Master of Science program in Architecture for Heritage

Thesis of Master's degree

Generative AI: Limits and Opportunities

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Abstract

This thesis investigates the possibilities and boundaries of generative Artificial Intelligence (AI) to conceptual reinterpret Iranian neighbourhoods (Mahallehs[1]) in the regime of vertical housing. Contemporary Iranian cities are characterized by urban densification and widespread application of high-rise housing, which often produces placeless environments that do not respect cultural identity, social bonds, and climatic appropriateness. Conversely, the old Mahalleh embodied socio-spatial notions such as hierarchy, privacy, communal interaction, and responsiveness to the environment. This research therefore asked: to what degree, and with what constraints, can new urban settings re-elaborate these notions using generative AI?

The study applied a design-based methodology combining cultural grounding, iterative prompt engineering with Midjourney, and a systematic evaluation framework of eight categories that emerged from principles in everyday life. The process was intentionally situated in the conceptual design stage, emphasizing AI as a conceptual collaborator rather than replacing architectural thought.

Results indicated a two-fold outcome. On the one hand, AI achieved rapid iteration, producing atmospheric pictures with legible vernacular signs of courtyard-like emptiness, iwans, rhythmic facades, and references to passive climatic strategies. On the other hand, it consistently failed to replicate socio-spatial coherence, order of functions, human scale, and communal spaces, reducing cultural aspects to ornamentation.

The thesis argues that generative AI can only be defined, first and foremost, as a catalyst for speculative exploration. It can facilitate experimentation and trigger critical examination, but it cannot instil architectural meaning and socio-cultural logic without human interpretation. The architect's position continues to be at the forefront of transforming AI-created imagery into knowledge and culturally embedded understanding.

Keywords: Generative Artificial Intelligence; Conceptual Experiment; Iranian Mahalleh; Vertical Housing; Heritage-informed Approaches; Prompt Engineering; Socio-spatial Principles

[1] Mahallehs: Iranian traditional neighborhoods

Dedicated

To the Pahlavi family, whose life was dedicated to service and prosperity of my beloved motherland, Iran. Their vision and sacrifices inspire generations. Especially to Mohammad Reza Pahlavi, who, based on the wisdom of a great man and the love of a father, followed the noble path of his predecessor, leading the country towards development, enlightenment, and progress. And to Reza Pahlavi, Crown Prince of Iran, who remains steadfast in unshakeable resolve in attempting to bring back dignity, respect, and hope to the Iranian people, reminding us all that love of country is eternal and unbreakable.

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1 / Introduction

1.1 Background and Rationale

Under the contemporary Iranian urban setting, residential zones have undergone severe transformation. The runaway development of tower blocks, particularly in Tehran and other metropolises, has created living conditions that are likely to be detached from cultural identity, social cohesion, and environmental consideration (Madanipour, 2006; Habibi & Deffner, 2016). Homogenized apartment blocks that emulate internationalized patterns of living disconnect themselves from the historical and cultural roots of Iranian urbanism.

In comparison, the traditional Mahalleh had been a socio-spatial order deeply rooted in communal life. Its typical features—spatial stratification, introversion and privacy, communal encounter, and climatic responsiveness—structured domestic layout and neighborhood patterns (Ardalan & Bakhtiar, 1973; Habibi, 2000). These features attained a balance between privacy on the individual level and identity on the communal level, as well as being able to offer environmental comfort through the use of courtyards, narrow alleys, and passive climate control elements (Fathy, 1986; Bahadori, 1978).

The widening gap between these two paradigms serves to highlight an immediate architectural challenge: how to reconnect with the values of the vernacular within unstoppable vertical city growth. Not to preserve or replicate old forms, but to translate their underlying logic into new housing is the aim. This thesis embraces that challenge and places its research within the wider context of design led by heritage.

Alongside this, the rise of Artificial Intelligence (AI) has opened up new possibilities for research through design. Among numerous applications of AI in architecture, from performance simulation to data-driven urban analysis, generative tools offer a specific potential for the creation of conceptual images and the exploration of hypotheticals (Burry, 2020; Carpo, 2021). Used critically, such tools can be conceptual co-creators, permitting architects to investigate how cultural proposals might be reimagined through different spatial dispositions.

This project is therefore motivated by the convergence of two conditions: the urgent need to rethink Iranian housing identity in the context of high-rise development, and the experiential affordance of exploring generative AI as an arena for rethinking vernacular logics. **It is important to note that the project does not aim to provide design solutions, but rather to test the potential and limitations of AI within a controlled conceptual framework.**

1.2 Research Problem

Iran's transition from the old neighborhoods to new high-rise complexes created a profound discontinuity in socio-spatial logics. While the Mahalleh once supported a layered regimen of privacy, communal life, and responsiveness to the environment, contemporary apartment blocks are largely characterized by homogenized layout, atomized social relations, and placelessness beauty (Relph, 1976; Madanipour, 2003).

This discontinuity generates several interrelated problems:

1. **Loss of cultural identity** – The disappearance of vernacular references has resulted in residential environments that are foreign and cut off from local heritage (Habibi, 2000).
2. **Erosion of social cohesion** – The absence of courtyards, half-public spaces, and thresholds results in fewer opportunities for interactivity with other residents, causing disconnection in high-density city life (Madanipour, 2006).
3. **Neglect of climatic adaptation** – Excessive reliance on mechanical systems has replaced passive ones, boosting energy usage and lowering environmental comfort (Givoni, 1994).

While attempts to directly preserve or replicate historic shapes may limit heritage in time, instead of reapplying its lessons in suitable terms (ICOMOS, 2013), an act of reinterpretation is needed: a translation of spatial and cultural values into present terms of vertical housing, without reducing them to shallow superficiality.

The research question is therefore set against this tension: how could the Iranian Mahalleh's principles be re-interpreted critically in contexts of high-rise, and what role can generative Artificial Intelligence play in this reinterpretation? **This question is approached not as a design project, but as an experimental investigation into the opportunities and boundaries of AI in heritage-informed architectural research.**

1.3 Research Aim and Objectives

The aim of this research is to critically advance the limits of generative Artificial Intelligence within the conceptual reinterpretation of the Iranian Mahalleh in a vertical housing context. The project places AI not as an alternative or solution to architectural design, but as a conceptual collaborator that can yield speculative imagery that is critiqued against cultural and architectural norms.

In order to achieve this goal, the following goals were set:

1. **Recognize** and **synthesize** the Iranian Mahalleh's socio-spatial, cultural, and environmental principles through literature reviews and case studies.
2. **Test the application of generative AI tools** (namely MidJourney) to generate concept outputs that attempt to reenvision the principles vertically.
3. **Develop and apply an evaluation framework** to systematically compare the AI outputs against culturally referenced criteria.
4. **Critically analyse** the strengths and weaknesses of AI to make a contribution to heritage-informed design in the conceptual stage.

These objectives position the research as both a design-based experiment and a critical review, with the aim of situating AI within architectural debate as an instrument of research rather than as an absolute design driver. **The emphasis throughout remains on speculative experimentation and critical assessment, rather than on delivering practical design solutions.**

1.4 Research Questions

According to the research problem and objectives established, the thesis is guided by a general question and supporting questions.

Main Research Question

- To what extent can generative Artificial Intelligence reinterpret the socio-spatial principles of the Iranian Mahalleh in the context of vertical housing?

Supporting Questions

1. Which cultural and spatial principles of the Mahalleh are most relevant to current Iranian housing challenges?
2. How can generative AI tools be guided to apply these principles to conceptual results?
3. What are the advantages and drawbacks of AI-generated images when tested with culturally informed evaluation criteria?
4. How does human–AI interaction (prompt engineering, refining, critical selection) impact the results?
5. How can AI be used heritage-informed design as a conceptual partner, rather than a replacement for architectural practice?

These questions are addressed through a conceptual and exploratory framework, emphasizing critical testing of AI's capacity and boundaries rather than the production of resolved architectural design.

1.5 Scope and Limitations

This research is situated at the **conceptual design stage**. Its scope is deliberately limited to exploring the **reinterpretation of vernacular principles** within the framework of vertical housing using generative AI tools. The focus lies not on producing technical drawings or construction-ready proposals, but on testing the capacity of AI to generate imagery that can be critically assessed against cultural and architectural benchmarks.

Scope

- Concentrates on the Iranian *Mahalleh* as a case of socio-spatial and cultural heritage.
- Employs **MidJourney** as the primary generative AI platform, used to produce conceptual images.
- Frames the outputs as **conceptual provocations**, suitable for evaluation but not as finalized design solutions.

Limitations

- AI outputs remain at the level of atmospheric imagery, lacking architectural drawings such as plans or sections.
- Results depend heavily on the quality and specificity of inputs (prompts and reference images).
- Findings are tool-specific and cannot be generalized to all AI platforms.
- The evaluation framework is qualitative, and although grounded in literature, it remains subject to interpretive judgment.

By acknowledging these boundaries, the research maintains a critical and experimental stance, emphasizing that AI is treated here as a conceptual collaborator rather than a comprehensive design solution. **The ambit is therefore self-consciously limited to speculative experimentation, with the intent of presenting the work as an experiment in exploring limits, rather than a prescriptive design exercise.**

1.6 Structure of the Thesis

The thesis includes six chapters:

- **Chapter 1 – Introduction**
  Establishes background, research issue, purposes, goals, and questions, and sets the scope and boundaries of the study.
- **Chapter 2 – Methodology**
  Describes the research strategy, data gathering, prompt engineering pipeline, evaluation system, and methodological constraints. The chapter offers the experimental basis for the design exploration.
- **Chapter 3 – Theoretical and Cultural Background**
  Explores the Iranian Mahalleh as a socio-spatial system, surveys vernacular housing concepts, establishes Iranian housing issues of the modern day, and situates the study into the reinterpretation debate and the new role of AI in architecture.
- **Chapter 4 – Testing AI in the Conceptual Reinterpretation**
  Introduces the design experiment, including the iterative process for the generation of AI outputs, results categorization, and synthesis of final conceptual images.
- **Chapter 5 – Discussion and Critical Reflections**
  Provides critical analysis of the outcomes, organized in the form of analytical tables and interpretive discussion, highlighting the advantages and limitations of AI in reinterpreting the Mahalleh.
- **Chapter 6 – Conclusion**
  Summarizes the main findings, explains the limitations of the research, and gives possible future research opportunities in heritage-informed architectural design and AI-assisted methods.

https://www.reddit.com/r/ProIran/
The Tabatabai house - Yazd/Iran

2 / Methodology

2.1 Introduction to the Chapter

This chapter outlines the methodological direction followed in this research. The study was not aimed at producing technical or buildable architectural proposals, but at conducting a conceptual and critical exploration. The primary question was the degree to which generative Artificial Intelligence (AI) might reinterpret the principles of the Iranian Mahalleh when projected onto a vertical high-rise context.

Following this, the methodology combines three primary components:

1. An experimental research approach, whereby iterative exploration and critical reflection operated in tandem.

2. The use of generative AI tools as conceptual partners, rather than substitutes for architectural reasoning.

3. A rigorous evaluation framework to assess outputs against culturally and contextually derived criteria.

The research approach, the data sources, the prompt engineering process, the evaluation framework, and the limitations of the method are described in the following sections.

2.2 Research Approach

This work employs a qualitative, conceptually informed research method within the field of experimental architectural inquiry. The focus is not on producing executable designs, but on conducting a controlled investigation into the capabilities and limitations of generative AI in the context of heritage-inspired architectural thinking.

The approach consisted of three interlinked levels:

- **Heritage-informed grounding**: Concepts of the Iranian Mahalleh — such as spatial hierarchy, introversion, community living, and environmental responsiveness — were uncovered in empirical studies and used as conceptual points of reference.
- **AI-assisted design generation**: The selected AI platform was used to generate iterative visual outputs based on well-prepared text and image inputs. AI acted as an exploratory partner, allowing for rapid speculation but not generating solved architecture solutions.
- **Critical human mediation**: The process remained reflexive and iterative. Outputs were constantly reviewed, constraints were defined, and prompts were rewritten by the researcher. Back-and-forth negotiation was critical to maintain cultural and architectural coherence.

This methodology aligns with experimental research traditions, but prioritizing AI as a means of **testing boundaries and stimulating consideration** rather than a provider of architectural answers.

2.3 Data Collection and Case Selection

The gathering of data in this research combined theoretical sources, visual material, and a contemporary case study for the purposes of creating a firm foundation for the AI-assisted conceptual experiment.

1. **Theoretical and cultural sources**
   Concepts of the Iranian Mahalleh were adapted from scholarly writings on vernacular urban form and urban morphology (e.g., Ardalan & Bakhtiar, 1973; Fathy, 1986; Habibi, 2000). Critical features such as spatial hierarchy, privacy thresholds, communal spaces, and climate adaptive measures were filtered and then applied to the assessment framework.

2. **Visual references**
   A collection of architectural images was assembled, including pictures and drawings of Iranian courtyard houses, alleys, iwans, domes, windcatchers, and urban clusters. These were employed as visual points of reference for guiding AI prompts so that reinterpretations of the traditional components were culturally meaningful even when used in vertical contexts.

3. **Case study context**
   As a contemporary source, a Tehran high-rise building complex, the Aseman Complex, was utilized. The choice was an expression of the struggle between residential high-density and cultural identity absence. The example was not treated as a design model, but as a contextual setting in which the reinterpretation exercise could be inserted.

All these sources ensured that the AI experiment remained grounded in recorded cultural knowledge, visual data, and real urban conditions, rather than arbitrary image generation.

2.4 Prompt Engineering and Iterative Workflow

The experiment was conducted in an iterative prompt engineering process, in which text and image inputs were carefully developed, tested, and modified to guide the AI outputs.

1. **Initial prompt construction**
   Prompts were developed by pairing descriptive language of Iranian vernacular elements (e.g., courtyard, iwan, brick façade, windcatcher) with spatial conditions relevant to high-rise housing (e.g., vertical clusters, stacked neighborhoods). The goal was to generate hybrid imagery juxtaposing traditional cues with vertical forms.

2. **Visual conditioning**
   Few reference images of traditional architecture were inserted every now and then to anchor the outputs towards culturally readable motifs. These visual datasets acted as a corrective against the AI reverting to generic or purely futuristic imagery.

3. **Iterative refinement**
   Outputs were rarely acceptable in their first version. Each cycle required critical human intervention:

   - **Diagnosing errors** (e.g., loss of hierarchy, incoherent circulation, distorted scales**)**.
   - **Reframing prompts** with added constraints or clarifications.
   - **Re-running the process** until images reached a level of cultural and architectural legibility.

4. **Role of the designer**
   The iterative process highlighted the mediating role of human judgment. The researcher's judgment had a key role in steering AI towards significant outcomes and in distinguishing between superficial similarity and genuine re-interpretation of principles.

Through this iterative process, the AI output was refined from crude approximations to material suitable for structured evaluation. The process itself became a central aspect of the methodology, demonstrating both the experimental potential and the inherent limitations of generative AI.

2.5 Evaluation Framework

In order to establish the AI-generated outcomes, a systematic assessment system was devised. It was not supposed to verify architectural validity in technical or constructional applications, but to examine to what extent the outcomes reflected the principles of the Iranian Mahalleh when translated into the framework of vertical housing context.

The system was informed by Chapter 3 theoretical analysis alongside tried-and-tested literature regarding vernacular and heritage-informed design (Ardalan & Bakhtiar, 1973; Fathy, 1986; Habibi, 2000; ICOMOS, 2013; UNESCO, 2021). It interpreted cultural and spatial considerations into eight measurable categories, grouped under three broad domains:

- **Socio-spatial order**: spatial hierarchy, introversion & privacy, communal/social life
- **Environmental responsiveness**: climate adaptation, natural ventilation, material expression
- **Cultural-symbolic continuity**: identity, ornament, coherence, urban presence

In these categories, the eight were defined as:

1. Spatial Hierarchy
2. Introversion & Privacy
3. Communal Life & Social Cohesion
4. Environmental Responsiveness
5. Symbolic & Aesthetic Features
6. Functional & Circulatory Logic
7. Human Scale & Proportion
8. Overall Urban Identity

The AI responses were then compared against these categories and marked off as achieved, partially achieved, not achieved, or not observable. This process ensured that analysis went beyond surface impressions and struggled with questions of deeper cultural continuity, spatial logic, and architectural plausibility.

2.6 Limitations of the Method

There were some limitations on the scope and direction of this work. These restrictions were not employed as weaknesses to be concealed behind, but as being integral to the critical process of the project.

1. **Conceptual, not technical, outputs**
   The generative AI produces atmospheric pictures but not drawings of architecture in the guise of plans, sections, or building specifications. The project was therefore intentionally conceptual and at a level of speculative exploration, rather than technical resolution.

2. **Reliance on input quality**
   The capacity of the AI to produce culturally relevant imagery relied mostly on the accuracy of prompts and data sets. Inputs needed to be laboriously prepared, polished, and reworked, underscoring the tool's narrow interpretive capabilities and the need for human guidance.

3. **Ambiguity of results**
   In general, outputs were ambiguous concerning spatial reason, size, or function. This generally made it irresolvable to ascertain whether certain principles had been achieved, and thus certain categories were scored as non-observable in checking.

4. **Non-replicability across tools**
   MidJourney was the focus of the study. Different platforms will yield different results, and thus results must be interpreted as being specific to a tool and not generalizable across all.

These limitations indicate that the project was not designed as a preservation method nor a concluded architectural form but as a critical experiment testing the boundaries of generative AI when confronted with culture-based architectural principles. It was not coincidentally that these boundaries were known but were inherent to the research itself.

Closing Remark

This chapter outlined the research methodological framework. It combined heritage-informed principles, AI-assisted design generation, iterative refinement of prompts, and a systematic evaluation. The approach was intentionally set at the conceptual investigation level, being aware of the possibilities and the constraints of generative AI.

The methodology led to the experimental process presented in Chapter 4, where iterative process and assessment framework were employed to explore how much AI was capable of engaging with the socio-spatiality of the Mahalleh within the context of a vertical housing.

https://whc.unesco.org/en/documents/158106
Yazd/Iran

3 / Theoretical and Cultural Background

3.1 Introduction to the Chapter

This chapter establishes the study's theoretical and cultural context. The research is founded on the belief that Iranian traditional neighborhoods, or Mahallehs, were not merely spatial structures but socio-cultural systems that fostered privacy, social integration, and environmental responsiveness (Ardalan & Bakhtiar, 1973; Habibi, 2000). Conversely, much of the high-rise housing in Iranian cities today tends to create placeless settings that overlook these values, provoking urgent questions regarding cultural continuity and identity in urban living (Carmona, 2010).

The chapter is divided into two parts. The first section explains the Mahalleh as a vernacular system of spatial hierarchy, social interaction, and climate-responsive design. It focuses on principles embedded in traditional housing typologies such as courtyard houses and narrow alleys that both maintained cultural identity and environmental sustainability (Fathy, 1986). Part two places these principles within contemporary architectural and heritage theory, wherein reinterpretation rather than preservation is identified as a major strategy. International charters, including the ICOMOS Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage (2013) and UNESCO's Culture 2030 Indicators (2021), emphasize the requirement to inscribe cultural values within present contexts without resorting to literal reproduction.

Finally, the chapter introduces the new role of Artificial Intelligence (AI) in architectural research. Rather than thinking of AI as a substitute for the architect, this research positions it as a conceptual and exploratory collaborator, with the potential to generate speculative imagery that can be critically assessed in terms of vernacular principles. The meeting point between Mahalleh traditions and experimentation via AI defines the principal research question: how can generative AI contribute towards reimagining socio-spatial logics in vertical housing?

3.2 The Iranian Mahalleh as a Socio-Spatial System

Iranian urbanism's Mahalleh was greater than a subdivision of area; it was a socio-spatial entity that structured daily life by structuring on bases of hierarchy, privacy, and social intercourse. Researchers describe the Mahalleh as functioning as a physical entity, a social collectivity, and a cultural signifier (Habibi, 2000; Madanipour, 1998). The Mahalleh morphology emerged from including religious, social, and environmental factors, thus creating a stratified city fabric whose form articulated collective values.

Spatial hierarchy

One of the typical principles of Mahalleh was grading from public to private space. Access generally followed from public areas such as bazaars, mosques, and principal alleys, into semi-public areas such as neighborly courtyards or hammams, and terminated in private areas within residential clusters (Ardalan & Bakhtiar, 1973). This grading allowed for social order as well as for the sheltering of domestic life.

