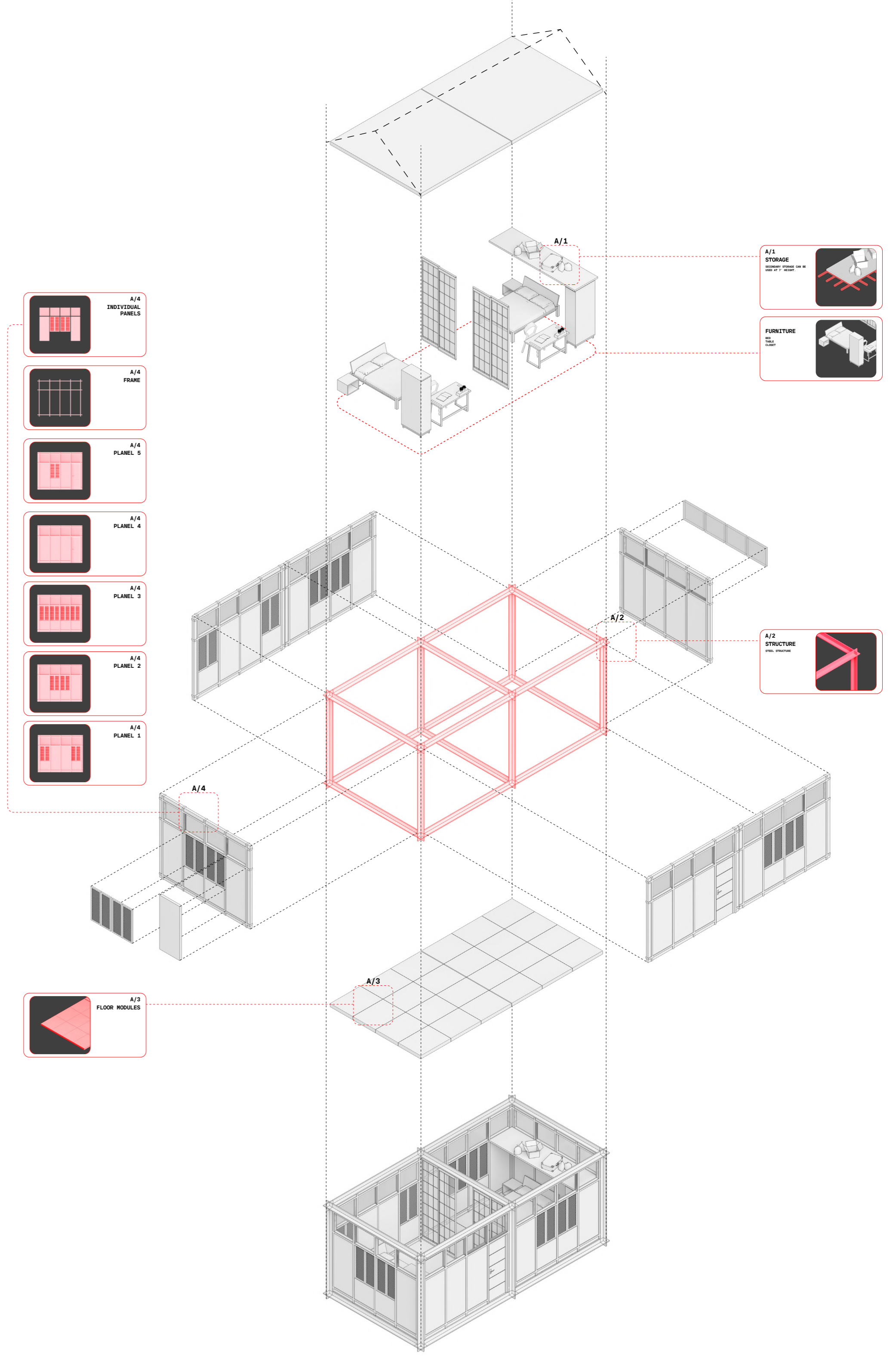
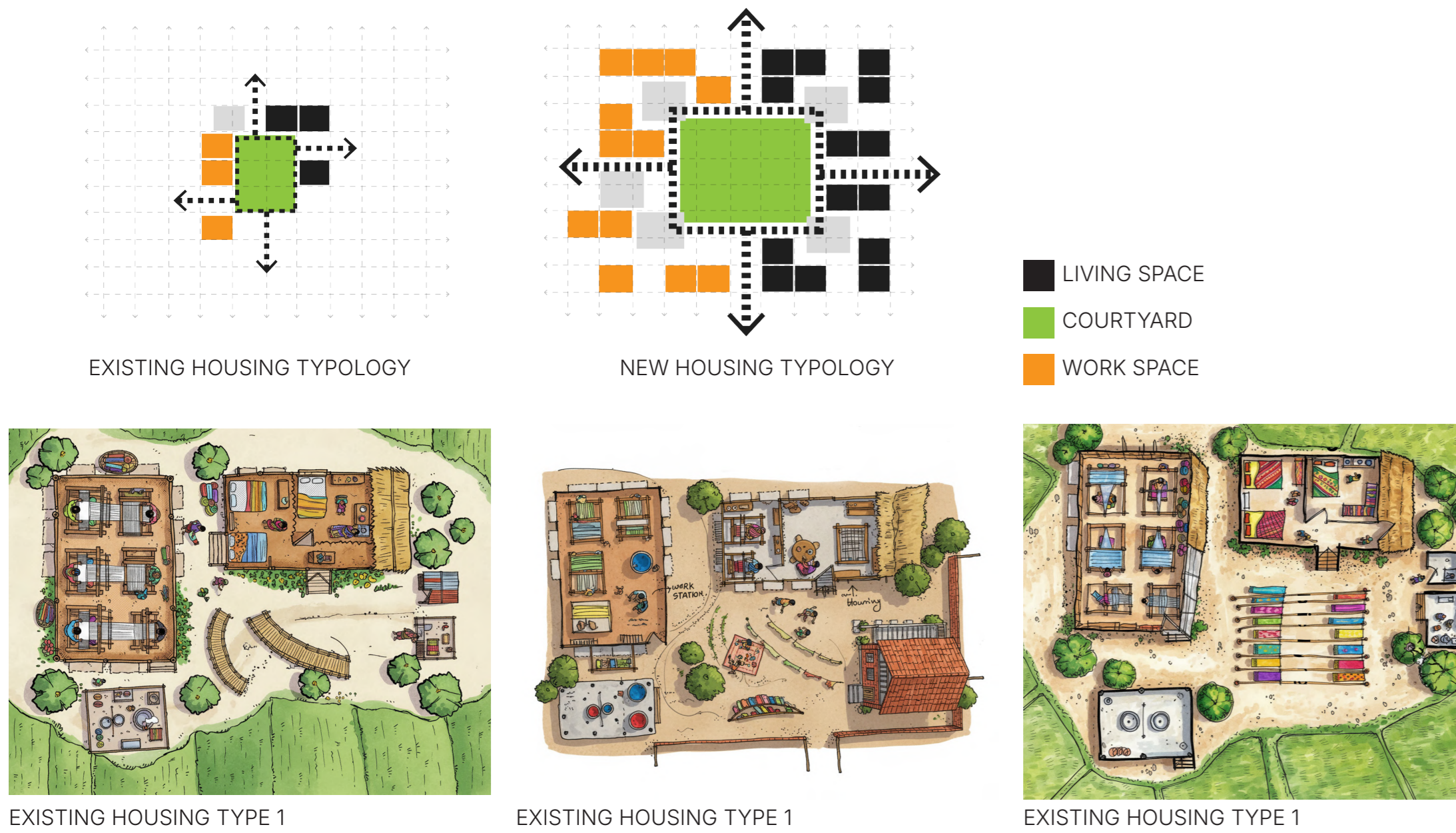
04

BRIDGE CONNECTION



# Artisan Housing Details

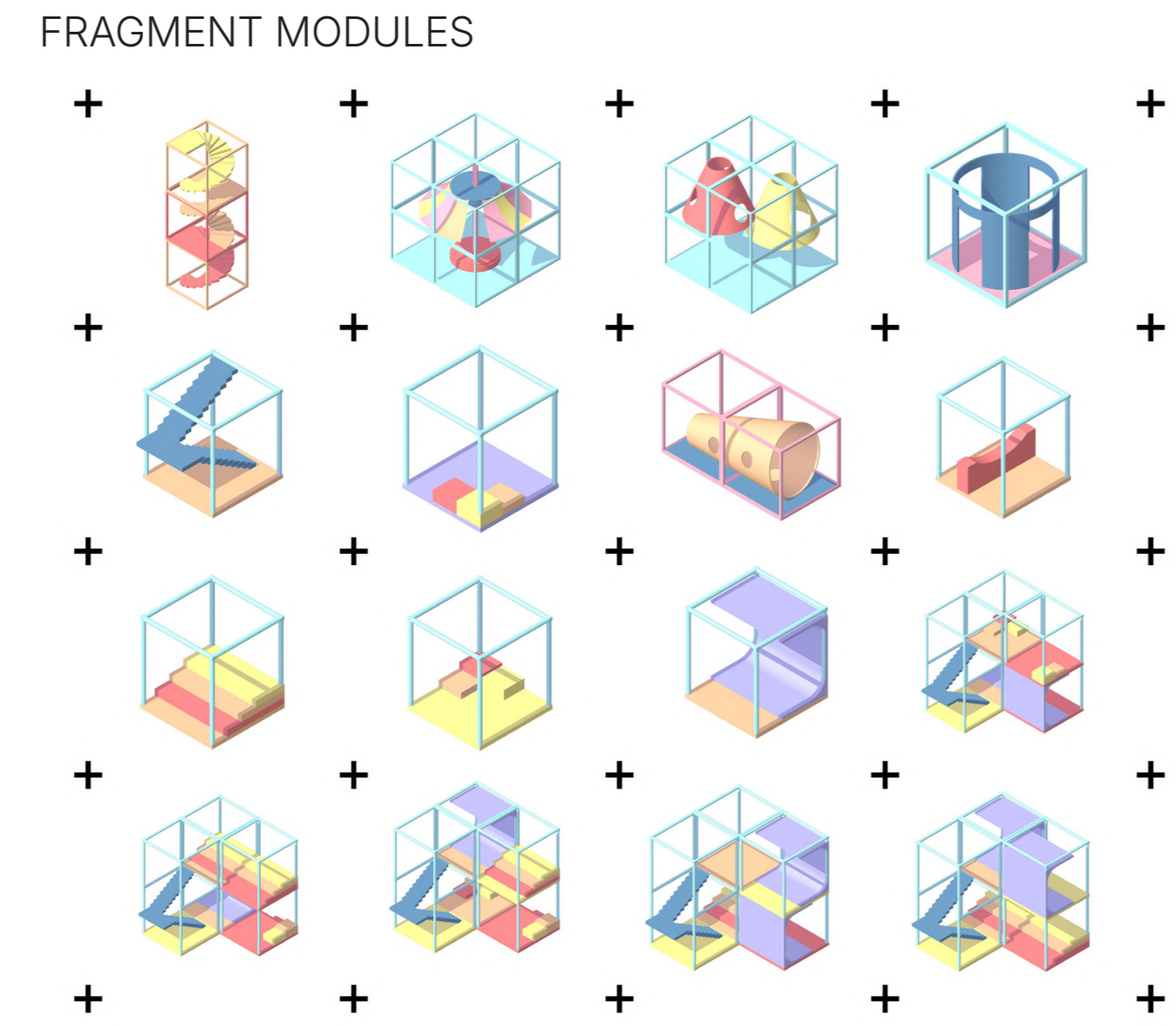
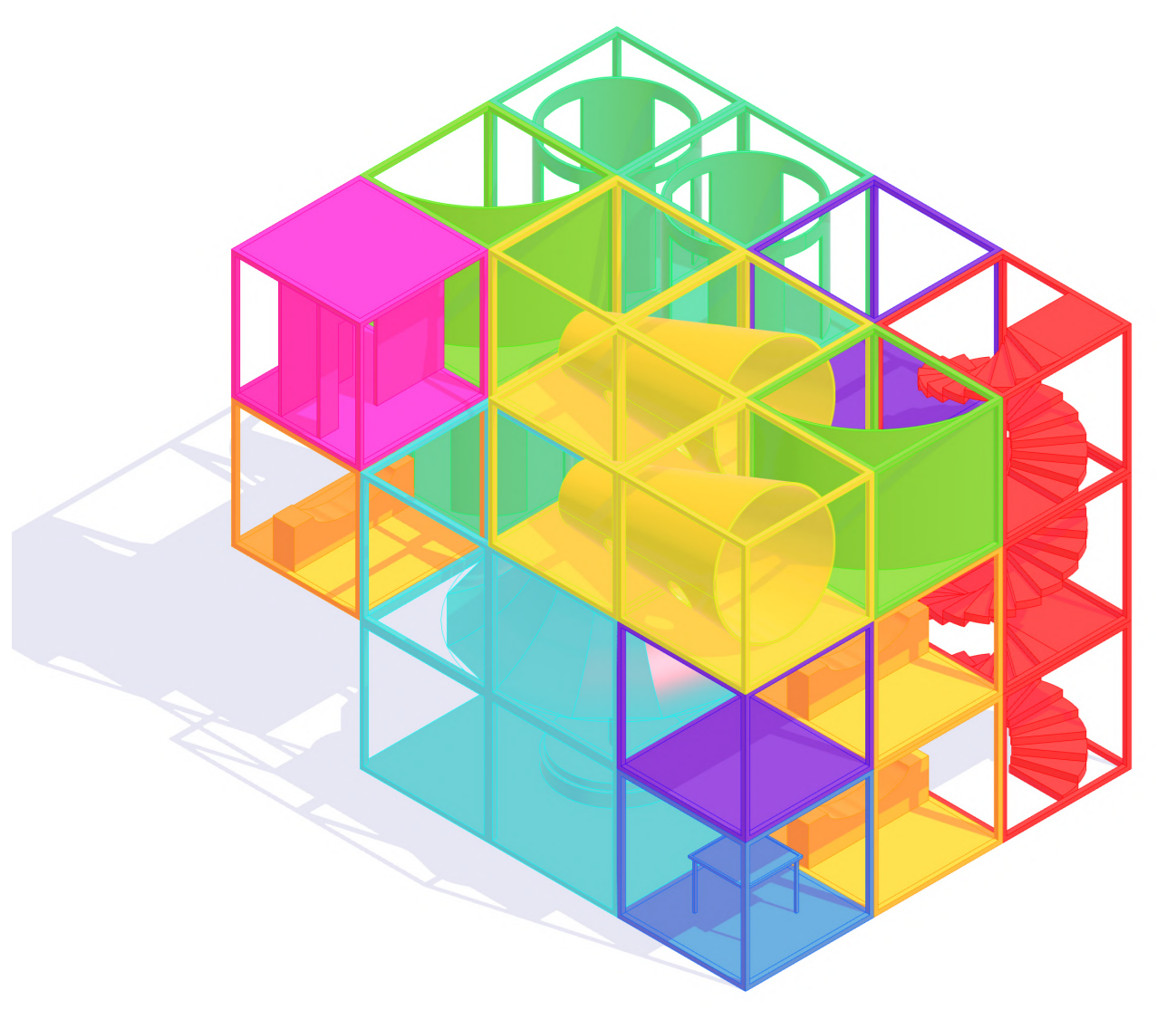
Preserving order through clear zoning. Rooted in traditional artisan housing, the courtyard is central, honored as a timeless space of informal activity, social exchange, and cultural continuity. The courtyard also acts as a climatic device, improving natural ventilation, daylight access, and thermal comfort within the dense fabric of the settlement.