Introversion and privacy

Most closely identified with hierarchy was the introversion principle. Living spaces were oriented inward, organized around inner courtyards, and separated from the street by intermediate thresholds. Introverted morphology accommodated privacy, an Iranian home-based cultural desire highly institutionalized (Memarian & Brown, 2006).

Communal life and social cohesion

The Mahalleh also offered proximate social relationships. Intersecting courtyards, narrow alleys (koocheh), and intervening public spaces created daily contact and interconnection among the residents (Habibi, 2000). The spaces created what Madanipour (1998) calls "an architecture of encounter," solidifying both solidarity and informal domination at the local scale.

Environmental responsiveness

Finally, the Mahalleh was an adaptive response to the climate. The narrow streets, curved alleys received maximum shade, courtyards provided passive cooling, and architectural elements such as windcatchers (badgirs) permitted greater natural ventilation (Fathy, 1986; Bahadori, 1978). Thermal massing was provided by materials such as adobe and brick that made the surrounding area comfortable even in harsh climatic conditions.

On that note, the Mahalleh would be defined as a multi-layered socio-spatial system where cultural, social, and environmental principles were interrelated. These are conceptual points of reference for the analytical framework employed within this study, particularly in determining how heritage-informed principles are translatable through AI-generated imagery.

3.3 Traditional Housing Typologies and Vernacular Principles

Central to Iranian urban morphology, the courtyard house was the fundamental building unit of the Mahalleh and the dwelling. This typology, fully documented in works on Islamic and Middle Eastern architecture, is a manifestation of a synthesis of cultural values, environmental adaptation, and social organization (Ardalan & Bakhtiar, 1973; Fathy, 1986; Memarian, 1998).

The courtyard as a spatial core

The courtyard (hayat) was the focal point of the traditional house, organising the plan on a sheltered open space. Rooms tended to be disposed on all four sides, to achieve a balance between openness and shelter. The courtyard functioned not only as an intermediary zone between private life and public life but also regulated the microclimate by enabling ventilation and shading (Edwards et al., 2006).

Introverted morphology

Iranian homes were generally inward-facing, with minimal street-facing openings and carefully regulated thresholds. This inward orientation ensured privacy of the household as well as ensured climatic comfort by reducing direct sunshine exposure (Memarian & Brown, 2006).

Key architectural elements

- **Iwan:** A vaulted semi-public area that serves as an intermediate space between interior and courtyard.
- **Badgir (windcatcher):** A vertical pipe to capture and direct airflow into the interior spaces for passive cooling (Bahadori, 1978).
- **Koocheh (narrow alley):** Exterior circulation defined that provided shade and led to close urban spaces.
- **Materiality:** Use of adobe, brick, and wood provided thermal regulation and cultural continuity.

Integration with neighborhood fabric

The courtyard house was not typologically distinct but part of a greater socio-spatial configuration. Clusters of houses were built with shared walls and courtyards that in turn opened up into half-public spaces leading to the public centre of the Mahalleh. The multi-layered integration served to maximise both social integration and readability of space (Habibi, 2000).

On the whole, therefore, there existed a popular wisdom in pre-Modern Iranian dwellings which in one sense addressed social order, cultural values, and environmental adaptation. These typologies, so embedded in historicity, provide conceptual analogs to be read and reinterpreted in contemporary analytical frameworks, making possible to critically consider the housing's cultural and spatial rationalities.

3.4 Contemporary Challenges in Iranian Housing

The recent urbanization trend in Iran has arrived as high-rise high-speed development, particularly in large metropolitan regions such as Tehran, Mashhad, and Isfahan. Triggered by population growth, land scarcity, and speculative property markets, the trend has led to the proliferation of homogenized flat block buildings with complete disregard for cultural identity and environmentalism (Habibi & Deffner, 2016; Madanipour, 2006).

Loss of cultural identity

Differing from traditional neighborhoods, with symbolic hints and recognized forms, most contemporary housing estates adopt standardized layouts and facades, generating what Relph (1976) calls placelessness. Vernacular reference absence results in environments thought of as being alien to local residents.

Erosion of social cohesion

High buildings lack middle-level semi-public spaces like courtyards, alleys, or shared terraces. This diminishes the possibility of daily interaction and weakens the shared social bonds that once characterized the Mahalleh (Madanipour, 2003). This leaves residents socially disconnected despite physical proximity.

Neglect of environmental responsiveness

Contemporary construction often underutilizes vernacular climate-control techniques in favor of mechanical systems. The result is higher energy consumption and lowered environmental comfort compared to that of traditional courtyard-type residences (Givoni, 1994).

Fragmented spatial hierarchy

The clear gradation from public to private that arranged Iranian neighborhoods no longer exists. Contemporary apartment complexes typically combine circulation with semi-private areas, eliminating subtle thresholds and reducing spatial legibility (Soltanzadeh, 2012).

Summary

Contemporary Iranian housing thus also faces complex challenges of cultural disconnection, social breakdown, and environmental ineffectiveness. These situations underscore the need to explore conceptual models that critically re-engage with principles of vernacularism against the backdrop of inescapable vertical urbanism.

3.5 Reinterpretation vs. Preservation in Architectural Discourse

In architectural terminology, reinterpretation and preservation need to be distinguished. Preservation is concerned with the safeguarding of existing physical heritage through conservation and restoration techniques towards material authenticity preservation of monuments and historic fabrics (Jokilehto, 1999; ICOMOS, 2013). Reinterpretation means drawing inspiration from cultural rules and spatial reasons without imitating their material form, situating them in contemporary conditions (UNESCO, 2021).

Preservation

Practice of conservation is concerned with authenticity, integrity, and conservation of material heritage. It is guided by international charters such as the Venice Charter (1964) and the Nara Document on Authenticity (1994). These are required for historic monuments and sites, but not within the scope of this thesis.

Reinterpretation

Reinterpretation operates in the realm of contemporary discourse. It seeks to recover abstract values — spatial order, community way of life, environmental tolerance — and to think about how these can be approached sensibly in contemporary contexts. For them, authors claim heritage-inspired design does not preserve buildings but enables culture memory and identity in contemporary situations (Ardalan & Bakhtiar, 1973; Fathy, 1986).

Position of this research

The thesis situates itself directly within the tradition of reinterpretation. It is not meant to conserve or to replicate historic Mahallehs, but to address how far their socio-spatial teachings can be of use in understanding vertical housing contexts. AI is thereby situated not as a tool of conservation but as intellectual collaborator in producing speculative research.

By putting reinterpretation first, the project aligns with existing heritage discourse that views cultural values as dynamic assets for creative innovation rather than static artifacts to be preserved.

3.6 Artificial Intelligence in Architecture: Potentials and Debates

Artificial Intelligence (AI) has now emerged in architectural discourse as a design generation tool, as well as the subject of critical debate. Its uses are diverse: generative image and form creation, performance simulation, design optimization, and urban-scale data analysis (Burry, 2020; Huang & Zheng, 2022). Yet its role in culturally aware or heritage-informed design remains poorly interrogated.

Potentials

AI offers particular advantages in early-stage conceptual exploration:

- **Generative capacity**: programs such as MidJourney, DALL·E, and Stable Diffusion are able to rapidly produce vast numbers of visual hypotheses, accelerating early concept exploration (Colton & Wiggins, 2012).
- **Speculative imagery**: AI excels at the creation of evocative and symbolic imagery that stimulates architectural imagination (Celani & Vaz, 2023).
- **Cross-disciplinary integration**: AI is able to engage with BIM systems, environmental simulators, and optimization techniques in order to further the design process (Burry, 2020).

Debates and criticisms

While observing these potentialities, critics emphasize key limitations:

- **Superficiality of outputs**: AI generative only reiterates fragments of aesthetics and not an overall spatial reasonableness (Carpo, 2021).
- **Bias and control**: Outputs depend heavily on prompt crafting and data quality, as making human intervention inevitable (Celani & Vaz, 2023).
- **Risk of cultural homogenization**: AI, if utilized uncritically, reproduces standardized globalized aesthetics, but at the cost of cultural specificity (Carpo, 2021).

Position of this research

This thesis is conservative in nature, positioning AI neither as an autonomous designer nor as a conceptual partner. Its role is exactly set at the conceptual inquiry level, where it can generate hypothetical images to be critically evaluated against whatever socio-spatial and cultural needs of the Iranian Mahalleh. In this case, AI is treated as a probe for boundaries and not as a source for generating architecture solutions.

3.7 Framing the Research Question

Theoretical background presented here identifies three critical dimensions. First, the Iranian Mahalleh embodied socio-spatial ideals of hierarchy, privacy, community living, and environmental accommodation characteristic of traditional residential life. Secondly, contemporary housing in Iran has largely abandoned such values, leading to placeless high-rise buildings characteristic of social disintegration and cultural disconnection. Thirdly, in architectural theory, reinterpretation and not preservation provides the most productive context for engaging with heritage in contemporary architecture.

Parallel to this is the emergence of Artificial Intelligence and its double promise of promise and challenge to architecture. Generative tools, by expanding conceptual exploration and providing speculative images, are short of creating coherent spatial or technical solutions. This duality makes AI a conceptual collaborator — a testing site for boundaries and not a design problem-solving partner.

Under these circumstances, the principal research question is thus stated as follows:

To what extent, and with what restrictions, can generative Artificial Intelligence redraw the socio-spatial maxims of the Iranian Mahalleh in the new context of vertical habitation?

This question relates the background theory to the following methodological framework. The following chapter provides a detailed description of the research design, the experiment nature of AI, and the criteria of evaluation on which the output generated was critically assessed.

4 / Testing AI in the Conceptual Reinterpretation

4.1 Introduction to the Chapter

In this chapter, the design development process is introduced wherein generative Artificial Intelligence (AI) acted as a collaborator to reinterpret the Iranian Mahalleh in the context of living in modern-day high-rise buildings. It was not a goal to produce a finished architectural project but to probe and test whether a remodeled Mahalleh, verticalized in thought, might be articulated conceptually, showing the promise as well as the limitations of AI in handling culturally rooted notions. This trajectory was motivated by a growing tension between the spatial and social values of traditional neighborhood—hierarchy, privacy, and collective interaction—and the reality of Iranian city vertical densification in the present.

The use of AI in the process was exploratory and supportive, not determinative. Even though the resources possessed the ability to generate culturally evocative images, they were dependent on human guidance, rigorous curation, and modification to maintain architectural and cultural continuity.

The chapter is structured through five stages:

1. **Data Gathering** – collecting theoretical, cultural, and architectural references.
2. **Prompt Engineering** – converting this information into AI-readable forms.
3. **Design Generation and Evaluation** – generating conceptual results and evaluating the architectural applicability of them.
4. **Iterative Refinement** – overcoming deficiencies through selective inputs and feedback.
5. **Final Synthesis** – leading selected outcomes into conceptual investigations of a vertical neighbourhood.

This chapter therefore presents no technical solution but an exploratory test of how AI can engage with heritage-informed principles to stimulate design thinking in a high-rise typology.

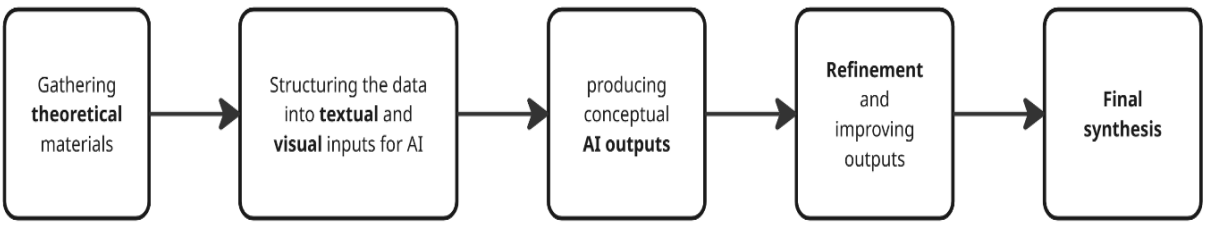

Figure 1: The structure of exploratory testing AI in conceptual reinterpretation

4.1.1 Objectives and Scope of the Chapter

The objective of this chapter is to present the project's development pathway as a structured sequence of interconnected stages, highlighting how generative AI was employed as **a collaborator in conceptual exploration** rather than as a solution for heritage preservation. The focus is not on safeguarding cultural heritage in the strict disciplinary sense, but rather on testing how traditional Iranian neighbourhood principles—such as spatial hierarchy, introversion, climatic adaptation, and social logic—can be reinterpreted within the vertical framework of a high-rise residential context.

The scope of the chapter is therefore twofold:

1. **Analytical** – to demonstrate how cultural and architectural knowledge derived from Iranian urban heritage can be translated into datasets and prompts that inform AI tools.
2. **Exploratory** – to evaluate the capacity and limitations of AI in generating conceptual outcomes that recall vernacular logics while adapting them to contemporary spatial and technical conditions.

This chapter does not claim to achieve architectural preservation in its conventional meaning. Instead, it positions AI-driven experimentation as a speculative and critical method for reimagining cultural principles in modern design scenarios. In this way, the work frames AI not as an autonomous author, but as a collaborator that extends the designer's ability to explore complex cultural-architectural relationships.

4.1.2 Overview of the Conceptual Exploration Process and the Role of Artificial Intelligence

Concept design was a procedure that was developed in this thesis that combines selected Iranian neighbourhood typological principles (Mahalleh) with the generative power of AI technology. The procedure is envisioned as a human–AI collaboration: the architect formulates cultural and architectural agendas, selects information, and designs prompts, and the AI provides quick visual results that can be critically assessed, refined, and personalized.

In this case, AI is neither a substitute for architectural practice nor a preservative against heritage loss. Instead, it serves an exploratory role: one that probes the boundaries of how far computational models can reinterpret recessive forms, spatial hierarchies, communal logics, and climatic responsiveness when projected onto the vertical axis of a high-rise tower.

By generating conceptual imagery, AI enables the designer to explore different scenarios cost-effectively and to reveal the promise as well as the limitations of blending vernacular conceptions with typologies in present times.

Concurrently, the methodology is recognizing the limitations of AI. The software used in this thesis cannot generate architectural plans, sections, or building details. Their results are still at the conceptual and graphical level with no provision to either implement or finalize them without continuous human review and correction for cultural appropriateness and spatial consistency. The process is still very much within human control, with AI acting as a generator of ideas and not as an independent decision-maker.

4.1.3 Structure and Roadmap of the Chapter

The chapter is structured to mirror the project's sequential process, starting from initial data collection procedures to the final synthesis of conceptual outcomes. Every section mirrors a main step within the design process and encloses the interface between human choice-making and AI-driven experimentation.

1. **Data Collection and Prompt Engineering (Section 4.2)** – Conceptual and project-based datasets are collected and converted into formatted prompts, which will be used to guide AI models.
2. **AI-Driven Conceptual Outcomes (Section 4.3)** – Prototypes are generated, classified, and critically examined in an attempt to determine the degree to which they satisfy spatial, cultural, and environmental needs.
3. **Refinement and Improvement of AI Outputs (Section 4.4)** – Gaps are closed, inputs are supplemented, and targeted approaches are tried for improvements in cultural and spatial coherence through iterative procedures.
4. **Discussion of Conceptual Exploratory Outcomes (Section 4.5)** – The book concludes with a synthesis of findings, keeping in mind the potential as well as the limitations of AI as a collaborator in the scenario of vertical reinterpretations of the Mahalleh.

This plan ensures that the chapter unfolds in a clear and sensible sequence so that the reader can track how cultural principles, computational experimentation, and iterative refinement coalesce into an integrated set of conceptual explorations.

4.2 Data Collection and Prompt Engineering

The foundation of the process of conceptual design lies in the careful choice of data and its translation into correct, AI-usable prompts. Data collection during this project was organized in two complementary paths:

1. conceptual heritage-based references
2. project-specific empirical parameters.

These were subsequently integrated using a formal process of prompt engineering, which transformed the datasets into instructions capable of guiding AI tools towards contextually relevant conceptual outcomes.

This phase was not to be a replication of architectural technical precision (e.g., plans, sections, building details), but to measure the capability of AI in producing conceptual images considering spatial and cultural values. By maintaining the task within the limits of the conceptual design phase, the study ensured alignment with the larger aim of exploring AI as a collaborator in conceptual investigation in architecture without overemphasizing its role for heritage preservation.

The following sub-sections outline the same step-by-step:

- **4.2.1 Conceptual Data Collection** – Selection of cultural, architectural, and heritage-based references.
- **4.2.2 Project-Specific Data Collection** – Integration of site-specific and functional parameters from the chosen case study.
- **4.2.3 Prompt Engineering** – Development of strategies to combine textual and visual data into effective AI inputs.
- **4.2.4 Prompt Formulation and Final Prompt** – Construction of the final structured prompts that guided the generation of conceptual outputs.

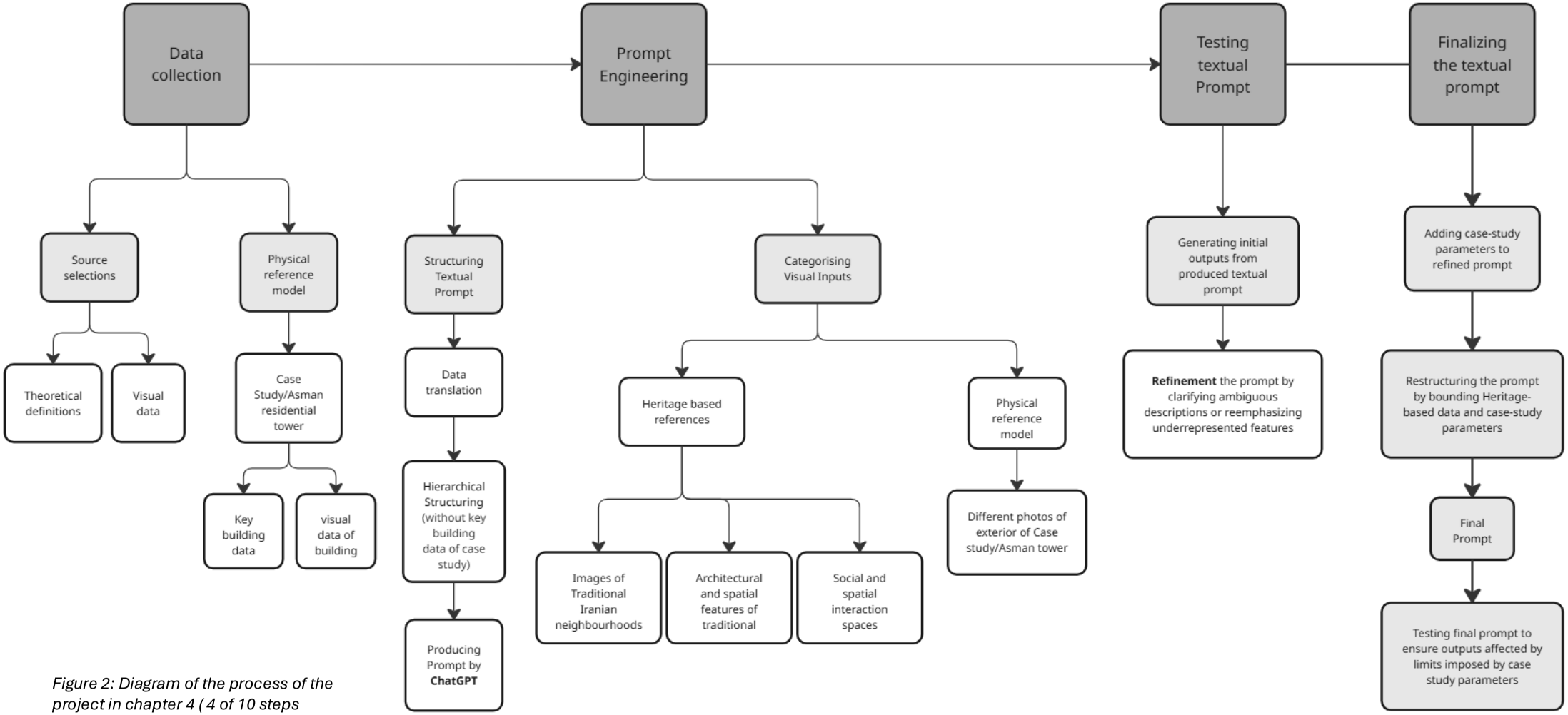

Figure 2: Diagram of the process of the project in chapter 4 (4 of 10 steps covered in section 4.2)

4.2.1 Conceptual Data Collection

Conceptual and Textual Evidence

The first operational phase of the project involved the consolidation of conceptual and textual evidence to establish the structure, culture, and environmental logic of the traditional Iranian Mahalleh. The intention was to develop a robust knowledge base that would subsequently be used to guide AI-supported design exploration, not preservation, but reinterpretation of vernacular principles in a vertical high-rise framework.

Step 1 – Source Selection

Broad literature survey was conducted in Persian and English, targeting authoritative resources such as seminal books on Iranian vernacular architecture, journal articles from peer-reviewed journals, and ancient treatises.

Criteria for selection were:

- Direct relevance to Mahalleh spatial organization and social dynamics
- Clear documentation of environmental adaptations and symbolic elements
- Proven scholarly credibility and architectural detail

Step 2 – Thematic Categorization

Data drawn were sorted into three structured datasets:

1. **Traditional Neighbourhood Concepts** – Definitions and concepts of social fabric, hierarchical spatial structure, norms of privacy, and cultural symbolism of the Mahalleh.
2. **Architectural Features of Traditional Houses** – Typologies, building methods, climatic devices including windcatchers (Badgirs) and thermal mass, and general internal spatial configurations.
3. **Key Neighbourhood Elements and Indicators** – Common urban elements such as narrow alleys (Koocheh), communal meeting points, religious/commercial hubs, and circulation patterns facilitating community interaction.

Visual Data Collection and Categorization

Following the written and conceptual introduction, the following was to develop a visual proof base to establish and authenticate the knowledge structure. This assured that AI output remained rooted not only in descriptive writing but also on real photographic evidence.

Step 1 – Image Acquisition

High-quality visual content was gathered from different sources, such as:

- Historical photos of Tehran, Isfahan, Yazd and Shiraz historic neighborhoods

- Repositories of fieldwork-procedure images and academic libraries

Technical drawings and analytical diagrams were explicitly not covered, since the AI applications used (e.g., MidJourney) will only accept photographic or photorealistic input.

Step 2 – Thematic Organization
Composite images were consistently classified into three categories for maximum utilization of AI prompting:

1. **Traditional Iranian Neighbourhoods**:

   general views of historic urban fabric, street patterns, alleys (Koocheh), and small squares; open areas such as mosques, bazaars, and civic spaces.

2. **Architectural and Spatial Features of Traditional Houses**:

   courtyards, iwans, gateway entries, wooden doors, threshold ornamentation; climatic devices (windcatchers, shading, water features); building material (brickwork, tilework, adobe).

3. **Social and Spatial Interaction Spaces**:

   semi-public courtyards, shared terraces, shared access paths; intermediary spaces between private, semi-public, and public space; spaces for assembly and routine exchange.

4.2.2 Project-Specific Data Collection

With the heritage knowledge base established, the second stream of data collection focused on anchoring the design exploration in real-world architectural parameters. The **Aseman Tower** in Tehran was selected as the project's physical reference model, providing a tangible high-rise context in which to reinterpret the Mahalleh.

Step 1 – Case Study Selection
The Aseman Tower was chosen due to its scale (approx. 100 m height, 37 floors, 104 units), its urban location, and its typological relevance as a vertical residential complex in Iran. This selection ensured that the vertical Mahalleh concept would be tested within a plausible, context-specific framework.

Step 2 – Empirical Data Gathering
Key building data were collected through architectural documentation, public records, and spatial analysis:

- **Dimensions**:

  Total height, floor count, floorplate proportions
- **Unit Configuration**:

  Distribution of residential, commercial, and administrative spaces
- **Population Estimates**:

  Based on unit count and average household size
- **Functional Zoning**:

  Allocation of private, semi-private, and public areas within the tower
- **Circulation Systems**:

  Vertical and horizontal paths (stairs, elevators, shared spaces, corridors)
- **Environmental Features**:

  Orientation, shading devices, natural ventilation strategies

Step 3 – Linking to Heritage Concepts
Each quantitative parameter was mapped against heritage-inspired spatial strategies from Section 4.2.1 and the visual dataset. For example:

- **Private zones** were related to courtyard-based privacy concepts.
- **Public/shared areas** were tested against traditional *Koocheh* and communal space models.
- **Circulation patterns** were compared to historic neighbourhood pedestrian flows.

Step 4 – Output for Next Stage

The result was a dimensionally and functionally defined design envelope. This dataset formed the measurable backbone for prompt engineering, ensuring that AI-generated designs would not only express cultural authenticity but also fit within real architectural limits.

4.2.3 Prompt Engineering

With both conceptual and heritage-based datasets prepared, the next step was the formulation of prompts—the textual and visual instructions used to direct the generative AI tools. Prompt engineering served as the translation layer between architectural knowledge and machine interpretation, ensuring that outputs remained responsive to cultural values while also being testable in controlled design scenarios.

The process unfolded in three stages:

1. Data Translation

- Cultural principles such as spatial hierarchy (private → semi-public → public), privacy gradients, communal courtyards, and vernacular climatic devices (e.g., windcatchers, thermal mass) were reformulated into clear descriptive text fragments.
- At this stage, project-specific parameters from the case study (Aseman Tower) were intentionally excluded. Prompts therefore described only the generic qualities of the traditional Mahalleh in order to test the AI's interpretive capacity without external constraints.

2. Hierarchical Structuring

- Prompts were organized from macro to micro: starting from the overall vision for a vertical reinterpretation of the Mahalleh, moving to mid-scale elements such as circulation logics, shared terraces, and façade compositions, and concluding at micro-level motifs such as decorative brickwork, iwans, and symbolic ornamentations.
- This hierarchical organization gave a framework to AI to venture various scales while ensuring internal consistency.

3. Iterative Testing and Refinement

- Initial outputs generated from these prompts were assessed for alignment with the cultural dataset.
- The absence of project-specific constraints resulted in outputs that were highly imaginative, often bordering on fantastical, and sometimes detached from architectural plausibility. This highlighted the critical role of embedding case-study parameters (such as building proportions, floor counts, and volumetric references) in later stages to discipline the creative process.
- Prompts were refined by clarifying ambiguous descriptions (e.g., "semi-public terraces as vertical courtyards") or by reemphasizing underrepresented features (e.g., climatic devices, shaded alleys).

Representative test outputs from this stage, generated without case study data, are inserted here

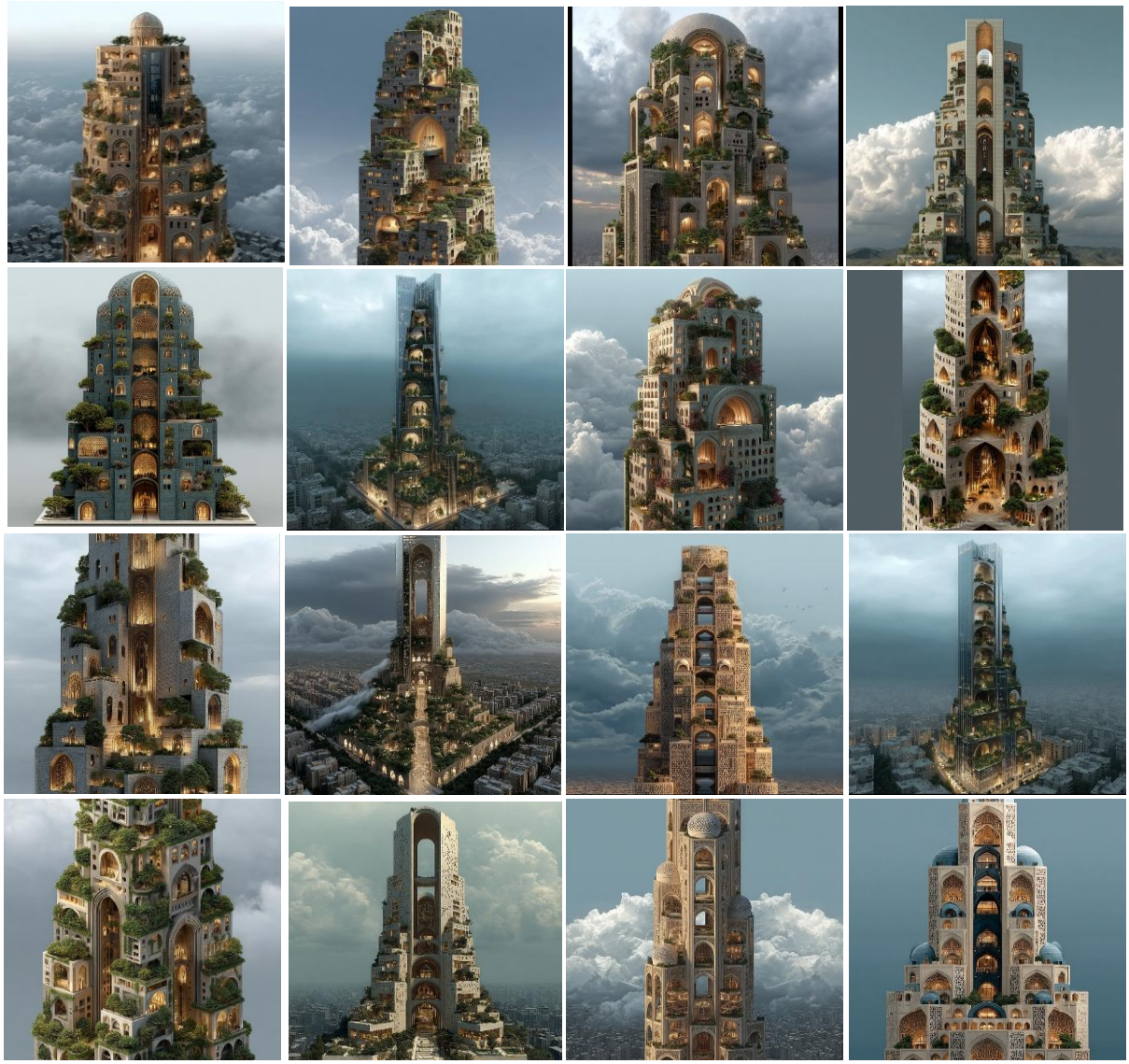

Figure 3: Outputs of testing prompt without case study data

In summary, this stage demonstrated that prompt engineering is not only a technical tool for guiding AI but also a design-thinking exercise for the researcher. By deliberately starting without the Asman Tower datasets, this step revealed the tendency of AI to produce unconstrained and speculative imagery—an important insight that reinforced the necessity of project-specific data integration in the subsequent stages.

4.2.4 Prompt Formulation and Final Prompt

Throughout this stage, the research shifted from exploratory testing to building of an integrated final prompt. Unlike in the first stage, when prompts were built with just conceptual heritage datasets alone, this step involved both cultural principles and project-based textual data that had been derived from the Aseman Tower case study.

Prompt Construction

- **Heritage-based inputs**: spatial hierarchy (private → semi-public → public), communal courtyards, narrow shaded alleys, iwans, symbolic detailing, and vernacular climatic strategies such as windcatchers and thermal mass.
- **Case-study parameters**: overall building height (~100 meters), number of floors (37), total number of units (104, residential, commercial, and administrative spaces), and mixed-use functional zoning.

By combining these two sets of inputs, the final prompt was developed in order to anchor the AI generation in both cultural identity and dimensional logic of a real high-rise building.

Final prompt:

"Create a conceptual design for a vertical traditional Iranian neighborhood integrated within a high-rise residential building inspired by the Asman Tower in Tehran, approximately 100 meters tall with 37 floors and around 104 total units including residential, commercial, and administrative spaces. The design should incorporate spatial, social, and cultural characteristics inherent in traditional Mahalleh neighborhoods, while preserving heritage values and addressing modern urban density challenges. The project should reflect a hierarchical spatial organization, featuring private courtyard houses arranged inwardly to ensure privacy, natural ventilation, family cohesion, multipurpose rooms, controlled access points, and flexible layouts accommodating extended families. Vertical and horizontal circulation systems should emulate traditional narrow shaded alleys (Koocheh) and cul-de-sacs (Bonbasts), fostering community interaction and secure, pedestrian-friendly movement within the building. A central mosque or religious gathering space must be integrated as the social and spiritual core, accompanied by bazaar-style commercial spaces supporting economic and social activities. Shared semi-private courtyards, terraces, and communal spaces across various floors should facilitate neighborly interactions, celebrations, and cultural rituals. Environmental adaptations, including windcatchers (Badgirs), thick thermal walls, and water features like pools or fountains, should be thoughtfully incorporated to respond to the local climate, enhancing comfort and sustainability. The building's exterior and interior must employ traditional Persian architectural symbolism, local or compatible materials, and spatial gradations reflecting privacy principles (Hefz-e-Hesiat) and social hierarchies inherent to Iranian culture. Access control and security measures should mirror the organic urban fabric of traditional neighborhoods, limiting entry points while maintaining openness and community integration. Overall, this conceptual project aims to propose a framework for reinterpreting Iranian architectural heritage within modern vertical urban housing, preserving collective identity, cultural symbolism, and social networks, while providing a realistic approach based on the dimensions, unit counts, and population estimates derived from the Asman Tower."

Representative outputs from the final prompt stage are inserted here

Figure 4: Outputs of final prompt by including Case-study parameters

Observed Outcomes

The integration of project-specific data imposed a level of constraint absent in the earlier stage. While outputs still bore traces of AI's speculative creativity, the results showed clearer alignment with realistic proportions and massing suitable for a vertical residential tower. Compared to the unconstrained imagery of the previous stage, the presence of Asman Tower data introduced a more plausible structural framework, resulting in designs that appeared closer to feasible architectural concepts.

Nonetheless, as no direct visual inputs of the case study were provided, the outputs were still somewhat abstracted and retained creative freedom. This confirmed both the strengths and the limitations of having only text-based inputs for project-based guidance: the AI could accurately estimate the ratios of a high-rise residential skyscraper but still wasn't capable of duplicating the building's architectural harmony that would be realized through the integration of photographic or visual data sets.

Significance

This step established that while datasets based on heritage functioned as cultural anchors, the inclusion of case-specific parameters was crucial for directing AI outputs towards architectural viability. Evolution from unbounded to partially bounded results highlighted the role of engineered textual data in directing generative design tools, setting the stage for even more advanced iterations in future steps.

4.3 AI-Driven Conceptual Outcomes

This section presents the **conceptual outputs generated by AI** based on the consolidated prompts prepared in the previous stage. The purpose here is not to treat these outputs as finalized designs, but rather as **exploratory artifacts**—visual hypotheses that reveal both the opportunities and the limitations of AI when applied to culturally sensitive architectural design.

The outcomes are grouped into three analytical layers:

1. **Exploratory Outputs**
    - Initial images that captured atmospheric qualities, spatial moods, and compositional rhythms.
    - These revealed AI's strength in generating diversity and speed but also exposed ambiguities in scale and spatial usability.
2. **Pattern-Driven Outputs**
    - Images where cultural motifs such as arches, courtyards, and vertical layering emerged more explicitly.
    - While these outputs reinforced the recognizable *aesthetic language* of Iranian heritage, they also demonstrated risks of *surface-level reproduction* without deeper functional integration.
3. **Hybrid Outputs**
    - Later iterations that successfully combined project constraints (e.g., tower footprint, height, and density) with vernacular cues.
    - These provided the most promising ground for critical reflection, as they suggested ways in which AI could *reinterpret* rather than merely replicate heritage forms.

A systematic **classification and critical analysis** of these outputs follows in the next subsection, where each category is examined in terms of cultural authenticity, spatial logic, and architectural viability.

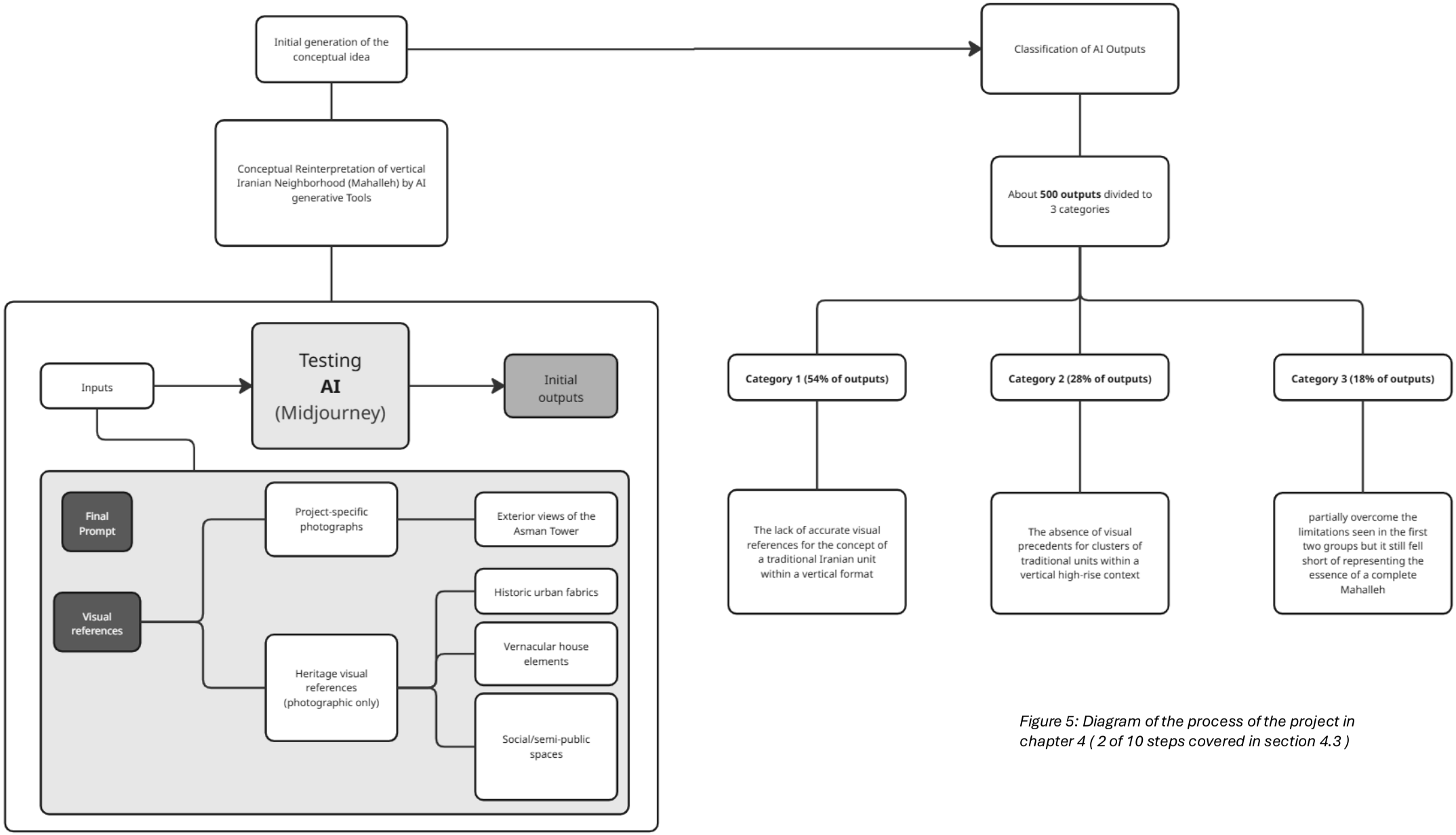

Figure 5: Diagram of the process of the project in chapter 4 (2 of 10 steps covered in section 4.3)

4.3.1 Overview of AI-Generated Outputs

Purpose and setup

This phase operationalized the curated inputs from Section 4.2 to produce concept images that *reinterpret* vernacular logics within a high-rise frame. The work is explicitly conceptual and does not claim to preserve cultural heritage; rather, it probes how vernacular cues can inform early-form finding under contemporary constraints.

Input package delivered to the AI.

- **Textual instructions.** The final prompt developed in Section 4.2.4 (vertical mahalleh; privacy gradients; koocheh-like circulation; environmental cues such as windcatchers and shading).
- **Heritage visual references (photographic only).**
    1. Historic urban fabrics (Tehran/Isfahan/Shiraz):

       koocheh patterns, neighbourhood squares, communal nodes.
    2. Vernacular house elements:

       courtyards, iwans, doors/thresholds, brick/tile textures, windcatchers.
    3. Social/semi-public settings:

       shared terraces, transitional zones, gathering spaces.

       Note: Diagrams, plans, and sections were **not** used as image inputs due to tool limitations; only photographs or photorealistic references were supplied.
- **Project-specific photographs (for scale/proportion only).** Exterior views of the Aseman Tower were included as volumetric/proportional benchmarks—not as architectural drawings—so that outputs remained plausibly scaled.