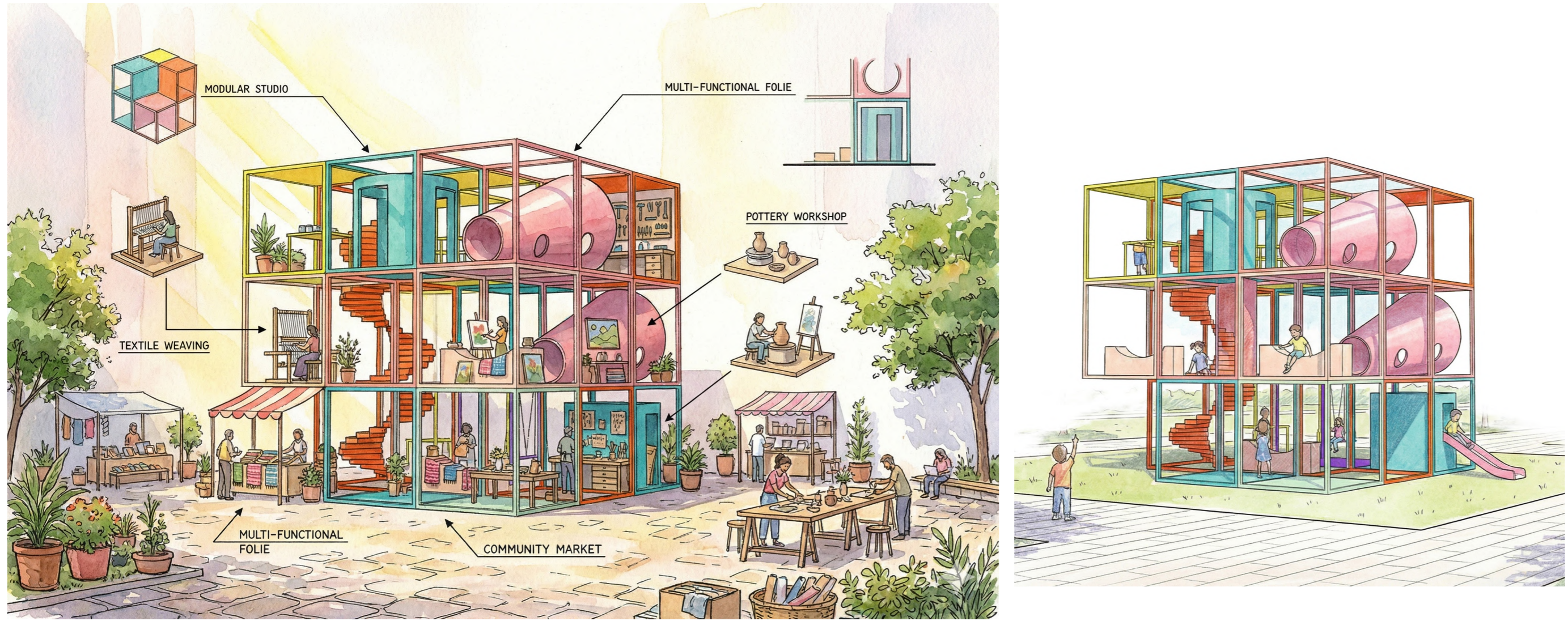
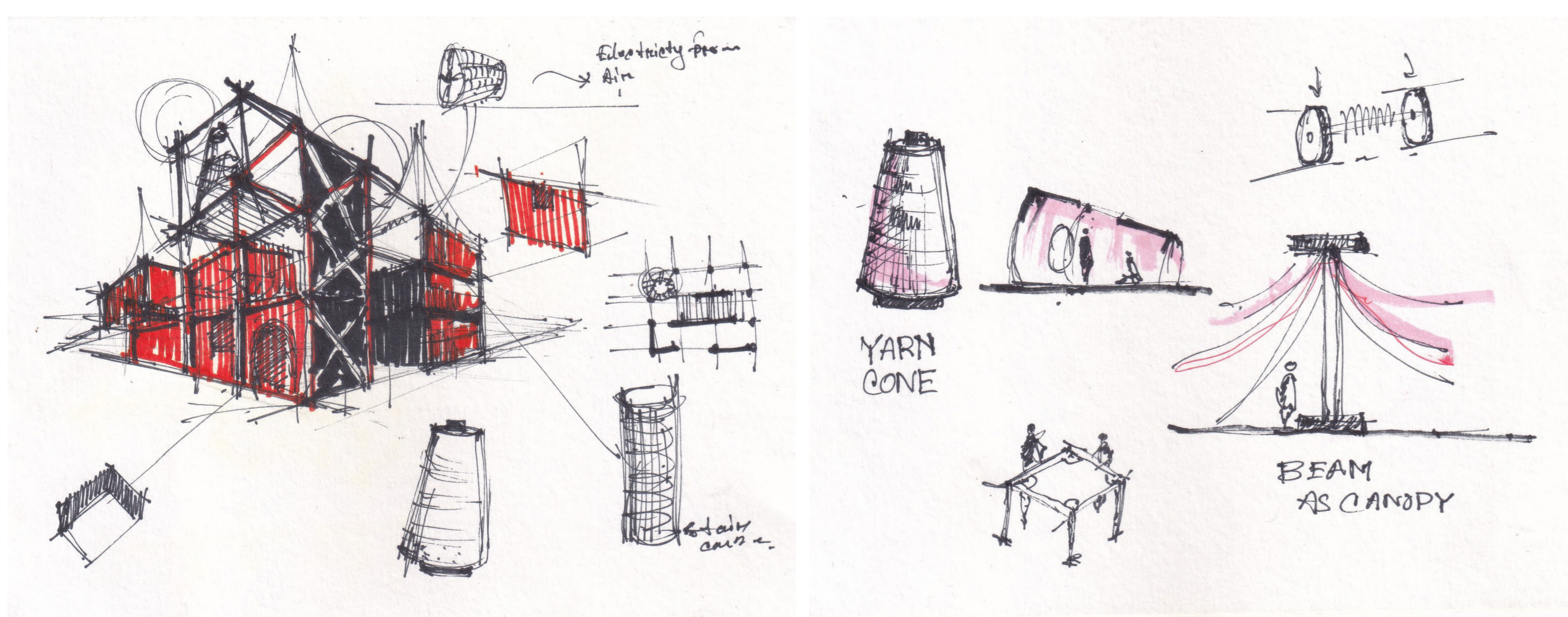
MODULAR PARTS OF HOUSING