Generation platform and procedure. MidJourney was used to blend the unified prompt with the layered photo references. Multiple seeds and prompt-weight variations were issued per batch to explore breadth while keeping proportional cues anchored by the Aseman Tower photographs.

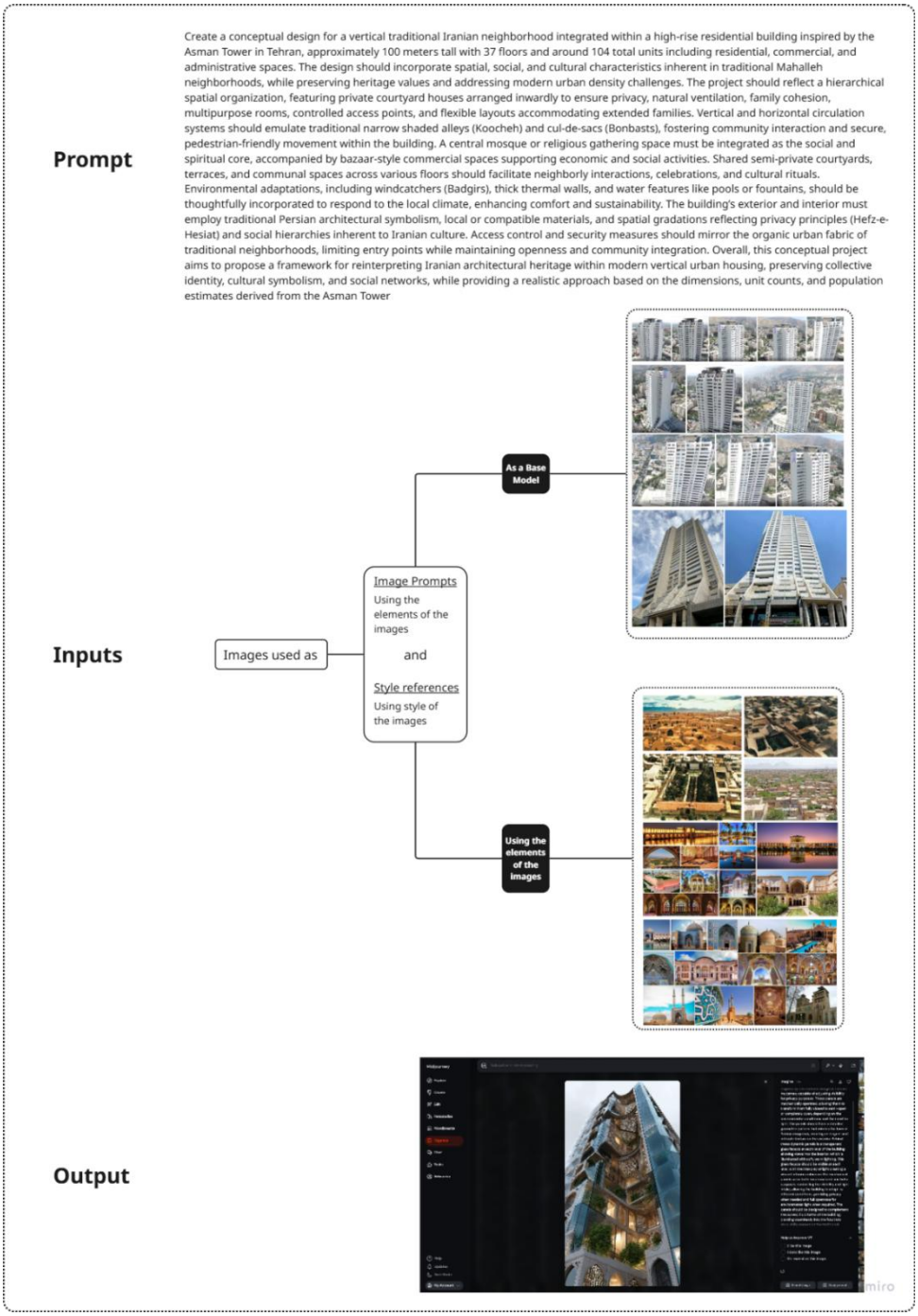

Figure 6: Generating initial conceptual outputs by using textual and visual inputs in Midjourney platform

Output scale and triage. Approximately 500 images were generated across iterative batches. A first-pass screening retained only those candidates that appeared minimally relevant—showing at least some recognizable vernacular cues, basic vertical plausibility (mass, stacking, circulation hints), or implied environmental strategies (porosity, shading, airflow voids). These filtered images were not considered successful outcomes but were preserved for analytical purposes. They formed the basis of the structured classification in Section 4.3.2, where their deficiencies were examined in detail.

4.3.2 Classification and Critical Analysis of AI Outputs

The AI-generated outputs were systematically grouped into three categories based on their ability to reference and reinterpret the core cultural and spatial characteristics of a traditional Iranian Mahalleh within a vertical high-rise context. However, the majority of these early results cannot be regarded as successful architectural propositions. Instead, they reveal the shortcomings of the AI, which—due to the absence of pre-existing visual references for critical design elements such as high-rise-integrated residential units or clustered neighborhood-like compositions—produced outputs that were incomplete, incoherent, or architecturally misleading. In this sense, the categories presented below function less as “types of success” and more as classifications of error, each highlighting a different way in which the AI failed to adequately translate vernacular principles into the vertical framework. This analytical breakdown makes clear why new, targeted datasets became necessary in subsequent iterations.

Category 1 – Fundamental Failure to Represent Traditional Units (54% of Outputs)
General Description
The largest group of AI-generated images—representing 54% of the total outputs—completely failed to capture the defining features of traditional Iranian residential architecture in a vertical context. Most designs resembled generic high-rise apartment blocks, with only superficial or inconsistent references to Mahalleh principles. These outcomes represent a clear error mode, where the absence of culturally grounded references caused the AI to revert to default, globalized imagery.

Key Deficiencies Identified

1. **Absence of core architectural characteristics:**

   central courtyards, windcatchers, iwans, and other signature features were omitted entirely or reduced to decorative motifs.

2. **Weak cultural symbolism:**

   façades rarely reflected Iranian ornamental motifs, brickwork, or tile patterns, resulting in limited cultural identity.

3. **Disrupted spatial hierarchy:**

   little evidence of gradation between private, semi-public, and public spaces; the layouts did not support the social dynamics typical of the Mahalleh.

4. **Unrealistic proportions and forms:**

   excessive vertical repetition and distorted geometries inconsistent with vernacular typologies.

Implications

This category highlights a structural limitation of the AI: without accurate visual precedents for traditional Iranian units within a vertical framework, the system defaulted to high-rise clichés devoid of cultural or spatial meaning. The outputs in this group are therefore not partial successes but fundamental failures, underscoring the necessity of creating targeted datasets to prevent the collapse into generic forms.

Representative images from Category 1

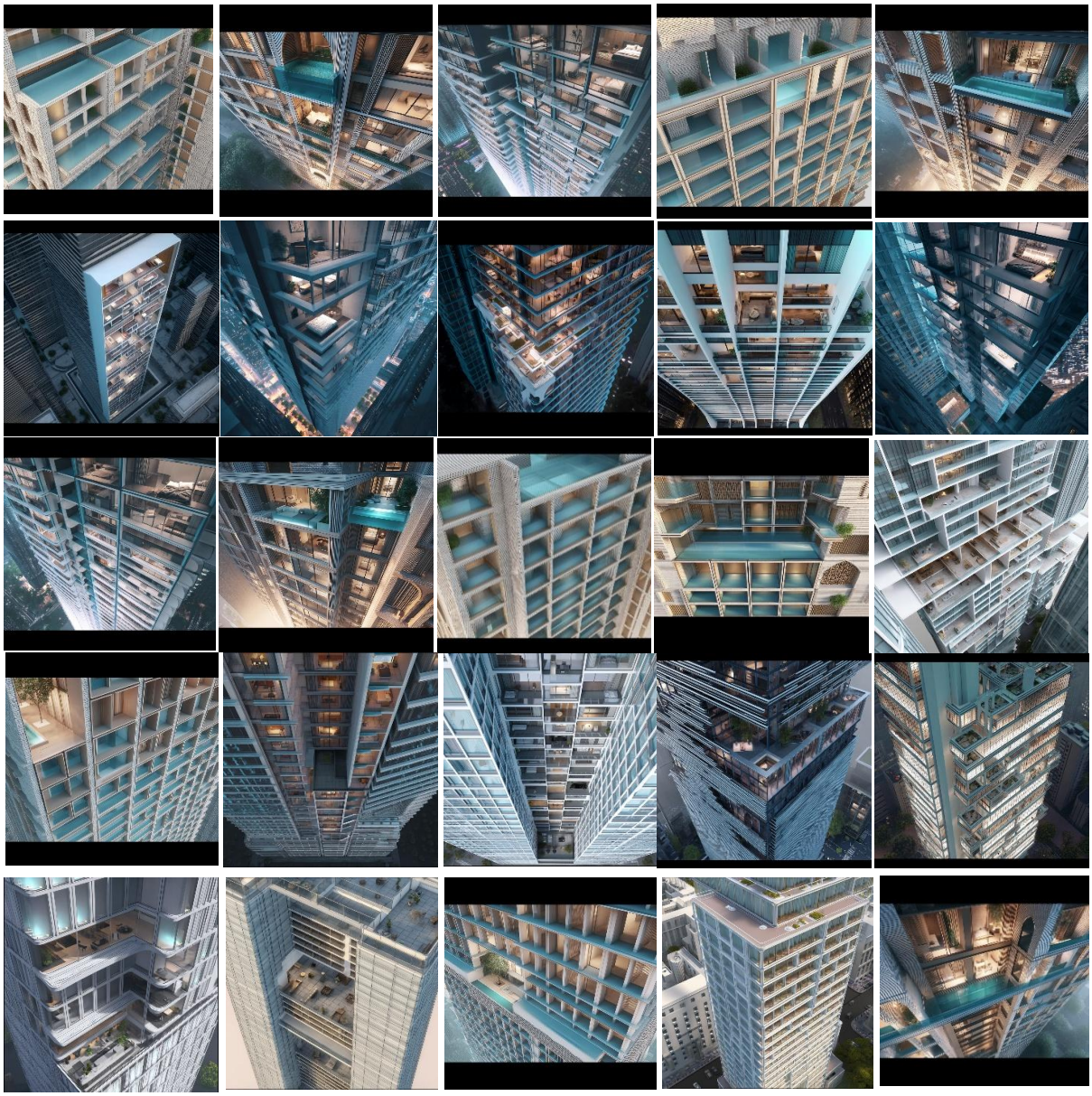

Figure 7: Initial outputs in the first category - completely failed to capture the defining features of traditional Iranian residential architecture in a vertical context

Category 2 – Fragmented and Incomplete Integration of Vernacular Elements (28% of Outputs)

General Description

Roughly 28% of outputs showed an intermediate level of success. While these images incorporated recognizable elements of traditional Iranian houses, their integration was inconsistent and fragmented across the vertical structure. This category reflects cases where the AI partially engaged with vernacular cues but failed to assemble them into a coherent architectural system.

Key Observations

1. **Selective use of traditional features:**
   Arches, courtyards, and decorative motifs appeared sporadically, while adjacent units often defaulted to generic modernist forms.
2. **Proportion inaccuracy and formality:**
   even heritage-driven, many outcomes suffered from disproportionate massing, abrupt transitions, and disproportionately oversized decorative details.
3. **Incomplete spatial hierarchies:**
   Layering of private, semi-public, and public zones was attempted but remained fragmented, undermining the social logic of the Mahalleh.
4. **Lack of functioning common areas:**
   such as shared courtyards, terraces, or semi-public corridors that were either missing or not clearly established, limiting social interaction possibilities.

Implications

This group illustrates the AI's inability to synthesize clusters of traditional units into a vertically coherent neighbourhood. Without visual precedents for multi-unit compositions, the system produced outputs that oscillated between heritage cues and generic high-rise typologies. The results represent partial errors: promising fragments of vernacular logic that, without targeted dataset reinforcement, collapsed into incoherent and culturally diluted forms.

Representative images from Category 2

Figure 8: Initial outputs in the second category - Fragmented and Incomplete Integration of Vernacular Elements of traditional Iranian residential architecture in a vertical context

Category 3 – Partial but Flawed Representation of Traditional Spatial Elements (18% of Outputs)

General Description

The smallest group, representing 18% of the outputs, showed more promising integration of traditional Iranian features into the vertical typology. These outcomes demonstrated stronger cultural references but still faced challenges in achieving functional and spatial coherence.

Key Observations

1. **Presence of distinctive features:**
   pointed arches, decorative brickwork, orosi (stained-glass windows), and vernacular rooflines appeared with improved accuracy.
2. **Integration of green spaces:**
   terraces and balconies included vegetation, recalling the ambiance of courtyard gardens.
3. **Partial hierarchical organization:**
   differentiation between private, semi-public, and communal spaces was attempted but often abrupt.
4. **Material and texture representation:**
   adobe tones, patterned brickwork, and tile mosaics were more consistently used, though sometimes in excess.
5. **Challenges in urban identity:**
   despite improved cultural detailing, circulation and social cohesion within the vertical form remained fragmented.

Implications

This category indicates that the AI was able to partially overcome the limitations seen in the first two groups by integrating more consistent cultural and architectural detailing. However, the main shortcoming was the insufficient definition of semi-public and public spaces across the vertical structure, preventing the outputs from capturing the collective and communal dimensions that are fundamental to neighbourhood life.

Representative images from Category 3

Figure 9: Initial outputs in the third category - partially overcome the limitations seen in the first two groups but insufficient definition of semi-public and public spaces across the vertical structure

4.4 Refinement and Improvement of AI-Generated Outputs

4.4.1 Identification of Key Deficiencies and Challenges

The refinement stage began by synthesizing the shortcomings observed across the three categories of AI-generated outputs identified in Section 4.3.2. These deficiencies highlighted structural gaps in the datasets and limitations in the AI's interpretive ability, making targeted improvements essential for advancing toward a coherent vertical Mahalleh concept.

Category 1

- **Missing core elements:**
  courtyards, windcatchers, iwans, and other traditional features often absent or treated as decoration.
- **Loss of cultural symbolism:**
  façades lacked recognizable Iranian motifs or material textures.
- **Disrupted hierarchy:**
  no clear distinction between private, semi-public, and public domains.
- **Unrealistic forms:**
  excessive vertical repetition and distorted geometries.

Category 2

- **Inconsistent application:**
  some units displayed arches or courtyards, while others reverted to generic designs.
- **Proportional errors:**
  awkward scaling and poor transitions between floors.
- **Fragmented hierarchies:**
  attempts at zoning private/semi-public/public spaces remained incomplete.
- **Weak communal integration:**
  limited definition of shared courtyards or terraces.

Category 3

- **Cultural details without full coherence:**
  while arches, brickwork, and stained glass appeared, they were overused or inconsistently applied.
- **Abrupt spatial transitions:**
  private, semi-public, and communal areas were not fully resolved.
- **Fragmented circulation and identity:**
  vertical alleys and communal flows lacked continuity, limiting the sense of a complete neighbourhood.

Synthesis of Challenges

Across all categories, the most persistent issues were:

1. Absence of reliable visual precedents for unit-level and cluster-level typologies.
2. Weak definition of semi-public and communal spaces within the vertical structure.
3. Proportional and scaling inconsistencies undermining architectural plausibility.
4. Limited ability of AI to translate cultural motifs into socially functional spaces.

These deficiencies formed the basis for the refinement strategy outlined in the subsequent sections, where new targeted prompts and visual inputs were employed to improve coherence, hierarchy, and cultural integration.

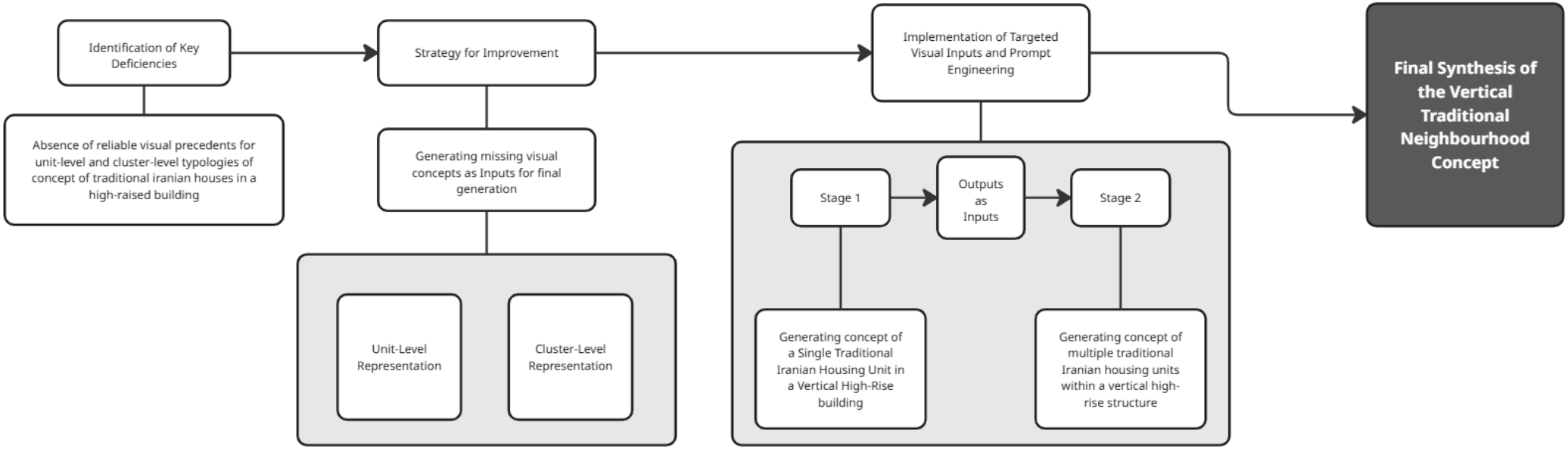

Figure 10: Diagram of the process of the project in chapter 4 (4 of 10 steps covered in section 4.4)

4.4.2 Strategy for Iterative Improvement and Data Augmentation

The strategy for iterative refinement was developed in direct response to the deficiencies observed in the AI outputs of Categories 1 and 2. Since the absence of precedents for a vertical reinterpretation of Iranian housing significantly limited the AI's ability to generate coherent results, a stepwise augmentation process was designed to supply the missing references.

Stage One – Unit-Level Representation

To address the lack of accurate references for single residential units (Category 1), the first step was to generate targeted images of a traditional Iranian house embedded within a high-rise structure. This required the preparation of a dedicated textual prompt—developed with ChatGPT—that translated the defining elements of a traditional Iranian dwelling (courtyard, iwan, badgir, spatial privacy hierarchy) into a vertical context. These conceptual images established a visual dataset that did not previously exist and provided the AI with the necessary foundation for subsequent clustering.

Stage Two – Cluster-Level Representation

Building upon the outputs of Stage One, the second step addressed the inconsistencies observed in clustered units (Category 2). Here, multiple unit-level references were combined and reintroduced into the AI workflow to simulate how a series of traditional-inspired units could coexist within a vertical residential block. This stage also relied on a newly engineered prompt that emphasized collective organization, shared spaces, and cultural continuity across floors. The outputs from this stage formed a critical intermediate dataset, bridging the gap between isolated units and neighborhood-scale composition.

Stage Three – Final Integration

With enriched datasets from the previous two stages, the final step focused on synthesizing a comprehensive vertical Mahalleh concept. By combining unit-level details, cluster-level organization, and project-specific parameters from the Asman Tower, the AI was directed toward producing more spatially coherent and culturally grounded outputs. This staged approach demonstrated how targeted data augmentation could progressively reduce the limitations identified in earlier iterations and guide the AI toward more plausible and meaningful results.

4.4.3 Implementation of Targeted Image Inputs and Prompt Engineering

Stage one — Single Traditional Iranian Housing Unit in a Vertical High-Rise

The first stage focused on generating culturally accurate representations of **single traditional Iranian housing units** adapted to a vertical high-rise context. The aim was to establish fidelity at the unit scale before attempting multi-unit compositions or larger neighborhood arrangements.

Stage-Specific Prompting Strategy:

- Prompts were crafted to emphasize the visualization of a single unit, ensuring the inclusion of defining vernacular elements such as courtyards, iwans, windcatchers (badgirs), and decorative brickwork.
- The textual instructions directed the AI to adapt these features into a verticalized form without losing cultural authenticity.
- At this stage, prompts deliberately avoided references to clustering or neighborhood-scale hierarchies, restricting the focus to the architectural and spatial logic of individual units.

Prompt for Stage One — Single Traditional Iranian Housing Unit in a Vertical High-Rise

"Create a conceptual design of a single traditional Iranian residential unit adapted for integration within a modern high-rise building inspired by the Asman Tower in Tehran, approximately 100 meters tall with 37 floors. The unit should reinterpret key vernacular features such as a private inward-facing courtyard, iwan entrance, multipurpose family rooms, controlled threshold access, and natural ventilation systems including windcatchers (Badgirs). Emphasize cultural principles of privacy (Hefz-e-Hesiat), family cohesion, and climate-responsive comfort through thick walls, shading devices, and small water features. The design must reflect authentic Persian architectural identity with decorative brickwork, wooden doors, and symbolic motifs while remaining adaptable to vertical stacking. Spatial layout should ensure functional flexibility for extended families and balance traditional architectural elements with high-rise constraints. This stage focuses exclusively on unit-level fidelity, without clustering or neighborhood-scale hierarchies, establishing the foundation for subsequent multi-unit compositions."

Visual dataset Inputs for Stage One included:

- **Traditional Housing Imagery**

  Traditional Persian houses in Tehran, Isfahan, Yazd and Shiraz with courtyards, iwan, windcatchers and decoration as primary concerns.

Figure 11: Samples of Iranian traditional houses collected through scraping on Wikimedia

- **Scaled References from the Aseman Tower**

  Used strictly for proportional accuracy and vertical adaptation, without reliance on architectural diagrams or construction drawings.

Figure 12: View of single and multiple residential units of Aseman tower from top floors

Outcome of Stage One:

This stage produced outputs where individual Iranian housing unit appeared as distinct, culturally faithful element adapted for high-rise living. Vernacular features such as courtyards, iwans, arcs, rooms, water, greenery were imagined within a vertical format, creating recognizable yet reinterpreted forms. Although conceptual, these outputs

provided the essential foundation for Stage Two by ensuring unit-level accuracy before addressing the complexity of multi-unit arrangements.

Outcomes:

Type 1 in different variations:

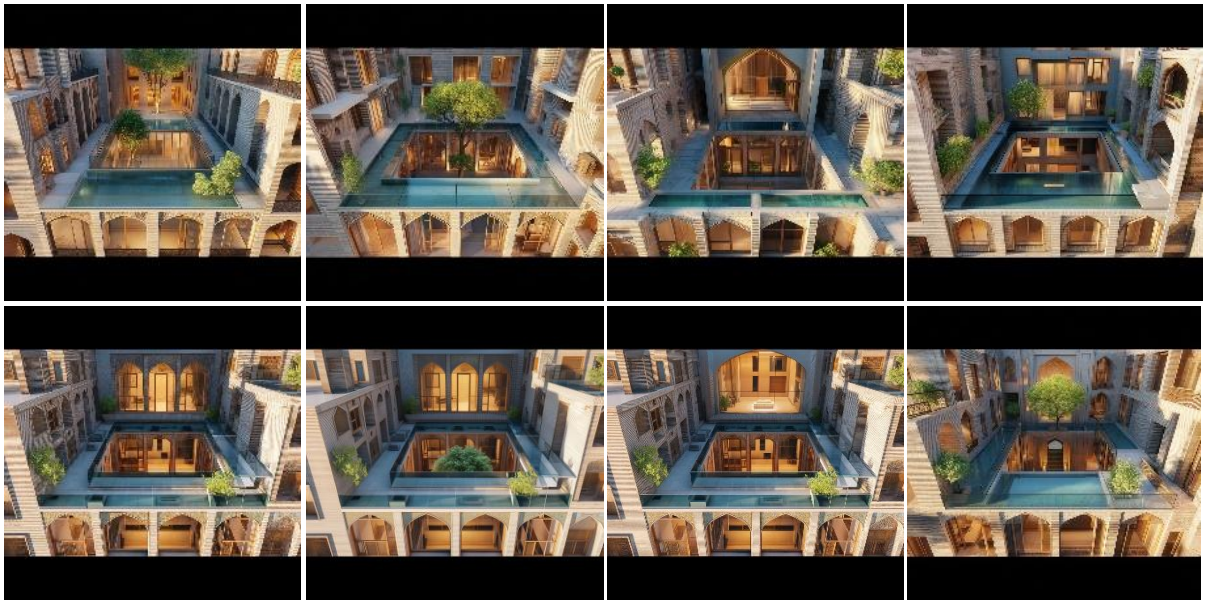

Figure 13: Generated conceptual outputs of traditional Iranian house adapted to a vertical high-rise context as a single unit – Type 1

Type 2 in different variations:

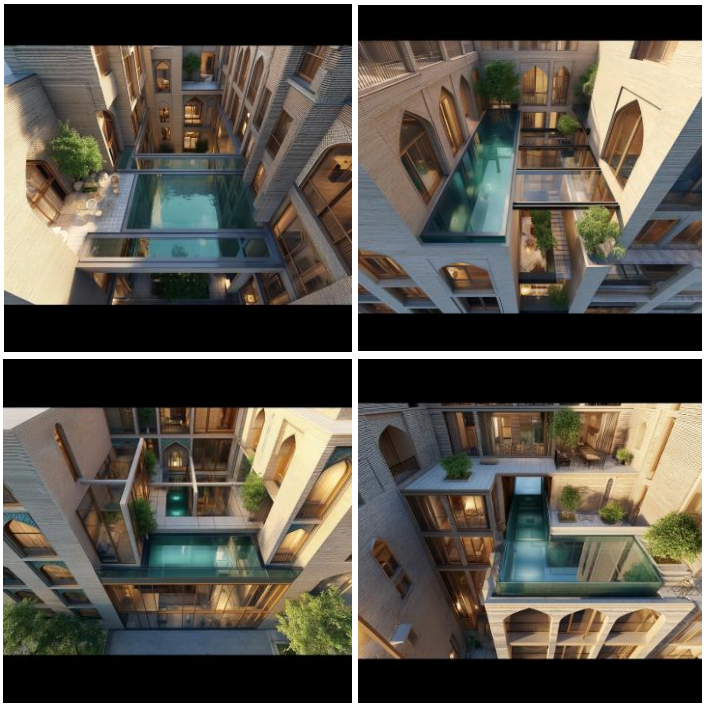

Figure 14: Generated conceptual outputs of traditional Iranian house adapted to a vertical high-rise context as a single unit – Type 2

Stage Two — Composite Vertical Neighborhood Synthesis

The second stage shifted focus from single-unit generation toward the arrangement of multiple traditional Iranian housing units within a vertical high-rise structure. The aim was not yet to replicate the full social hierarchy of a Mahalleh, but rather to test how clusters of refined units could coexist within a shared volumetric framework.

Stage-Specific Prompting Strategy:

- Prompts were crafted to emphasize the stacking and adjacency of multiple housing units within one tower.
- The textual instructions directed the AI to explore how several vernacular-inspired units could be positioned together across different levels, while maintaining cultural detailing and climatic responsiveness.
- At this stage, prompts did not yet articulate private–semi-public–public hierarchies at the neighbourhood scale; instead, they were restricted to building-level organization and inter-unit spatial logic.

Prompt for Stage two — Multi-Unit Clusters within a Vertical High-Rise

"Create a conceptual design for the vertical arrangement of multiple traditional Iranian housing units within a high-rise residential building inspired by the Asman Tower in Tehran, approximately 100 meters tall with 37 floors. The design should explore how several vernacular-inspired units, each featuring inward-facing courtyards, iwans, and climate-responsive features such as windcatchers (Badgirs), can coexist as clusters across different levels within one tower. Emphasize adjacency, repetition, and proportional balance between units to test compositional density while maintaining authentic Persian architectural identity. Dataset references include imagery of traditional Iranian houses with private courtyards and decorative detailing, refined outputs from single-unit generation, and proportional guides from the Asman Tower showing multi-unit groupings. The building exterior and shared frameworks should preserve cultural detailing, façade ornamentation, and thermal comfort strategies while adapting to vertical constraints. This stage focuses on unit-to-unit relationships and high-rise volumetric logic, without yet addressing neighborhood-scale social hierarchies, thereby establishing a crucial intermediary step between single-unit fidelity and final integrated Mahalleh synthesis."

Visual dataset Inputs for Stage Two included:

- **Traditional Housing Imagery** – reused from Stage One, providing authentic references for vernacular detailing, materiality, and spatial character.
- **Refined Outputs from Stage One** – serving as visual anchors for individual unit fidelity and cultural accuracy.
- **Imagery of the Aseman Tower** – specifically selected views highlighting the grouping and adjacency of multiple residential units, used to guide proportional control and compositional density in the vertical arrangement.

Figure 15: Views of Aseman tower taken by a drone

Outcome of Stage Two:

This stage produced outputs in which multiple traditional Iranian housing units were arranged as coherent clusters within a single high-rise framework. The emphasis was on exploring adjacency, repetition, and proportional balance of units in vertical form, while maintaining vernacular detailing introduced in Stage One. Although still conceptual, these results represent a critical intermediary step—bridging the development of single-unit fidelity (Stage One) with the broader integration of neighborhood-scale hierarchies that would be addressed in the final synthesis stage.

Outcomes:

Representatives of 2 Types in different variations:

Figure 16: outputs of units in vertical form while maintaining vernacular detailing, were arranged as coherent clusters within a high-rise framework

4.4.4 Final Synthesis into conceptual explorations of a vertical neighbourhood.

The final synthesis stage brought together all refined datasets, engineered prompts, and targeted image inputs to create a comprehensive conceptual visualization of a vertical traditional Iranian neighbourhood. This phase tested the AI's capacity to produce a culturally rich, spatially coherent, and functionally plausible high-rise interpretation of the Mahalleh.

Integrated Input Framework

The AI generative process was informed by:

1. **Finalized Prompt:**
    - The Mahalleh's hierarchical spatial structure (private → semi-public → public).
    - Key architectural elements:
      courtyards, iwans, windcatchers, narrow shaded alleys (koocheh), and decorative motifs.
    - Environmental strategies:
      natural ventilation, thermal mass, shading devices.
    - Social dynamics:
      communal courtyards, plazas, and gathering spaces.

   Final prompt:

> "Create a conceptual design for a vertical traditional Iranian neighborhood integrated within a high-rise residential building inspired by the Asman Tower in Tehran, approximately 100 meters tall with 37 floors and around 104 total units including residential, commercial, and administrative spaces. The design should incorporate spatial, social, and cultural characteristics inherent in traditional Mahalleh neighborhoods, while preserving heritage values and addressing modern urban density challenges. The project should reflect a hierarchical spatial organization, featuring private courtyard houses arranged inwardly to ensure privacy, natural ventilation, family cohesion, multipurpose rooms, controlled access points, and flexible layouts accommodating extended families. Vertical and horizontal circulation systems should emulate traditional narrow shaded alleys (Koocheh) and cul-de-sacs (Bonbasts), fostering community interaction and secure, pedestrian-friendly movement within the building. A central mosque or religious gathering space must be integrated as the social and spiritual core, accompanied by bazaar-style commercial spaces supporting economic and social activities. Shared semi-private courtyards, terraces, and communal spaces across various floors should facilitate neighborly interactions, celebrations, and cultural rituals. Environmental adaptations, including windcatchers (Badgirs), thick thermal walls, and water features like pools or fountains, should be thoughtfully incorporated to respond to the local climate, enhancing comfort and sustainability. The building's exterior and interior must employ traditional Persian architectural symbolism, local or compatible materials, and spatial gradations reflecting privacy principles (Hefz-e-Hesiat) and social hierarchies inherent to Iranian culture. Access control and security measures should mirror the organic urban fabric of traditional neighborhoods, limiting entry points while maintaining openness and community integration. Overall, this conceptual project aims to propose a framework for reinterpreting Iranian architectural heritage within modern vertical urban housing, preserving collective identity, cultural symbolism, and social networks, while providing a realistic approach based on the dimensions, unit counts, and population estimates derived from the Aseman Tower."

2. **Layered Visual References**

including:

- Photographs of historic neighbourhoods in Tehran, Isfahan, and Shiraz, showing urban morphology and social spaces.

Representative images:

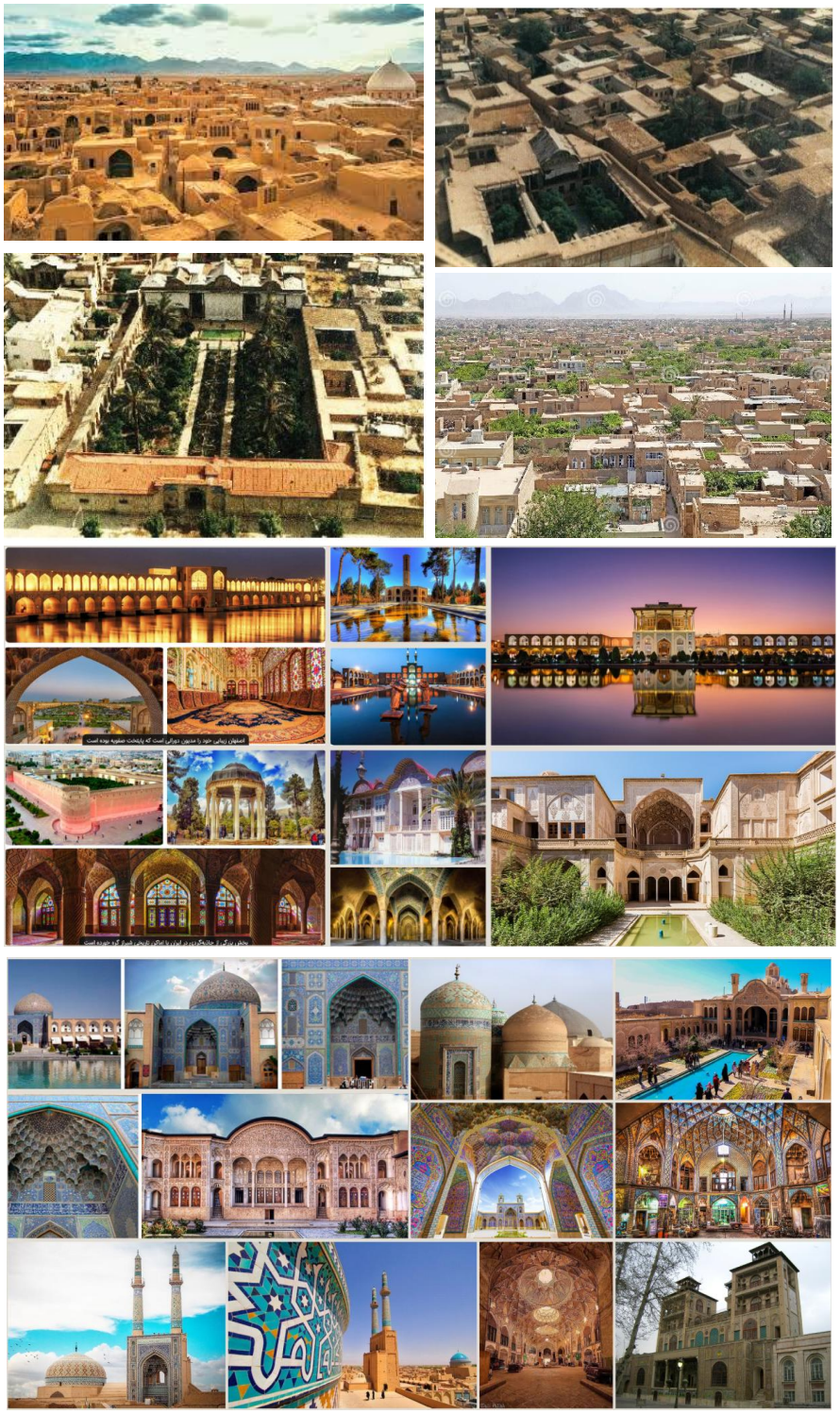

Figure 17: Representatives of visual dataset from different features in Iranian traditional neighbourhoods collected through scraping on Wikimedia

- Documented architectural components from vernacular houses.

Figure 18: Representatives of visual dataset from Iranian traditional houses collected through scraping on Wikimedia

- Refined outputs from Stage One (single traditional housing units) and Stage Two (partial vertical compositions).

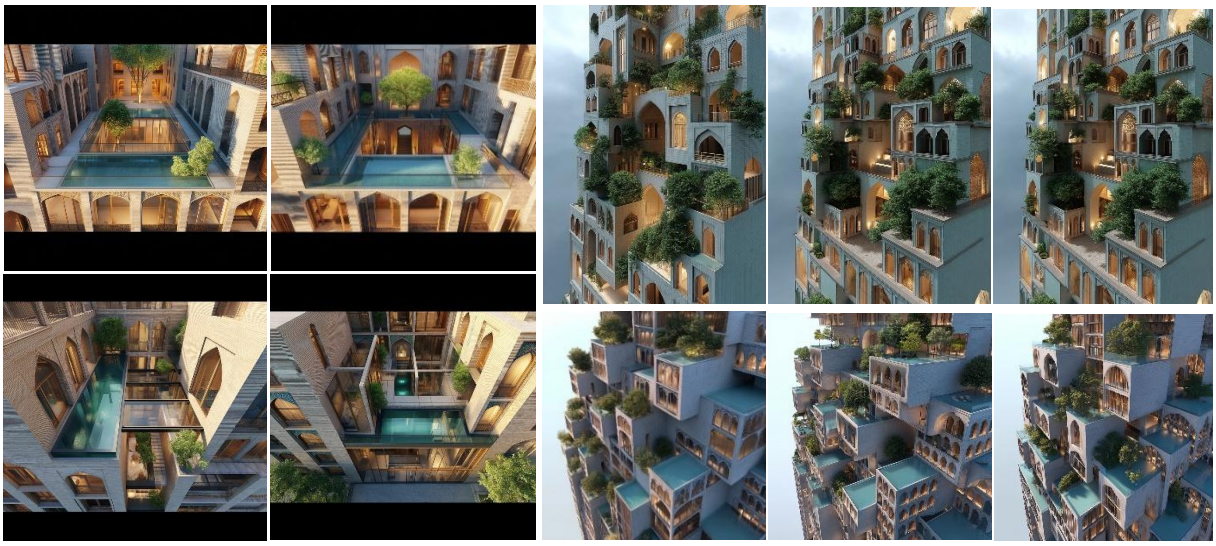

Figure 19: Using Refined outputs from Stage One and Stage Two as new inputs

- Scaled references from the Asman Tower for proportion and volumetric control.

Figure 20: different views of Aseman tower taken by a drone

Generative Process and Variations

With these inputs, the AI produced a series of variations on the end concept, each attempting different relationships between units, treatment of the façade, and relationship of the spaces. Iterative generation produced a set of options from which the most rational and culturally appropriate results could be selected for further interpretation.

Results into conceptual explorations of a vertical neighborhood:

Type 1:

Type 2:

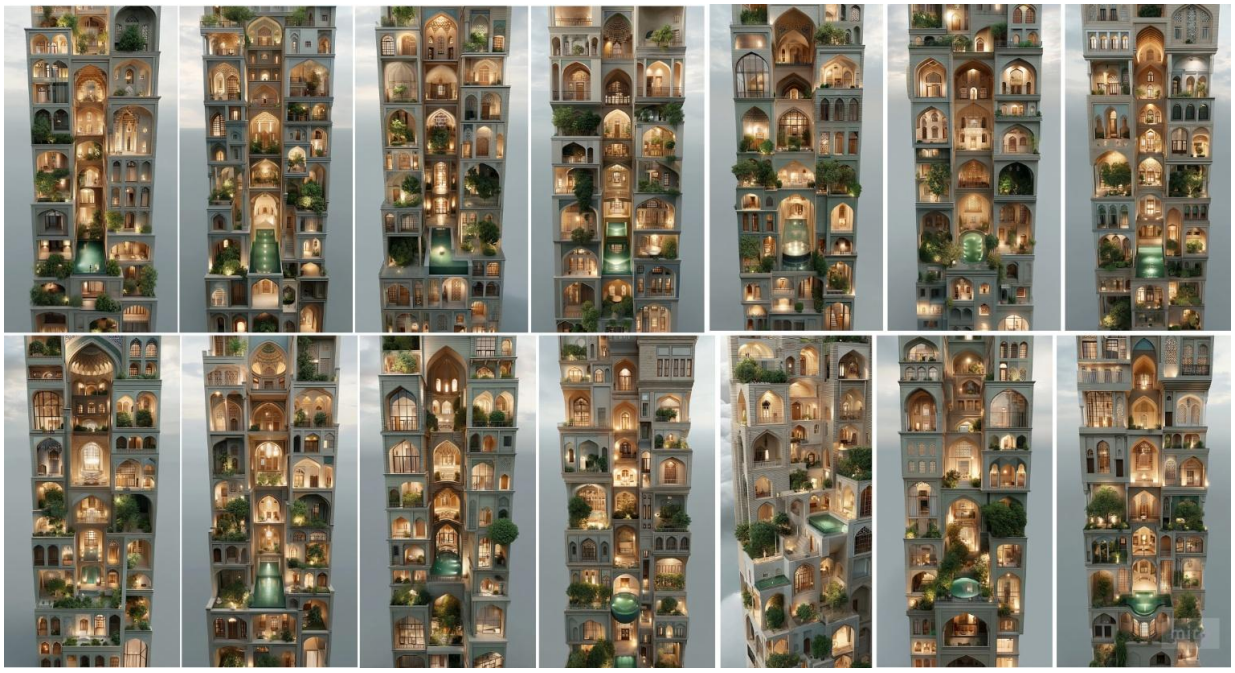

Figure 21: Outputs of Final Synthesis - conceptual explorations of a vertical neighbourhood in 2 Types

Key Observations from the Final Synthesis

- **Recognition of Spatial Logic**: Vertical stacking retained a legible sequence of private, semi-public, and public layers, supported by circulation systems that echoed alley-like transitions.
- **Cultural Referencing**: Vernacular motifs and elements appeared with more coherence than in earlier stages, though their application remained stylistic rather than structural.
- **Conceptual Plausibility**: The outputs suggested how high-density housing might borrow from traditional logics, but without resolving technical, functional, or environmental performance questions.
- **Visual Harmony**: The refined iterations displayed stronger integration between heritage-inspired forms and vertical massing, offering a more cohesive silhouette.