# Fragments Details

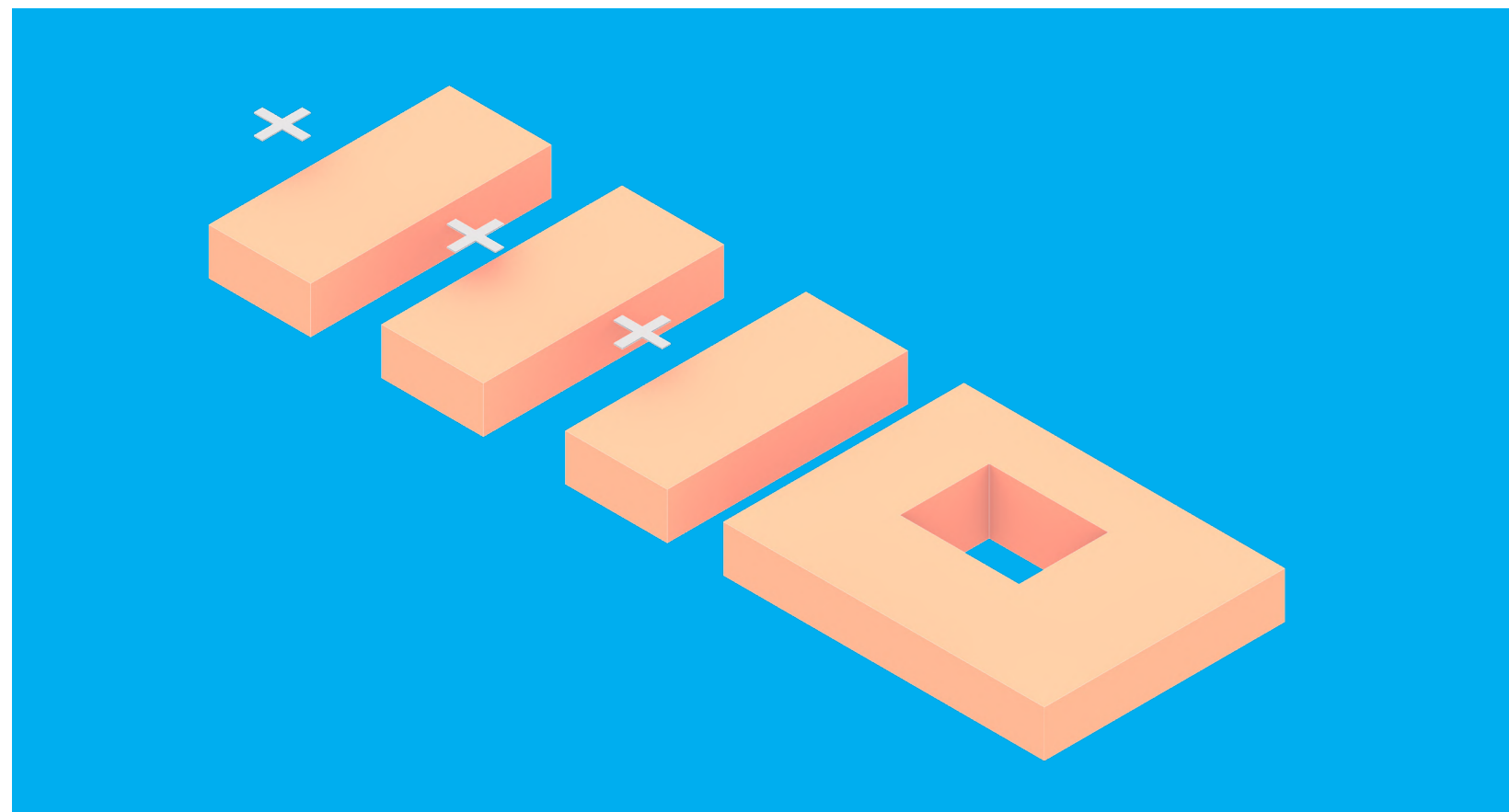


Fragments are small yet strategic interventions dispersed throughout the factory landscape, acting as catalysts for social, cultural, and recreational activity. Rather than functioning as conventional buildings, they operate as adaptable spatial devices that activate courtyards, pathways, and transitional zones between production and living environments. Each fragment introduces opportunities for gathering, learning, play, performance, exhibition, or reflection, transforming residual spaces into places of engagement.

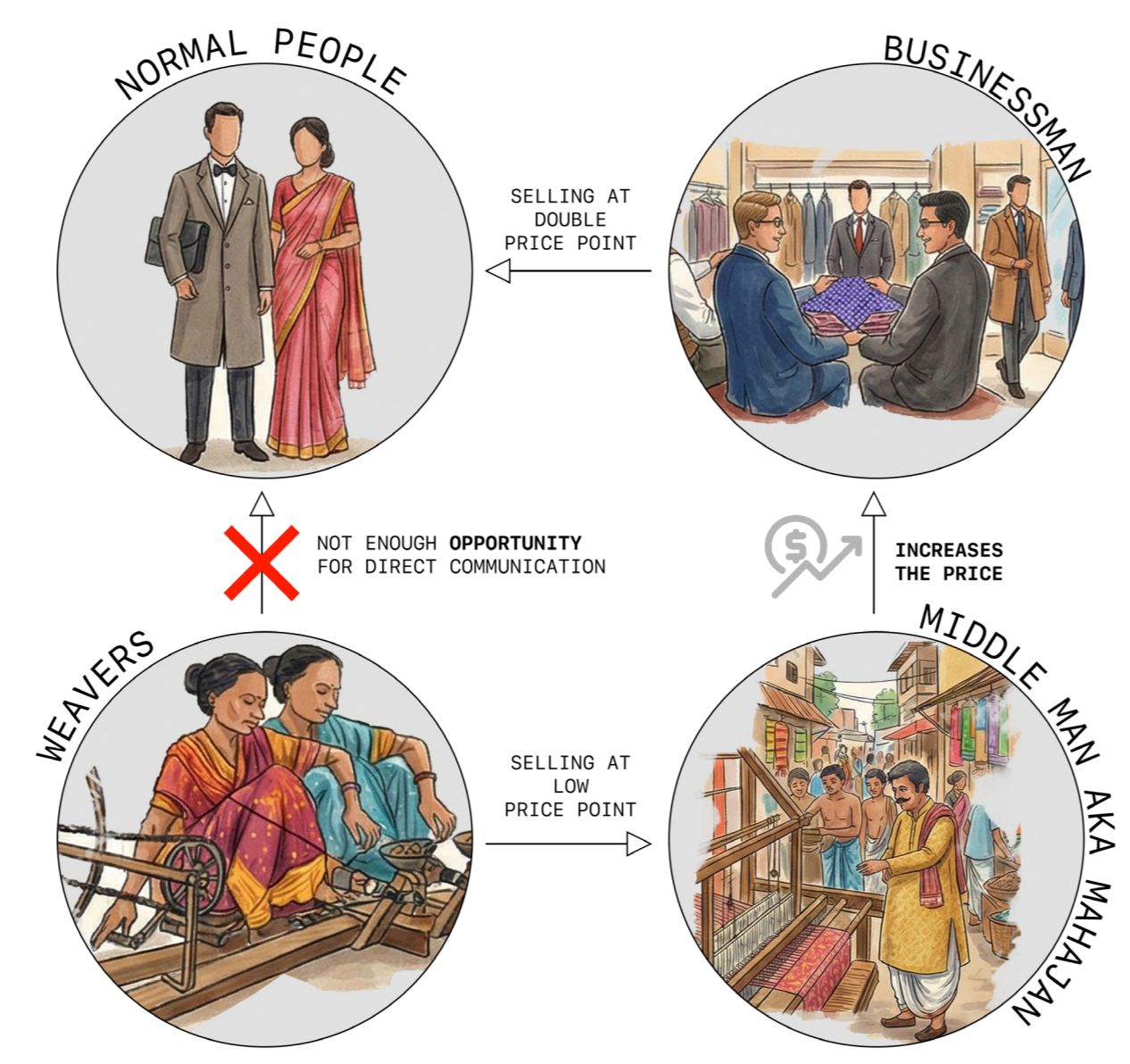


View of Fragments with landscape

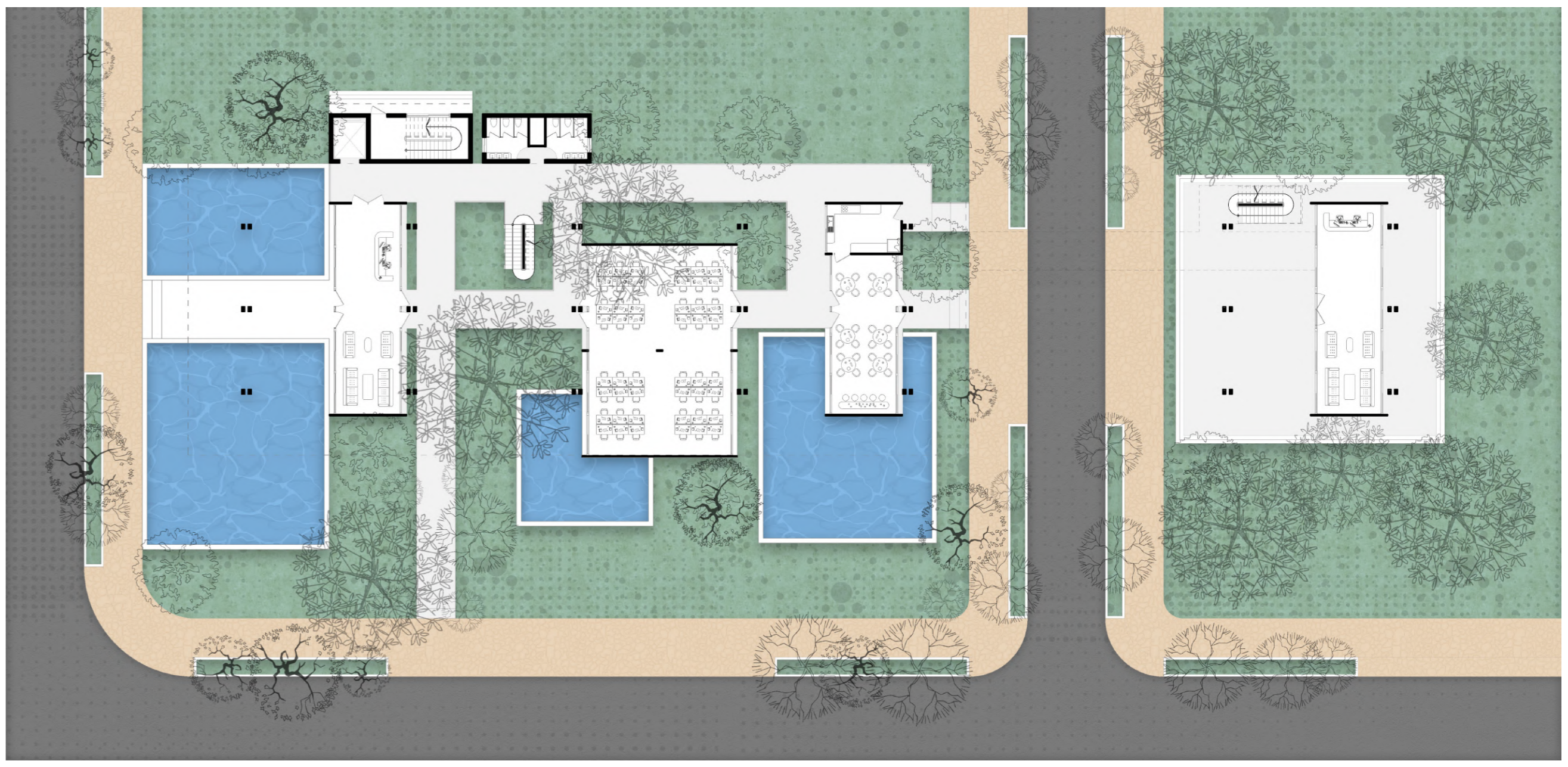
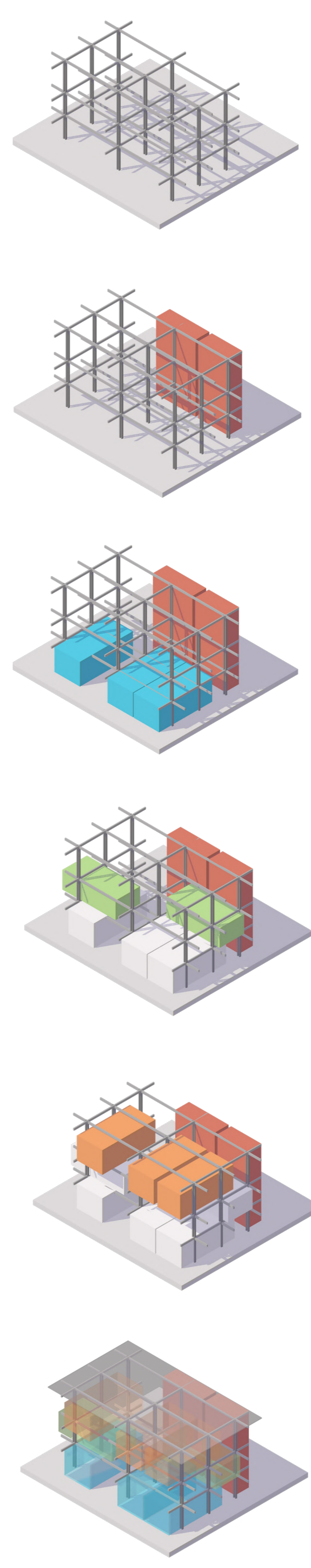
# Logistics Zone