Remaining Conceptual Nature

The final outcomes remain exploratory visualizations rather than architectural solutions. Critical aspects such as structural feasibility, detailed environmental strategies, circulation efficiency, and lived user experience require further human-led design development and cannot be addressed through the generative tools employed here.

4.5 Discussion of Conceptual Exploratory Outcomes

The explorations presented in this chapter were not intended to provide finalized architectural solutions but to test how far generative AI can engage with the cultural and spatial logics of the Iranian *Mahalleh* within a vertical high-rise framework. The process confirmed that while AI can serve as a catalyst for conceptual exploration, its outputs remain dependent on human interpretation to achieve architectural and cultural coherence.

Key Strengths

AI was helpful in creating quick visual iterations that included familiar cultural references like courtyard-like voids, rhythmic façades, and symbolic ornamentation. AI also provided environmental analogies in some instances—windcatcher-like towers, shaded terraces, or layered volumes—that resonate with vernacular climatic strategies. These aspects prove AI useful as an inspiration source in the initial conceptual phases of design.

Key Limitations

At the same time, the outputs revealed critical shortcomings. Spatial hierarchies were often fragmented, semi-public and communal domains were poorly defined, and circulation systems lacked coherence. Proportions and human scale were inconsistent, and cultural features were frequently reduced to surface motifs rather than integrated socio-spatial principles. These issues underscored AI's inability to deliver functional or socially grounded architecture without human guidance.

Final Reflection

Overall, the findings reaffirm that AI is not a tool for heritage preservation or technical design resolution, but an exploratory partner that can enrich conceptual imagination. Its outputs serve as raw material—provocative and inspiring, yet incomplete. The architect remains indispensable as interpreter and mediator, transforming AI's imagery into coherent, contextually meaningful design proposals.

https://www.fodors.com/news/photos
Shah Mosque - Isfahan/Iran

5 / Discussion and Critical Reflections

5.1 Introduction to the Chapter

This chapter provides a critical discussion of the experimental outcomes presented in Chapter 4. The aim is not to celebrate the results as finalized architectural proposals, but to test and reflect on how far generative Artificial Intelligence (AI) could reinterpret the principles of the Iranian Mahalleh within a vertical high-rise framework.

The discussion builds on two complementary layers: first, the author's analytical observations during the iterative process; and second, the structured evaluation of final outputs against defined categories such as spatial hierarchy, privacy, communal life, environmental responsiveness, symbolic features, functional logic, human scale, and overall urban identity.

The findings show that reaching outputs with sufficient coherence for qualitative assessment required a complex, back-and-forth process in which AI alone was insufficient. Human intervention was necessary at every stage to identify errors, refine prompts, and reintroduce missing cultural or spatial elements. Even in the final stage, AI's achievements were more visible in the reproduction of architectural forms, ornaments, and atmospheres than in the accurate reconstruction of social or spatial hierarchies.

This chapter therefore places AI neither as solution nor as conceptual facilitator: capable of delivering atmospheric imagings and symbolic suggestions, but not fully able to represent the socio-spatial reasoning of the Mahalleh without suffering human intervention. The following sections provide an analytical overview of the outcomes, the evaluation framework, the outcome tables, and finally, a critical recount of achievements and limitations.

5.2 Analytical Overview of the Project Outcomes

The results of the AI design experiment illustrate the potential and the limitations of generative tools when handling culturally sophisticated architectural principles. This assessment showed that AI was able to generate images full of recognizable forms and atmospheres—arches, iwans, domes, central courtyards, or shaded terraces—but was at a loss when asked to assemble these elements into coherent socio-spatial systems.

At the unit level, AI had managed to adapt courtyards, adjacent rooms, plants, water elements, and brick finishes. These were somehow parts of a partial yet recognizable reconceptualization of vernacular features. However, at the neighborhood level, weaknesses were apparent: spatial hierarchy deficits, communal and semi-public spaces, circulation, and privacy.

This comparison is meant to illuminate a salient point: AI was better able to replicate islands of tradition than to integrate them into a socially significant whole. Its greatest contribution was to the visual and symbolic environment of a vertical Mahalleh.

5.3 Framework for Evaluation

The evaluation framework was designed to critically test how far AI-generated outputs could reflect the principles of the Iranian Mahalleh when reinterpreted in a vertical housing context. Eight categories were identified, drawn from the theoretical discussion in Chapter 2 and supported by established references on Iranian vernacular architecture and heritage-sensitive design (Ardalan & Bakhtiar, 1973; Fathy, 1986; Habibi, 2000; ICOMOS, 2013; UNESCO, 2021).

The categories represent an operationalization of three broader domains:

- **Socio-spatial order**: spatial hierarchy, introversion & privacy, communal/social life
- **Environmental responsiveness**: climatic adaptation, natural ventilation, material expression
- **Cultural-symbolic continuity**: identity, ornament, coherence, urban presence

Within these domains, the eight categories were specified as follows:

1. **Spatial Hierarchy**

   coherence of public, semi-public, and private domains.

2. **Introversion & Privacy**

   thresholds, controlled access, and domestic privacy.

3. **Communal Life & Social Cohesion**

   shared gathering spaces and opportunities for interaction.

4. **Environmental Responsiveness**

   vernacular climatic devices such as courtyards, shading, and natural ventilation.

5. **Symbolic & Aesthetic Features**

   recognizable motifs including arches, iwans, domes, brickwork, and ornamentation.

6. **Functional & Circulatory Logic**

   clarity of circulation and logical progression of spaces.

7. **Human Scale & Proportion**

   legibility of room sizes, courtyards, and façades in relation to human use.

8. **Overall Urban Identity**

   the balance between tradition and innovation in evoking the identity of the Mahalleh.

Each category was then broken down into concrete elements (e.g., courtyards, alleys, communal terraces, façades, circulation systems) and tested against the final AI outputs. This framework ensured that the evaluation moved beyond surface impressions and addressed deeper questions of cultural continuity, social function, and architectural plausibility.

5.4 Evaluation Tables of Final AI Outputs

Two final AI-generated outcomes were selected for systematic evaluation using the above framework. The results are summarized in tables where each criterion is marked as achieved, partially achieved, not achieved, or not observable. The latter category refers to cases where the AI outputs did not provide enough clarity to allow for a reliable judgment.

The tables reveal a clear pattern. While symbolic and aesthetic features such as arches, iwans, and brick textures were often present, other categories—particularly spatial hierarchy, communal life, functional logic, and human scale—were weakly defined or absent. In several criteria, key aspects such as privacy gradients or semi-public spaces were simply not observable, underlining the limits of AI in producing socially coherent outputs.

It is also important to note differences between the two final outcomes: one showed relatively stronger performance at the unit scale (e.g., incorporating courtyards and surrounding rooms), while the other was weaker at the neighborhood scale, where circulation systems and social hierarchies broke down.

Overall, the tables reinforce the observation that AI performed more effectively in reproducing atmospheres and decorative fragments than in structuring functional, social, and spatial logics. Its value lies in generating visual cues and evocative forms, while the architectural coherence of a vertical Mahalleh remains dependent on human mediation.

Figure 22: The two final AI-generated outcomes that selected for systematic evaluation

Category 1 – Spatial Hierarchy

Public Spaces

Element	Evaluation
Mosque / prayer hall	☒ Achieved ☐ Partial ☐ Not achieved
Bazaar / commercial edge	☐ Achieved ☐ Partial ☒ Not achieved
Public plaza / square	☒ Achieved ☐ Partial ☐ Not achieved
Major communal hub (shared assembly)	☒ Achieved ☐ Partial ☐ Not achieved
Pedestrian spine (main circulation visible)	☐ Achieved ☐ Partial ☒ Not achieved

Semi-Public Spaces

Element	Evaluation
Neighborhood courtyards	☒ Achieved ☐ Partial ☐ Not achieved
Hammam / bathhouse or equivalent	☐ Achieved ☐ Partial ☒ Not achieved
Semi-public terraces	☐ Achieved ☒ Partial ☐ Not achieved
Community nodes (e.g., gathering spots)	☒ Achieved ☐ Partial ☐ Not achieved

Private Spaces

Element	Evaluation
Inward-facing courtyards	☐ Achieved ☒ Partial ☐ Not achieved
Residential cluster coherence	☒ Achieved ☐ Partial ☐ Not achieved
Family unit privacy levels	☐ Achieved ☐ Partial ☐ Not achieved

Figure 23: Evaluation table/Spatial Hierarchy

Public Spaces

- **Mosque / prayer hall** – Religious node at the heart of the neighborhood, acting as both spiritual and social anchor.
- **Bazaar / commercial edge** – Linear or nodal commercial frontage that sustains daily economic life and defines public boundaries.
- **Plaza / public square** – Open civic area for pedestrians for all citizens, creating congregations, rituals, and communication.
- **Major communal hub (shared assembly)** – Great collective center of congregation (e.g., Friday Mosque courtyard, square) confirming neighborhood identity.
- **Pedestrian spine (main circulation visible)** – Primary pathway structuring public movement, typically a central street or alley network.

Semi-Public Spaces

- **Neighborhood courtyards** – Shared open spaces within residential clusters, balancing access and communal interaction.
- **Hammam / bathhouse or equivalent** – Traditional public–semi-public facility supporting both hygiene and social cohesion.
- **Semi-public terraces** – Elevated or shared open platforms accessible to multiple households, supporting intermediate interaction.
- **Community nodes (gathering spots)** – Less extensive, informal points (e.g., benches, shaded niches) encouraging shared interactions.

Private Spaces

- **Inward-facing courtyards** – Courtyards oriented internally to protect privacy and family life.
- **Residential cluster coherence** – Logical grouping of homes that reinforces social bonds while maintaining household autonomy.
- **Family unit privacy levels** – Hierarchical separation between private rooms, family courtyards, and shared access paths.

Category 2 – Introversion & Privacy

Public

Element	Evaluation
Controlled access from main streets	☒ Achieved ☐ Partial ☐ Not achieved
Transitional thresholds (public → semi-public)	☐ Achieved ☐ Partial ☒ Not achieved

Semi-Public

Element	Evaluation
Limited visual exposure from circulation	☐ Achieved ☐ Partial ☒ Not achieved
Separation of male/female zones (if referenced)	Not observable
Semi-public spaces framed by walls/arcades	☐ Achieved ☒ Partial ☐ Not achieved

Private

Element	Evaluation
Inward-facing housing units	Not observable
Hierarchical access from public → semi-public → private	Not observable
Preservation of domestic privacy	☐ Achieved ☒ Partial ☐ Not achieved

Figure 24: Evaluation table/Introversion & Privacy

Notes on elements:

Category 2 – Introversion & Privacy: Definitions

Public

- **Controlled access from main streets** – Limited, official points of entry from major streets into the neighborhood, boosting security and filtering strangers.
- **Transitional thresholds (public → semi-public)** – Clear physical or symbolic boundaries (e.g., gateways, constrictions) that allow the progression from public to more private areas.

Semi-Public

- **Limited visual exposure from circulation** – Spatial arrangements that prevent direct views into private domains from alleys or shared paths.
- **Separation of male/female zones (if referenced)** – Gendered use of space traditionally present in some cultural contexts, often visible in semi-public gatherings.
- **Semi-public spaces framed by walls/arcades** – Courtyards or terraces enclosed by architectural elements to control visibility and maintain a sense of seclusion.

Private

- **Inward-facing housing units** – Houses organized around internal courtyards, turning away from the street to protect family life.
- **Hierarchical access (public → semi-public → private)** – Sequential layering of access routes, ensuring gradual transition toward privacy.
- **Preservation of domestic privacy** – Architectural strategies (walls, screened windows, controlled entrances) ensuring family activities remain shielded.

Category 3 – Communal Life & Social Cohesion

Public

Element	Evaluation
Central communal courtyard	☒ Achieved ☐ Partial ☐ Not achieved
Shared public amenities	☒ Achieved ☐ Partial ☐ Not achieved
Processional / ceremonial spaces	☐ Achieved ☒ Partial ☐ Not achieved

Semi-Public

Element	Evaluation
Intermediate gathering spots	☐ Achieved ☒ Partial ☐ Not achieved
Children's play and daily-life courtyards	☐ Achieved ☒ Partial ☐ Not achieved
Shops integrated into the fabric	☐ Achieved ☐ Partial ☒ Not achieved

Private

Element	Evaluation
Shared walls / adjacency fostering interaction	☒ Achieved ☐ Partial ☐ Not achieved
Small-scale communal clusters	☐ Achieved ☒ Partial ☐ Not achieved
Daily reciprocal interaction	☐ Achieved ☒ Partial ☐ Not achieved

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Figure 25: Evaluation Table/Communal Life & Social Cohesion

Public

- **Central communal courtyard** – A large shared open space that serves as the focus for neighborhood rituals, celebrations, and events.
- **Shared public amenities** – Wells, fountains, or benches that serve collective needs and reinforce social bonds.
- **Processional / ceremonial spaces** – Formal processional routes or plazas for festivals, processions, and community religious or cultural events.

Semi-Public

- **Intermediate gathering spots** – Smaller-scale meeting places (e.g., shaded niches, corner spaces) that allow for daily contact between residents.
- **Courtyards for children's play and daily** – life courtyards – Semi-public areas where children are free to play and where families also meet informally as part of their daily routines.
- **Shops integrated into the fabric** – Local business integrated into fabric of the community (e.g., corner shops, bakeries) in aid of social and economic cohesion.

Private

- **Shared walls / adjacency fostering interaction** – Homes that share walls or have close spatial proximity foster social interaction, and dependence between household members.
- **Small-scale communal clusters** – Homes clustered into groups where there are shared semi-private courtyards or access ways.
- **Daily reciprocal interaction** – Frequent social interaction between neighbors owing to both proximity, shared workloads, and coinciding routines.

Category 4 – Environmental Responsiveness

Public

Element	Evaluation
Narrow shaded alleys (koocheh)	☐ Achieved ☐ Partial ☒ Not achieved
Urban shading systems	☒ Achieved ☐ Partial ☐ Not achieved

Semi-Public

Element	Evaluation
Semi-shaded courtyards	☒ Achieved ☐ Partial ☐ Not achieved
Passive cooling devices visible (e.g., windcatchers)	☐ Achieved ☐ Partial ☒ Not achieved

Private

Element	Evaluation
Courtyard ventilation	☒ Achieved ☐ Partial ☐ Not achieved
Thick walls / thermal massing	☒ Achieved ☐ Partial ☐ Not achieved
Orientation & solar control	Not observable

Figure 26: Evaluation Table/Environmental Responsiveness

Notes on elements:

Category 4 – Environmental Responsiveness: Definitions

Public

- **Narrow shaded alleys (koocheh)** – Narrow pedestrian walking streets that offer the maximum shade, airflow, and comfort in the hot weather.
- **Urban shading systems** – Broader schemes such as arcades, overhangs, or canopies of trees that create constant shadow across public areas.

Semi-Public

- **Semi-shaded courtyards**
  Courtyards partially shaded by trees, awnings, or surrounding walls, balancing sunlight and comfort.
- **Passive cooling devices visible (e.g., windcatchers)**
  Architectural features like badgirs that send air into interior spaces for natural cooling.

Private

- **Courtyard ventilation**
  Use of central courtyards to regulate temperature and airflow, enhancing comfort within houses.
- **Thick walls / thermal massing** – Mass masonry buildings which trap heat by day and release it by night to moderate indoor climate.
- **Orientation & solar control** – Building and opening alignment to optimize winter light while minimizing summer heat.

Category 5 – Symbolic & Aesthetic Features

Public

Element	Evaluation
Arches & iwans	☐ Achieved ☐ Partial ☐ Not achieved
Domes & rooflines	☐ Achieved ☐ Partial ☐ Not achieved

Semi-Public

Element	Evaluation
Decorative brickwork	☐ Achieved ☐ Partial ☐ Not achieved
Tilework & ornament	☐ Achieved ☐ Partial ☐ Not achieved

Private

Element	Evaluation
Orosi windows	☐ Achieved ☐ Partial ☐ Not achieved
Material authenticity	☐ Achieved ☐ Partial ☐ Not achieved
Symbolic motifs	☐ Achieved ☐ Partial ☐ Not achieved

Figure 27: Evaluation Table/Symbolic & Aesthetic Features

Notes on elements:

Category 5 – Symbolic & Aesthetic Features: Definitions

Public

- **Arches & iwans** – Vaulted openings and recessed halls (iwans) of considerable scale both functional and symbolic in Iranian architecture.
- **Domes & rooflines** – Bulbous or curved roof forms used to define spiritual, communal, or monumental spaces.

Semi-Public

- **Decorative brickwork** – patterned brickwork (e.g., herringbone, geometric motifs) giving texture and local identity on façades.
- **Tilework & ornament** – Decorative glazed ceramic tiles and surfaces that convey cultural symbolism in geometric or floral forms.

Private

- **Orosi windows** – Wooden lattice stained-glass windows admitting filtered light and providing privacy with colored interior moods.
- **Material authenticity**
  Using old materials like brick, adobe, wood, and plaster in a way that is campatible with local and cultural identity.
- **Symbolic motifs**
  Geometric, plant, or calligraphic motifs having more than decorative cultural and symbolic meaning.

Category 6 – Functional & Circulatory Logic

Public

Element	Evaluation
Major circulation axes	☐ Achieved ☐ Partial ☐ Not achieved
Clear entry points	☐ Achieved ☐ Partial ☐ Not achieved

Semi-Public

Element	Evaluation
Vertical circulation (stairs/elevators) with coherence	☐ Achieved ☐ Partial ☐ Not achieved
Secondary circulation (alleys, corridors)	☐ Achieved ☐ Partial ☐ Not achieved

Private

Element	Evaluation
Access to individual units	☐ Achieved ☐ Partial ☐ Not achieved
Logical progression of spaces (entry → courtyard → rooms)	☐ Achieved ☐ Partial ☐ Not achieved

---

Figure 28: Evaluation Table/Functional & Circulatory Logic

Notes on elements:

Category 6 – Functional & Circulatory Logic: Definitions

Public

- **Major circulation axes** – Primary routes within the settlement that structure pedestrian or vehicular flow and connect key public spaces.
- **Clear entry points** – Obvious points of access that define access to the neighborhood, adding to legibility and safety.

Semi-Public

- **Vertical circulation (stairs/elevators) with coherence** – Transport systems between floors that are rationally placed, accessible, and in accordance with overall planning.
- **Secondary circulation (alleys, corridors)** – Small-scale routes connecting private or semi-public spaces, reflecting the intimacy of old alleys.

Private

- **Access to individual units** – Clear and practical routes that allow residents to reach their homes while preserving privacy.
- **Logical progression of spaces (entry → courtyard → rooms)** – Sequential arrangement ensuring smooth transition from outside to inside, aligned with vernacular principles.

Category 7 – Human Scale & Proportion

Public

Element	Evaluation
Scale of plazas/squares	☐ Achieved ☐ Partial ☐ Not achieved
Façade rhythm at urban scale	☐ Achieved ☐ Partial ☐ Not achieved

Semi-Public

Element	Evaluation
Courtyard size & proportion	☐ Achieved ☐ Partial ☐ Not achieved
Transitional spaces (thresholds, terraces)	Not observable

Private

Element	Evaluation
Human-scaled room proportions	☐ Achieved ☐ Partial ☐ Not achieved
Door/window ratios	☐ Achieved ☐ Partial ☐ Not achieved

Figure 29: Evaluation Table/Human Scale & Proportion

Notes on elements:

Category 7 – Human Scale & Proportion: Definitions

Public

- **Scale of plazas/squares** – The relationship of dimensions of open public spaces so that they are not rendered unusable and inhospitable but rather, remain usable.
- **Façade rhythm at urban scale** – The repetition and spacing of façade elements (windows, arches, niches) which create harmony along streets or squares.

Semi-Public

- **Courtyard size & proportion** – Physical proportion of courtyards, not too large to compromise intimacy and control of climate nor too small to be ineffective.
- **Transitional spaces (thresholds, terraces)** – Those transitional zones which act as a middle stage between indoor/outdoor, public/private.

Private

- **Human-scaled room proportions** – Interior space proportions based upon human comfort and familiar living practices.
- **Door/window ratios** – Proportionate door and window sizes, ensuring usefulness, ventilation, and harmony with local designs.

Category 8 – Overall Urban Identity

Element	Evaluation
Cultural coherence	☐ Achieved ☐ Partial ☐ Not achieved
Spatial legibility	☐ Achieved ☐ Partial ☐ Not achieved
Balance of tradition and innovation	☐ Achieved ☐ Partial ☐ Not achieved
Community presence	☐ Achieved ☐ Partial ☐ Not achieved
Symbolic recognizability	☐ Achieved ☐ Partial ☐ Not achieved

Figure 30: Evaluation Table/Overall Urban Identity

Notes on elements:

Category 8 – Overall Urban Identity: Definitions

- **Cultural coherence** – The extent to which the design conveys a consistent and identifiable cultural identity, not arbitrary or superficial.
- **Spatial legibility** – Legibility of the overall urban arrangement, so users can intuitively easily understand circulation, zoning, and spatial hierarchy.
- **Balance of tradition and innovation** – The success of the combination of vernacular principles and contemporary design logics in such a way as to appear simultaneously authentic and advanced.
- **Community presence** – The visibility and facilitation of social life, ensuring the design is conducive to gathering, engagement, and group activities.
- **Symbolic recognizability** – The power of the design to evoke familiar Iranian architectural symbols, whereby the place identity becomes spontaneously recognizable.

5.5 Discussion of Results

The evaluation of the final AI-generated outcomes highlights a fundamental tension between the tool's ability to reproduce recognizable forms and its inability to synthesize them into coherent socio-spatial systems. While the outputs displayed arches, iwans, courtyards, brick textures, and ornamental details, they rarely translated these into functional architectural logic.

The difference in scale performance was critical: at the unit level, inward-facing layouts with courtyards and rooms showed partial success, whereas at the neighborhood scale, where communal spaces, circulation networks, and hierarchies were required, the outputs fell short.

The evaluation tables confirmed this contrast. Symbolic and aesthetic features were consistently achieved, but categories such as spatial hierarchy, human scale, and communal cohesion were often weak or not observable. This underlines the limitations of generative tools when applied to socially embedded principles, which extend beyond visual ornamentation.

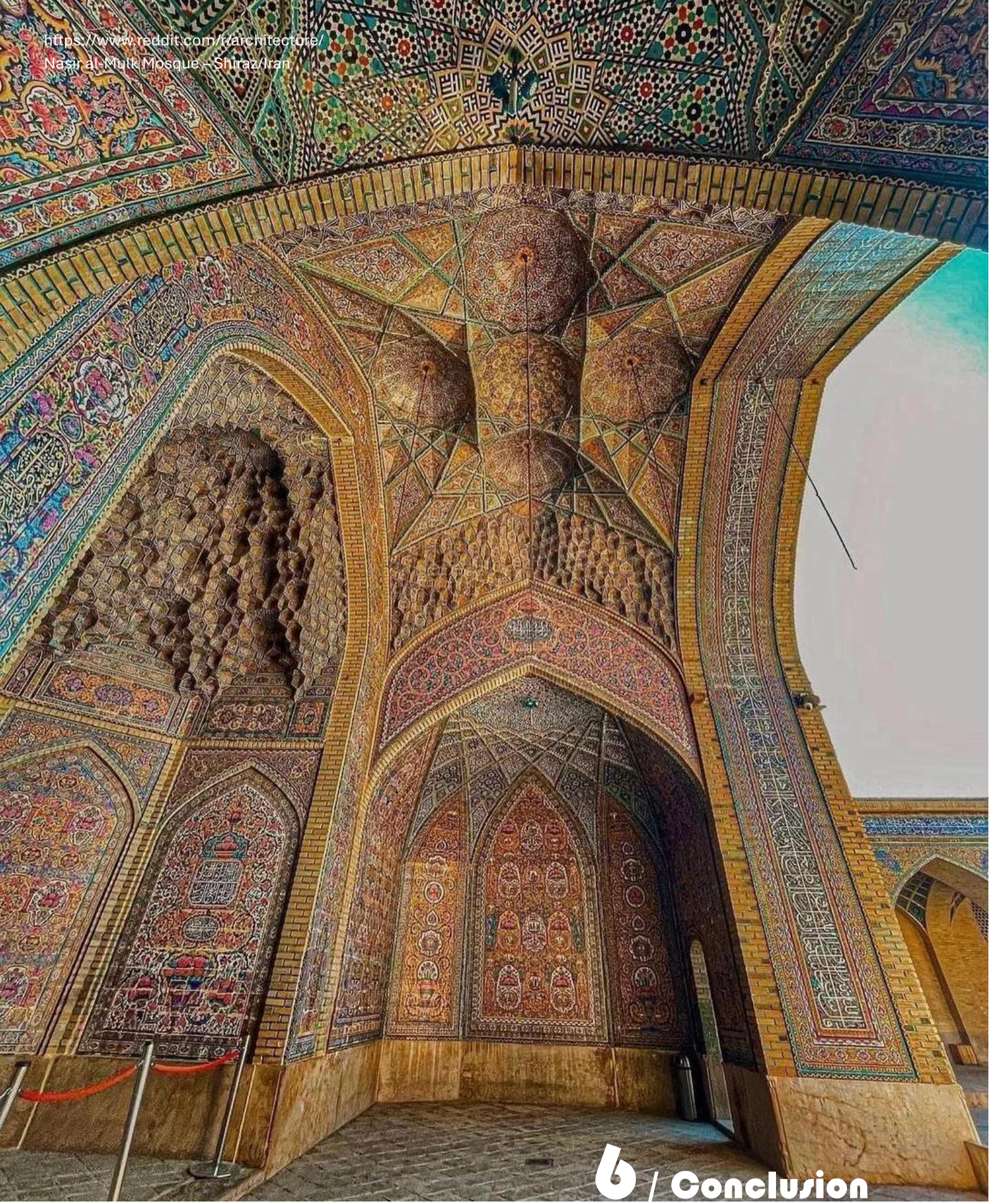
These results emphasize the indispensable role of the human designer: only through continuous refinement and interpretation could outputs reach the point of qualitative assessment. Even then, they remain conceptual rather than architectural—provocative imagery rather than resolved design.

5.6 Concluding Remarks

The reflections of this chapter underline the dual nature of AI in design: effective in producing atmospheric and symbolic imagery, yet limited in reconstructing the spatial and social logics that define the Mahalleh.

Strengths were most visible at the unit scale, where domestic features could be reimagined in vertical form, while weaknesses emerged at the neighborhood scale, with absent or unclear communal spaces, circulation, and privacy.

Taken together, the discussion confirms AI's role as a conceptual partner — a tool for generating speculative imagery that can stimulate design thinking, but not a substitute for human interpretation and architectural resolution. This chapter also reinforced the project's central focus: testing the limits of generative AI in reinterpreting the logics of the Mahalleh within a vertical housing framework.



6 / Conclusion

This chapter concludes the thesis by testing the limits of generative Artificial Intelligence (AI) in the conceptual reinterpretation of Iranian neighborhoods (Mahallehs) within vertical housing. It synthesizes the research trajectory established in Chapters 1–5, consolidating what the study reveals about AI's capacity and boundaries when confronted with culturally grounded, socio-spatial principles. The research is maintained at the level of conceptual design, in which AI is employed as a conceptual collaborator—a tool for speculative inquiry rather than a substitute for architectural judgment or an instrument of preservation. The next sections concisely synthesize the research, articulate principal findings, acknowledge limitations, summarize contributions, and outline directions for future research, in full continuity with the framework and results already established.

6.1 Summary of the Research

The thesis began by finding a fundamental tension of Iranian urbanism: the contrast between traditional Mahallehs, where there is spatial hierarchy, privacy, communal solidarity, and environmental sensitivity, and the placeless high-rise residential environments overwhelming the modern city. The research placed this divergence not as a question of preservation, but of reinterpretation—the transference of vernacular principles into new architectural contexts.

In order to investigate this, the study employed generative AI technologies, specifically MidJourney, in a controlled design pipeline process. The approach combined three levels: (1) theory and culture-source foundation, (2) iterative prompt engineering in order to produce speculative outputs, and (3) structured framework for assessment of eight categories to assess the outputs.

Chapters 4 and 5 documented the experimental process and critical reflections. The outputs confirmed AI's ability to generate atmospheric imagery with recognizable vernacular cues, but also revealed its limited capacity to produce coherent socio-spatial systems. The thesis therefore positions AI as a catalyst for imagination and critical dialogue, rather than as a design solution.

6.2 Key Findings

The research conducted in this thesis revealed a dual nature of generative AI within the application of culturally responsive architectural design.

Strengths

• **Iteration speed and variety**: AI generated multiple variations in a much shorter time than would have been achievable through manual exploration, expanding the scope of conceptual experimentation.

• **Detection of vernacular cues**: The majority of outputs integrated culturally significant features such as courtyard-like voids, iwans, brick façades, and rhythmic compositions recalling Iranian traditions.

• **Environmental analogies**: Certain outputs evoked passive design responses, including windcatcher-like towers, shaded terraces, and volumetric layering reminiscent of natural ventilation.

• **Imaginative provocation**: Images leaned towards introducing unexpected analogies or aesthetic directions, serving as catalysts for creativity and encouraging architects to step off conventional paths.

Limitations

• **Absence of architectural documentation**: Outputs remained at the atmospheric image level, lacking plans, sections, or construction logic.

• **Fragmented spatial logic**: Circulation networks and hierarchical transitions between public, semi-public, and private domains were inconsistent or absent.

• **Inadequate representation of social domains**: Semi-public and communal spaces, the essence of the Mahalleh, were shallow or altogether absent.

• **Distorted human scale and proportions**: Visually engaging as many outputs were, they were unrealistic as inhabitable spaces.

• **Reduction of vernacular principles**: Environmental and cultural aspects were reduced to ornamental motifs rather than being addressed as operational socio-spatial systems.

Overall, the results verify that AI can create culturally recognizable design imagery but not the competence to convey architectural meaning, functional coherence, and cultural profundity.

6.3 Limitations of the Study

The limits and conclusions of this thesis are set by some inherent limitations, which were not coincidental but were purposefully in conformity with the project goal of extending the frontiers of generative AI.

1. **Conceptual scope**

The work remained at the conceptual design stage intentionally. Outputs were visual and atmospheric, without architecture drawings, plans, or technical details. This is a limitation of the current AI tool capabilities and not a methodological flaw.

2. **Dependence on input quality**

The reliability of the output was highly sensitive to the precision of textual prompts and reference image choice. There was substantial prompt engineering effort and iterative tuning, which emphasized the tool's lack of interpretive power.

3. **Ambiguity of results**

The majority of the outputs were visually good but indistinct in terms of functionality, dimension, or spatial organization. This at times resulted in "not observable" categories in evaluation, indicating the interpretational challenges that come with AI imagery assessment.

4. **Tool-specificity**

MidJourney was the subject of investigation because of its more elaborate visual outputs. The findings cannot be applied to every AI environment because each environment handles various data and sets of algorithms.

In recognition of these constraints, the thesis situates its own contribution not as a definitive architectural solution but as a critical test case, both framing the potentialities and the limitations of AI generativity in heritage-conditioned design.

6.4 Contributions of the Thesis

In spite of its conceptual extent and methodological limitations, the thesis contributes in a number of ways to architectural discourse at both national and international contexts.

1. Contribution to Iranian architecture

The study resumes the debate on how the socio-spatial values of Mahalleh—privacy, hierarchy, communal life, and climatic adaptation—can be critically re-engaged in the unavoidable context of vertical housing. By framing the question as reinterpretation, rather than preservation, it emphasizes the responsiveness of cultural principles to emergent urban realities.

2. Contribution to heritage-informed design discourse

The thesis demonstrates reinterpretation as a legitimate means of working with heritage. The thesis reveals how intangible cultural values can instigate new typological orientations without copying historic forms literally. This is in line with contemporary international discourse that interprets heritage as a dynamic resource rather than a passive residue.

3. Contribution to AI and design research

By extending the limits of generative AI in this culturally specific context, the thesis enters the ongoing debate regarding the application of digital tools in design. It makes the case for AI as a conceptual collaborator, capable of stimulating creativity and provoking critical thinking, while reinstating the invaluable role of the human architect as interpreter and mediator.

6.5 Future Directions

The findings of this thesis point to several avenues for future investigation and research:

1. data specialization

Educating AI systems on carefully handpicked datasets of Iranian vernacular architecture may enhance their ability to generate outputs that move beyond the superficial decoration of present designs toward more readable socio-spatial meanings.

2. parametric and BIM integration

The integration of generative AI with parametric modelling and BIM-based processes has the potential to bridge the gap between inspirational images and first architectural sketches, allowing for a closer correlation between inspiration and technical feasibility.

3. Cross-cultural applications

It is possible to apply the approach to other cultures environments—e.g., Mediterranean, Japanese, or Islamic urbanism—to investigate whether AI may easily be adaptive to different vernacular logics and how evaluation frameworks would have to be modified.

4. Extending the limits of spatial representation

As AI tools develop, future studies will need to explore their ability to generate diagrams, plans, or reduced sections. This may allow for more straightforward conversion of conceptual results into architectural design procedures.

5. Exploring collaborative workflows

Studies in the future can explore how iterative human–AI collaboration might be structured, not only to enhance outputs but also to advance architectural pedagogy and practice.

6.6 Closing Remark

This thesis investigated the potentials and limitations of generative AI in conceptual reinterpretation of Iranian Mahalleh in vertical housing. The study demonstrated that AI can effectively open up the arena of conceptual exploration and infuse culturally responsive imagery, yet it cannot embed socio-spatial coherence, human scale, and functional logic.

The project emphasizes that AI should not be conceived as an autonomous designer but rather as a conceptual collaborator whose output is meaningful only if mediated critically by the architect. To this degree, the project presents no definitive architecture but a critical experiment with edge-pushing: a piece that investigates how human interpretation and digital fantasy can meet with cultural requirement in novel urban contexts.

Finally, the responsibility for architectural meaning, cultural relevance, and technical possibility is thrown on to the human architect, who has to balance innovation and continuity in mediating the possibilities and constraints of new technologies.

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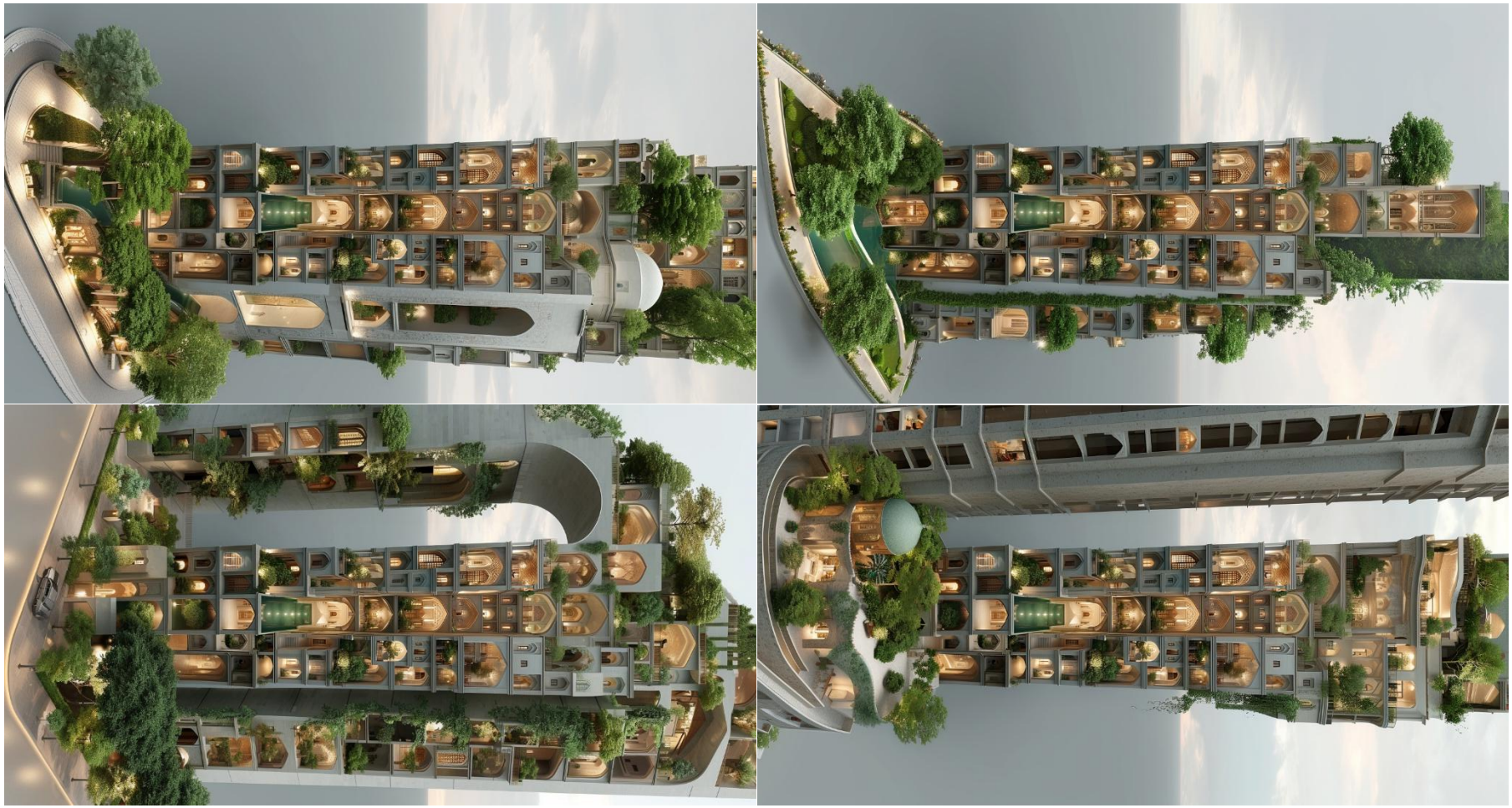
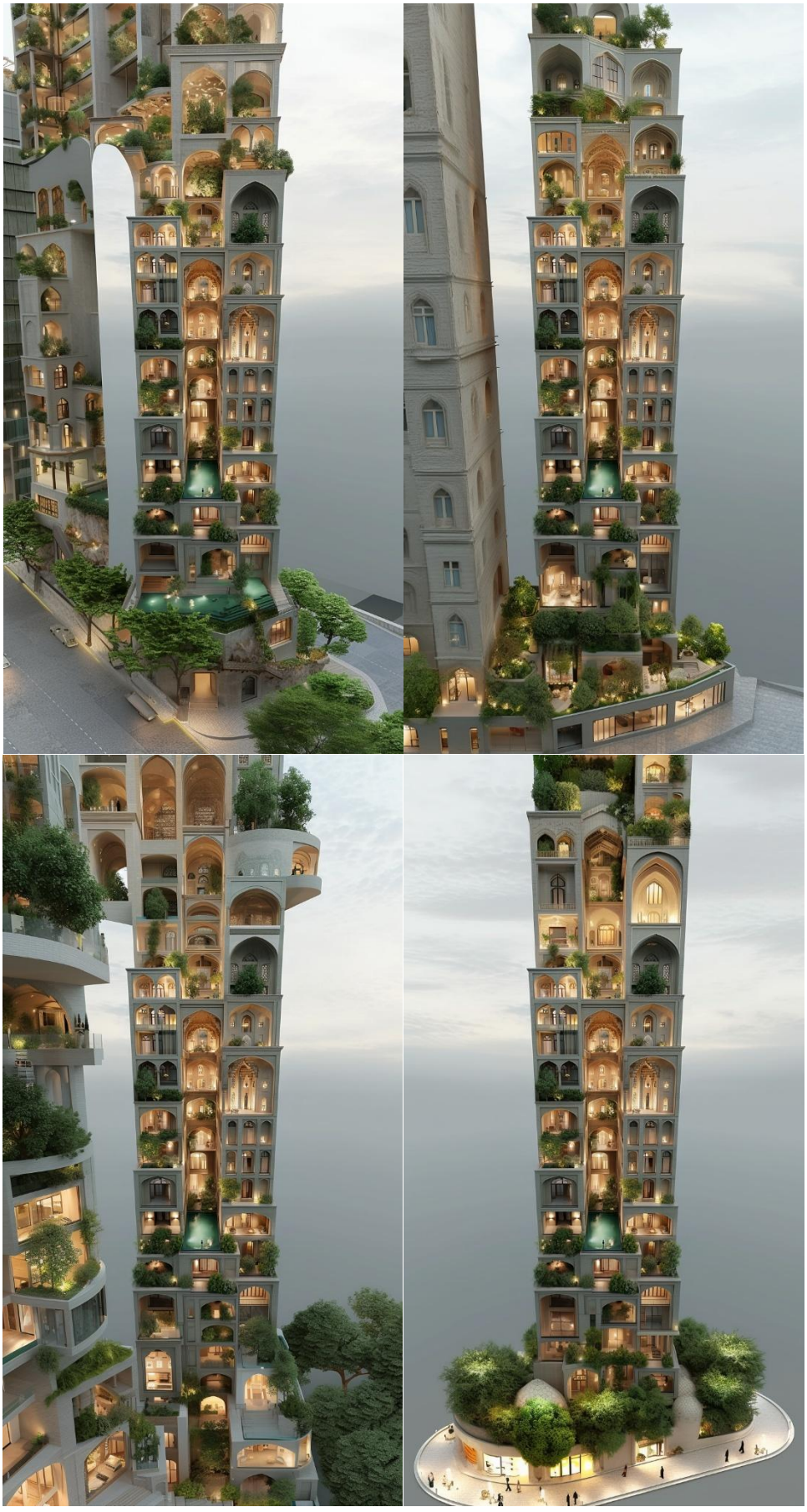
Appendix