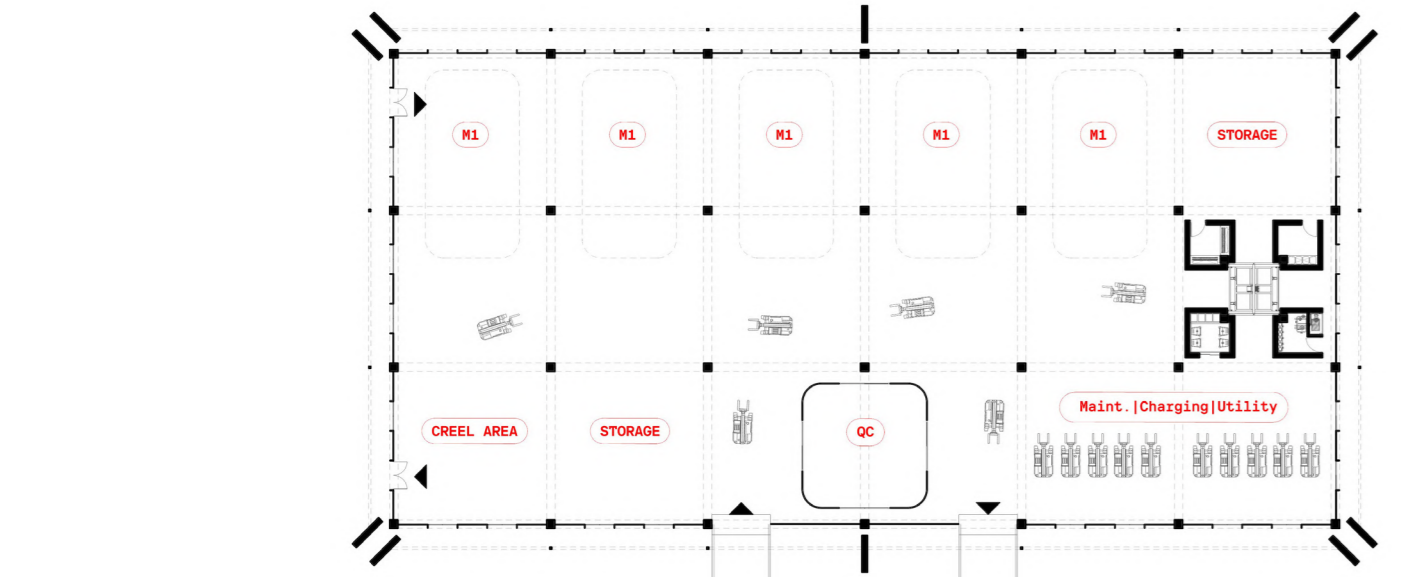
# Open Market



# Admin

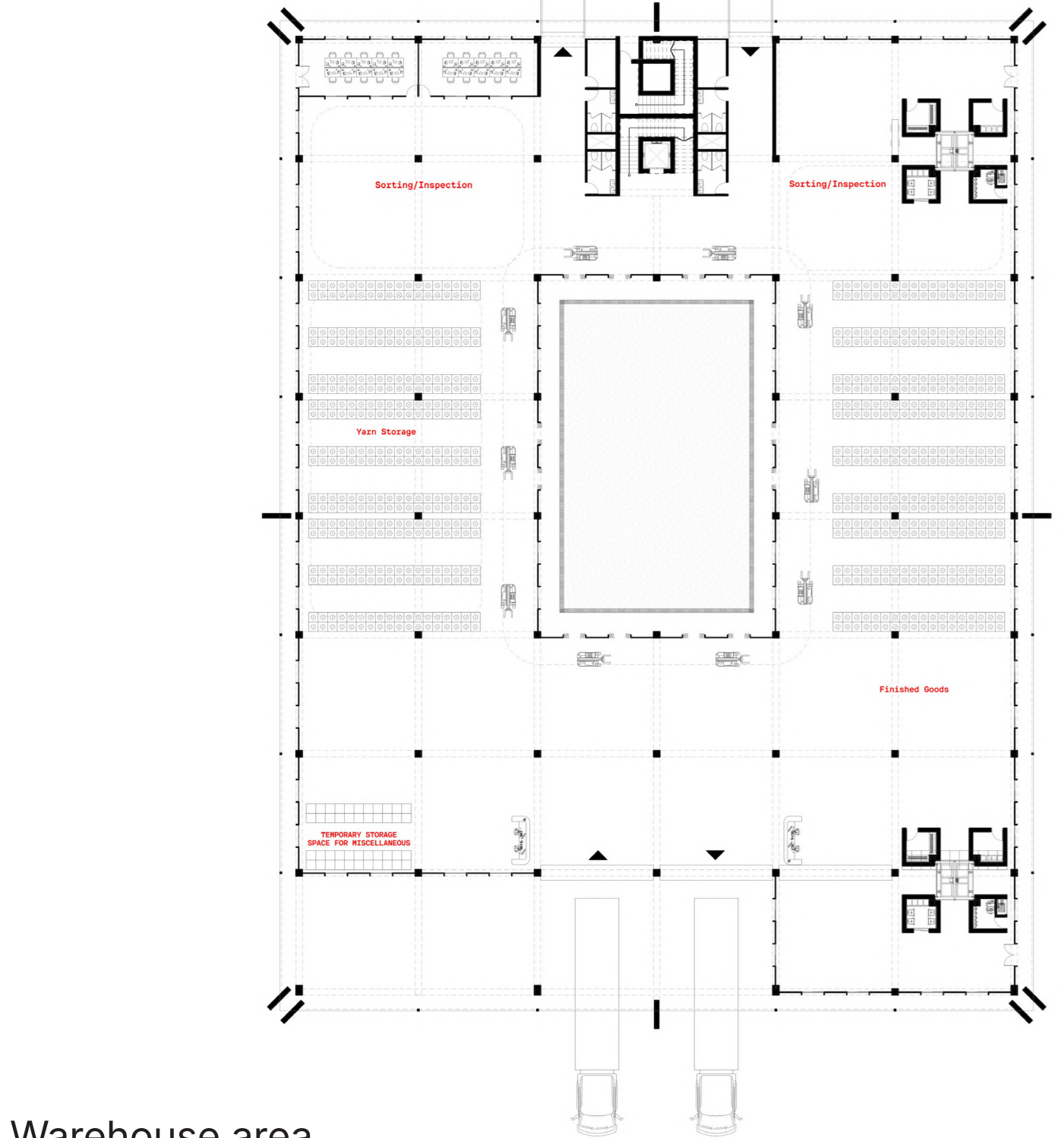
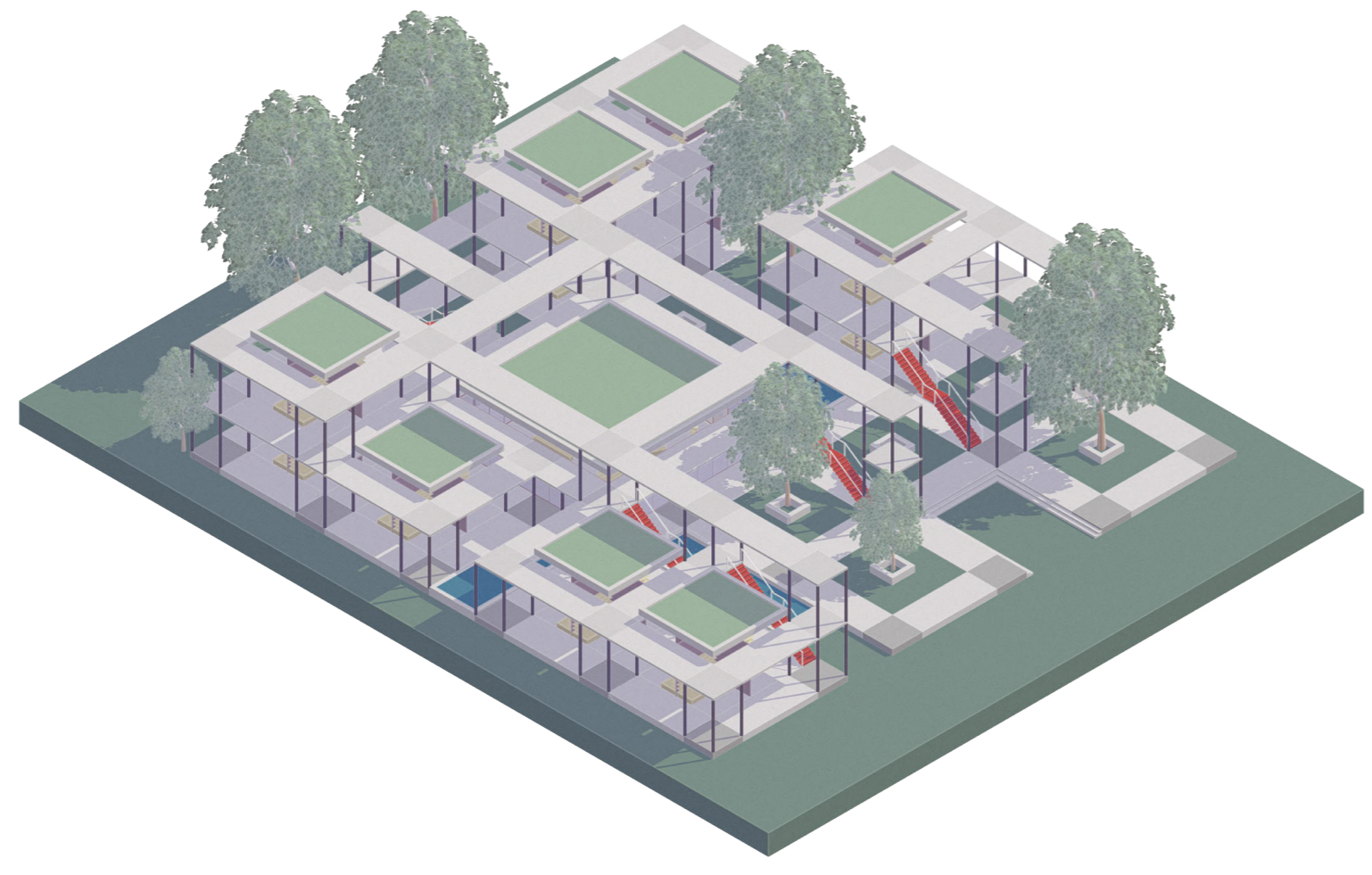


Ground Floor Plan

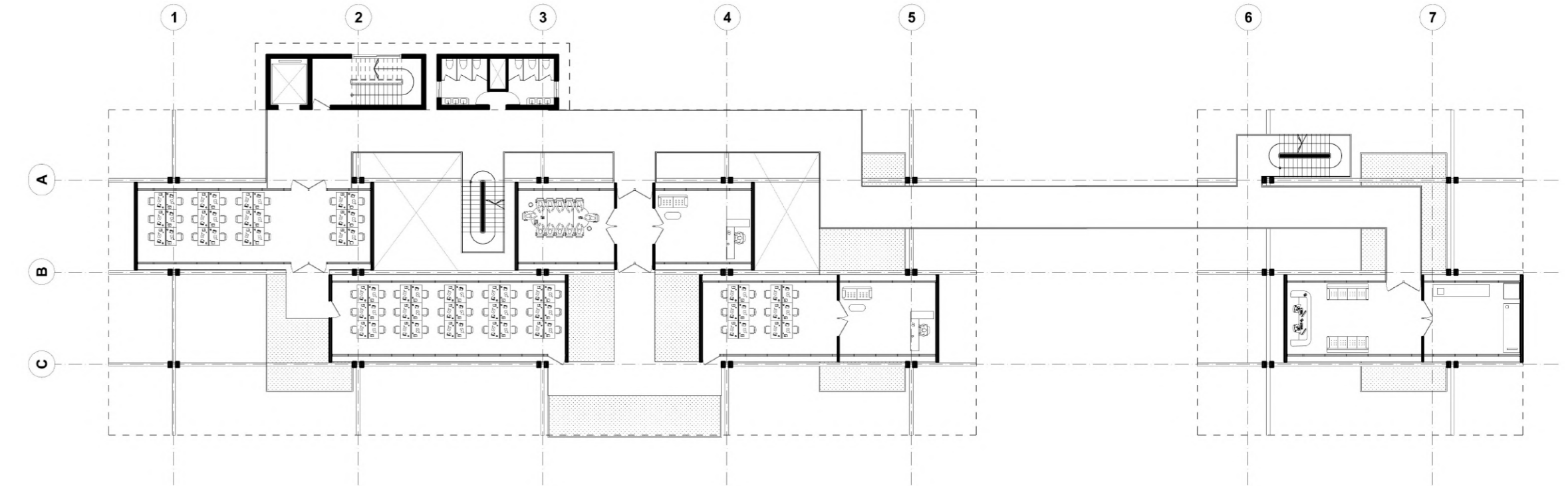


Wrapping Area

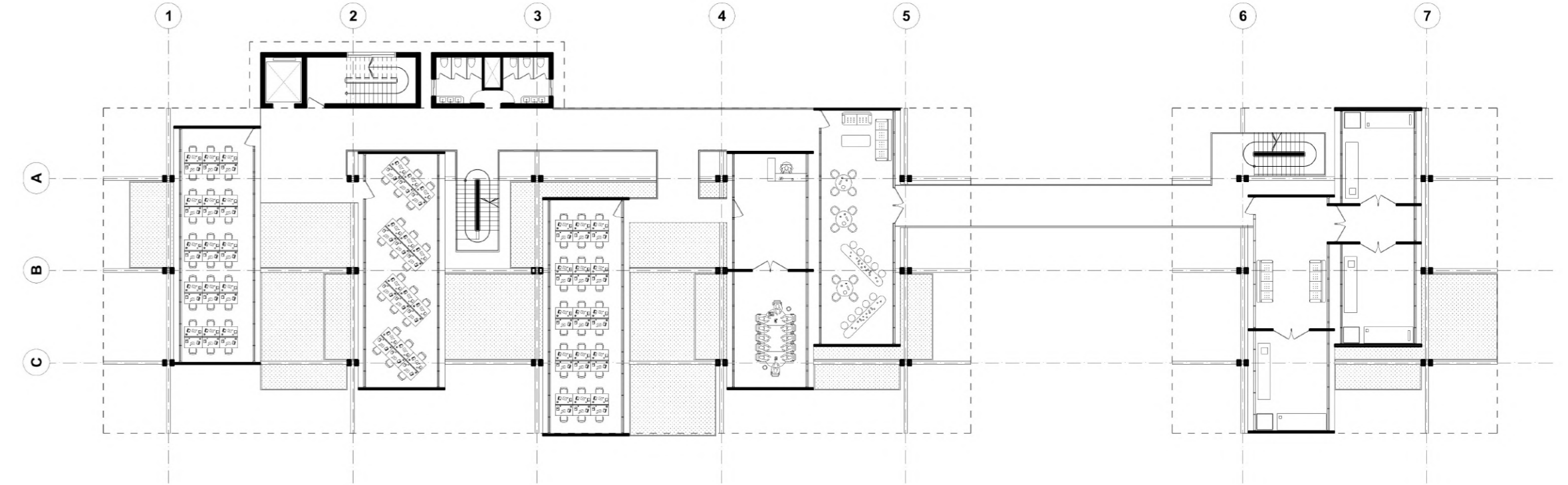
Handloom weaving is a delicate, culturally rich craft, yet its future is threatened by the growing disconnect between artisans and customers. This project restores that lost bridge by creating a shared platform where weavers, designers, students, and global buyers can interact directly. By removing intermediaries, it ensures fair wages, greater exposure, and first-hand communication, empowering artisans to sustain their livelihood. The initiative functions as an institution in itself, supporting learning, collaboration, and cultural preservation. Through proper supervision and an integrated ecosystem, it aims to revive the craft, enrich the community, and ensure that handloom weaving continues to inspire future generations.



Warehouse area



First Floor Plan



Second Floor Plan



View of Batik Printing Zone



Within Factory[n]Certainty, fragments act as physical manifestations of uncertainty and adaptability. They provide moments where production gives way to recreation, where workers become learners, and where everyday routines intersect with collective experiences.



View of Factory Courtyard at Day

# Factory[n]Certainty is not limited to physical reality.



View of Factory Courtyard at Augmented Reality



View of Factory Courtyard at Night

Extending beyond its courtyards, workshops, and communal spaces, it unfolds into virtual environments where artisans, visitors, and future generations can engage in new forms of cultural participation. Through metaverse platforms and game-based experiences, users can explore the evolving factory, learn traditional crafts through interactive simulations, and experiment with designing and building their own communities. These playful digital landscapes transform the factory into a space of imagination and collective creation. Artisans become both makers and storytellers, sharing tacit knowledge through immersive experiences that transcend geographical boundaries. Younger generations are invited to rediscover craftsmanship not as a relic of the past, but as an engaging and evolving practice. Community members can gather virtually, collaborate

on future scenarios, and contribute to the continuous redefinition of work, leisure, and cultural identity. By embracing both physical and virtual realms, Factory[n]Certainty proposes a future in which industry is not merely productive, but participatory, educational, and playful. It becomes an adaptive ecosystem where communities do not simply inhabit spaces of production; they actively shape them, ensuring that the future of making remains deeply human.



View of Automated Factory



View of central plaza



View of Admin



View of Artsian Housing Cluster



View of Artisan's Weaving Space



View of Artisans Dyeing Zone



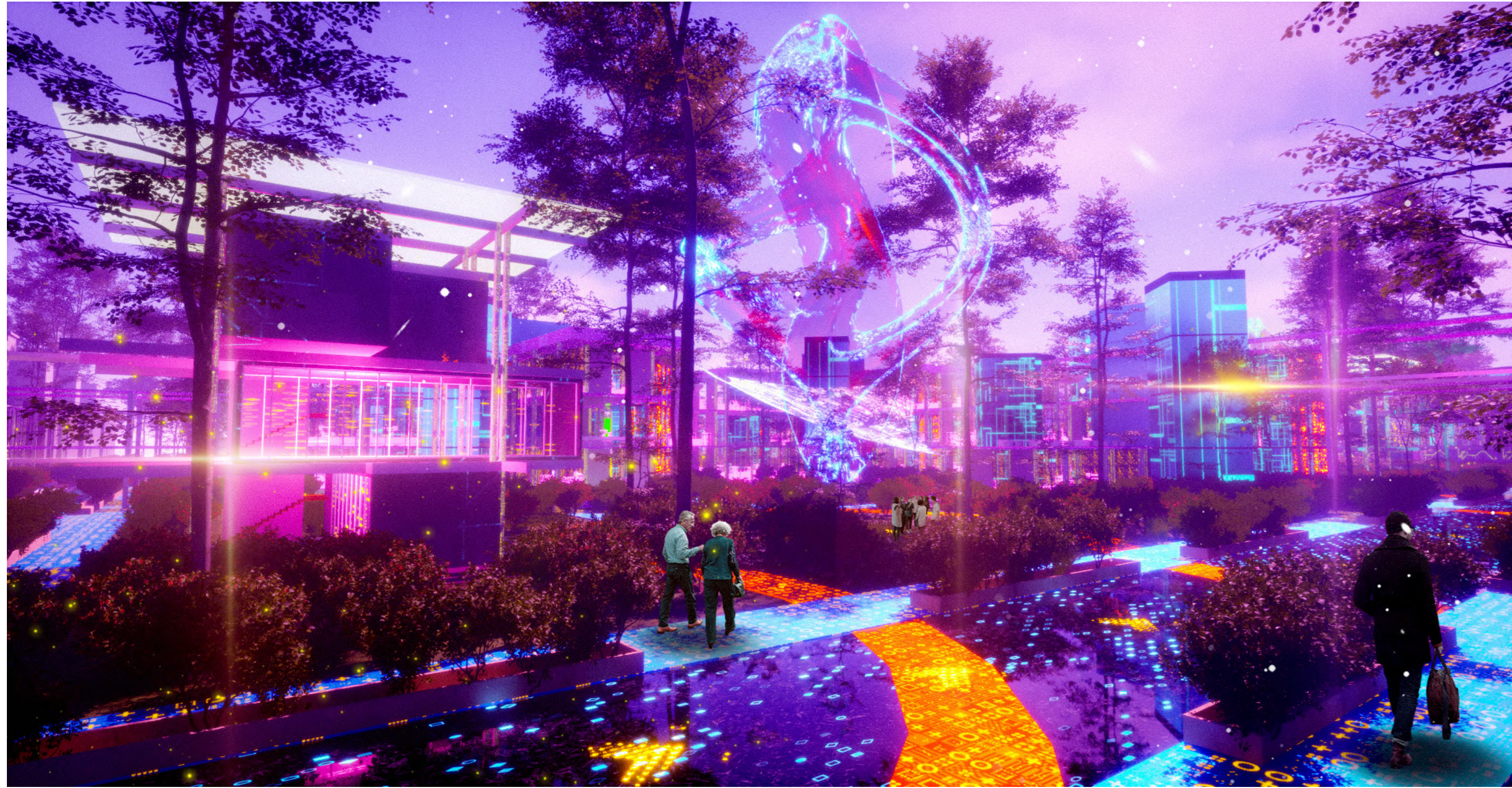
View of artisan housing workspace



Factory in Augmented Reality



Factory in Augmented Reality



Factory in Augmented Reality



Fragments in Augmented Reality