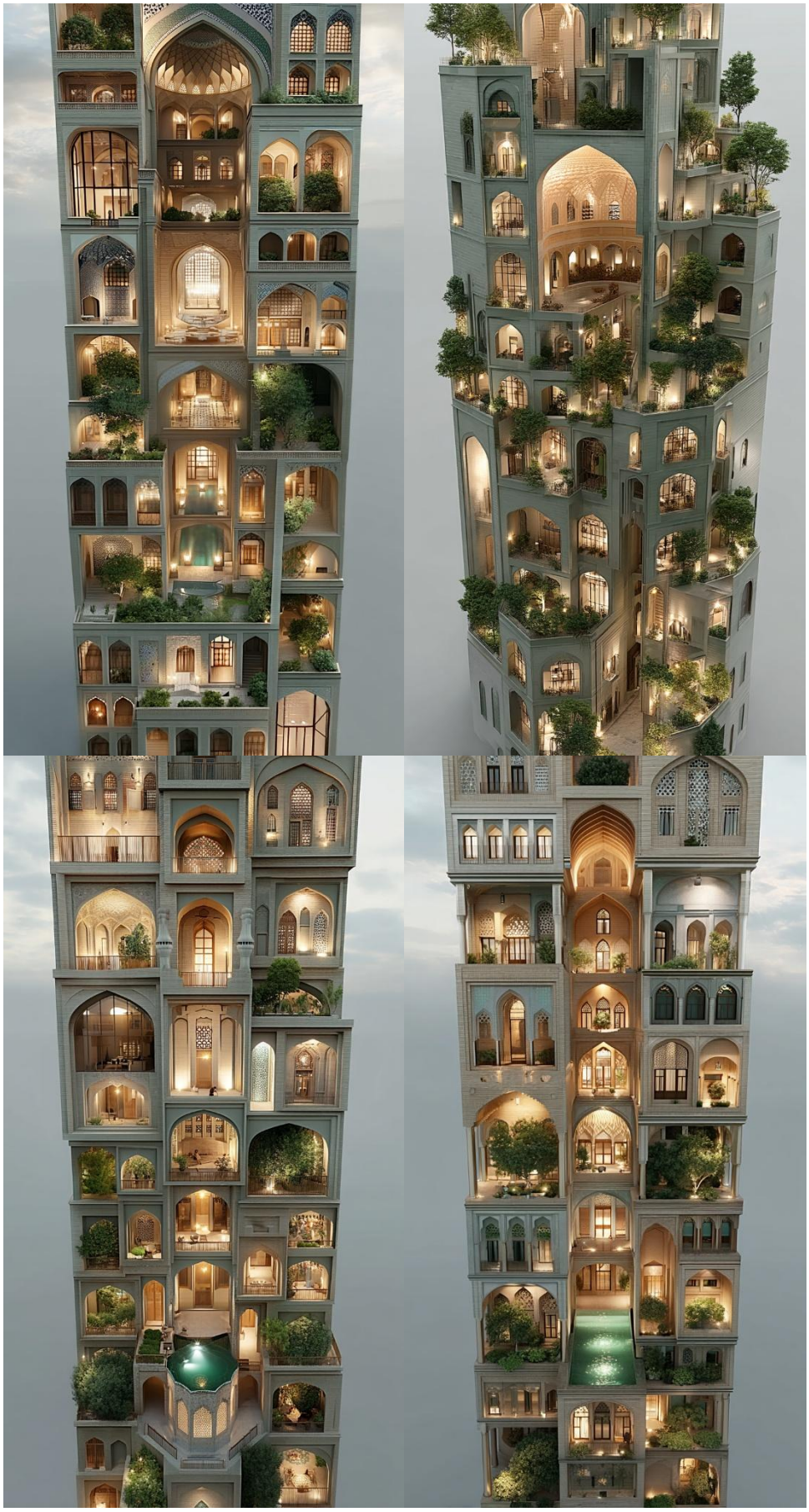
This appendix has a specially curated collection of AI results obtained via Midjourney, in the process of imagining how the traditional Iranian neighborhood (Mahalleh) can be mapped to a vertical city context. The results presented range from failure to partially successful results.

The intention of recording this spectrum is to give visibility to the iterative process of the AI-augmented process, where both the obstacles faced and incremental developments realized are marked. This appendix, by presenting failures together with partial successes, demonstrates the process of learning, the impact of human intervention, and the limitations of AI potential in reading cultural and spatial concepts.

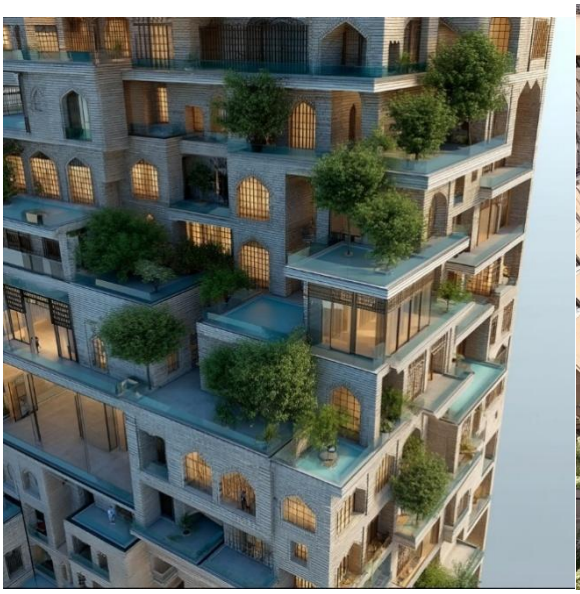
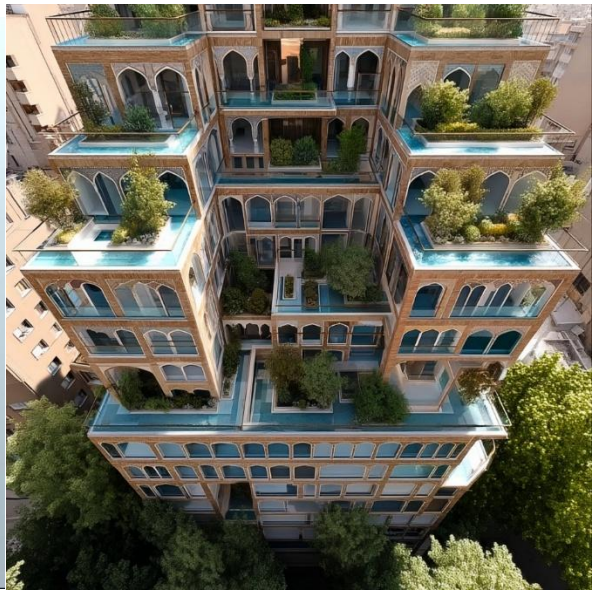
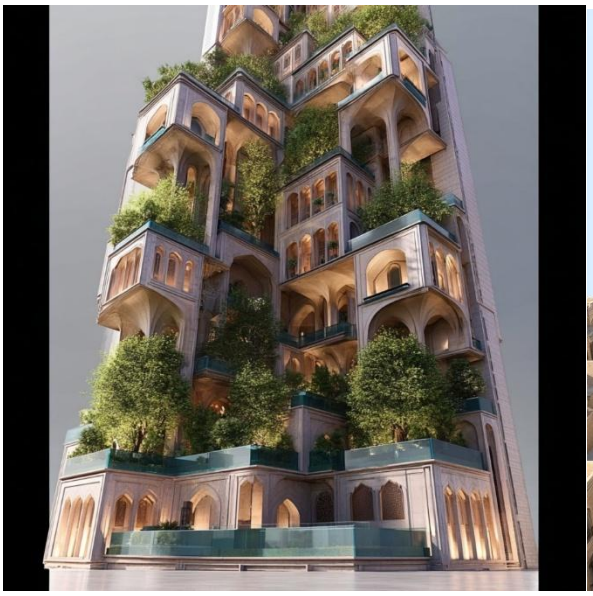
Collection of final outcomes

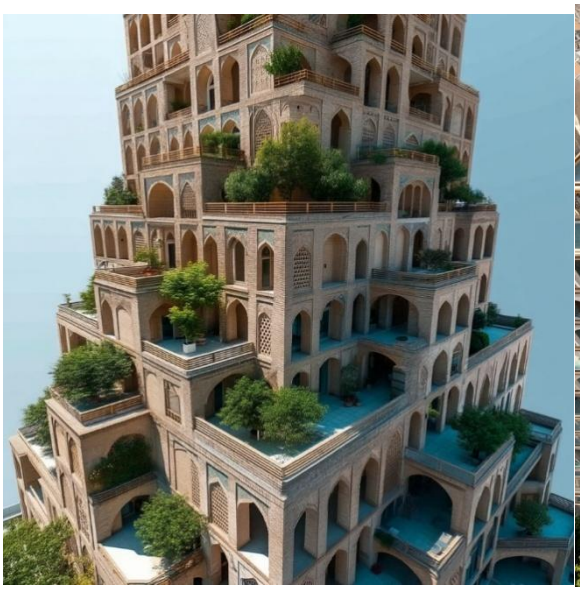
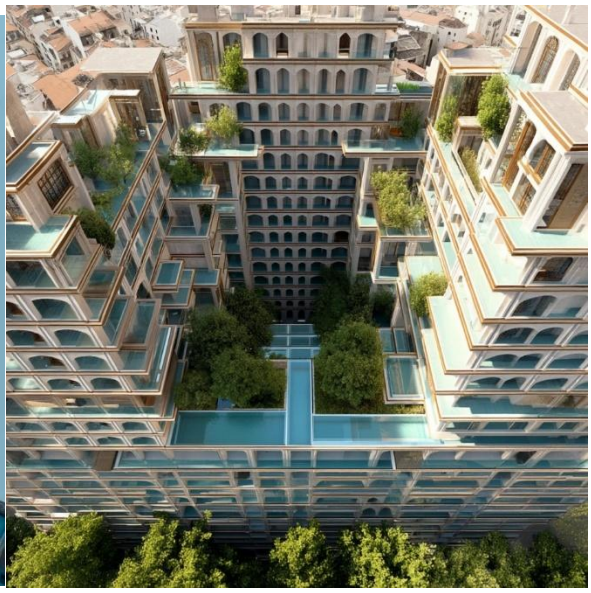


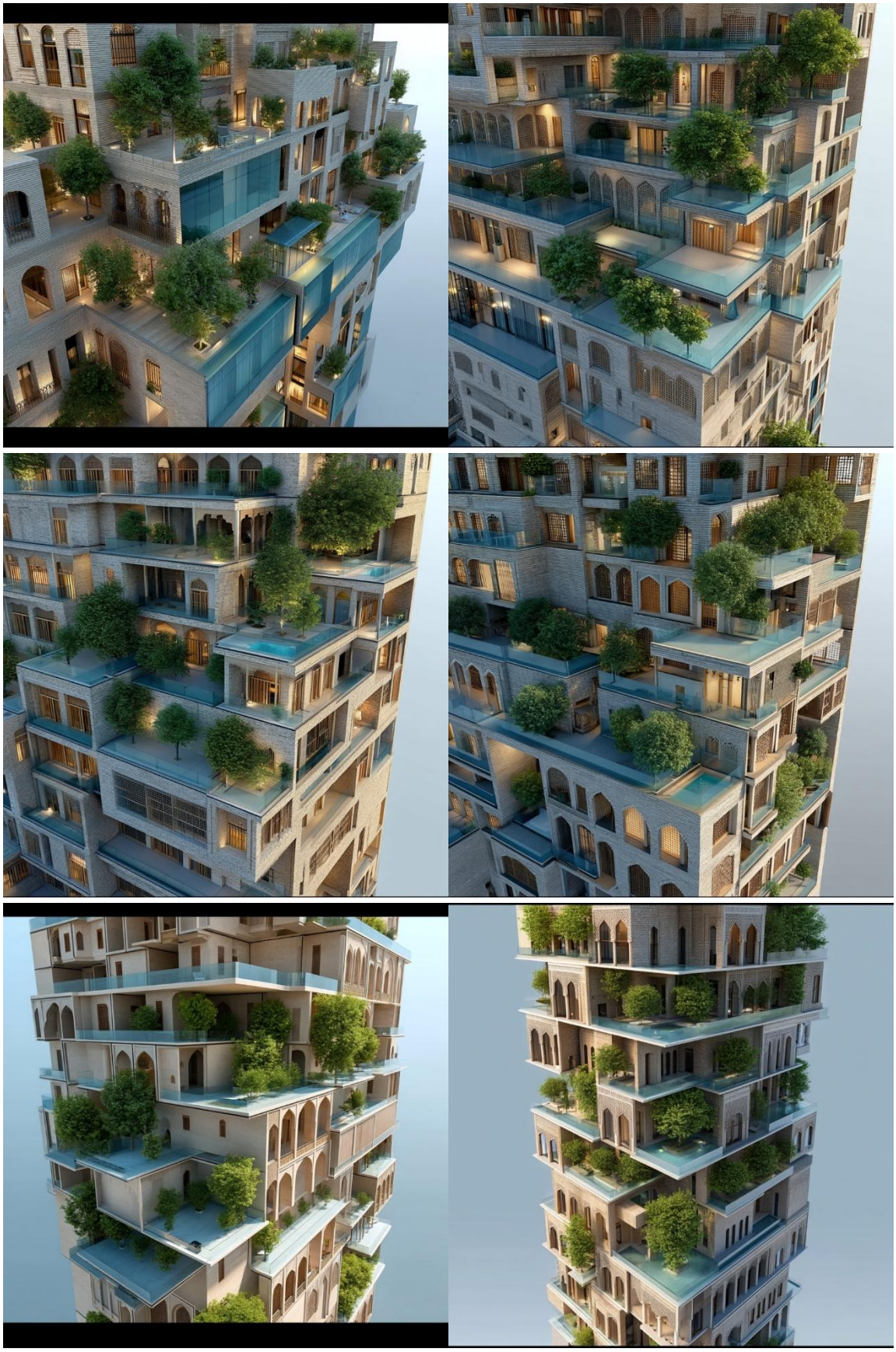


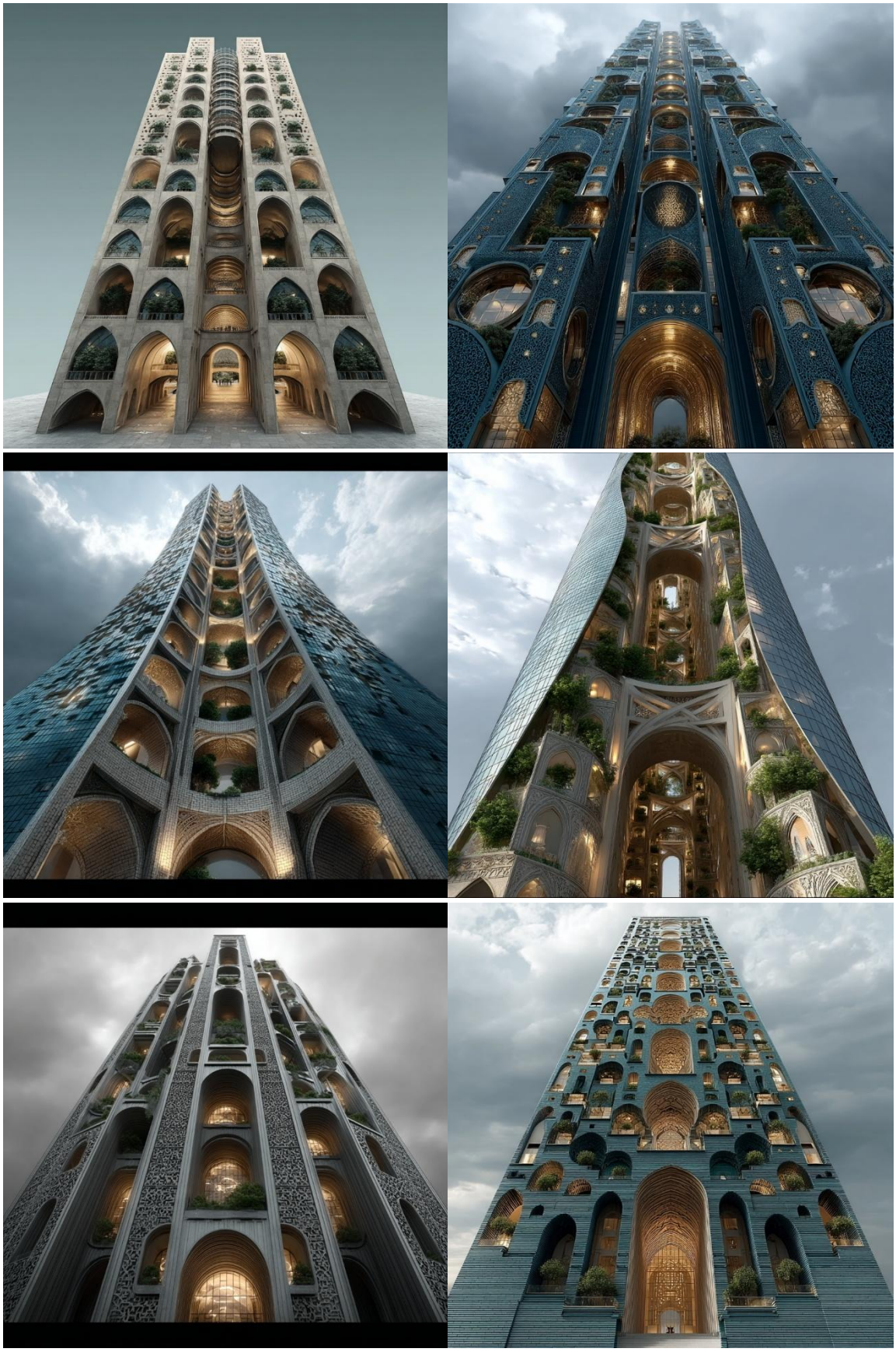


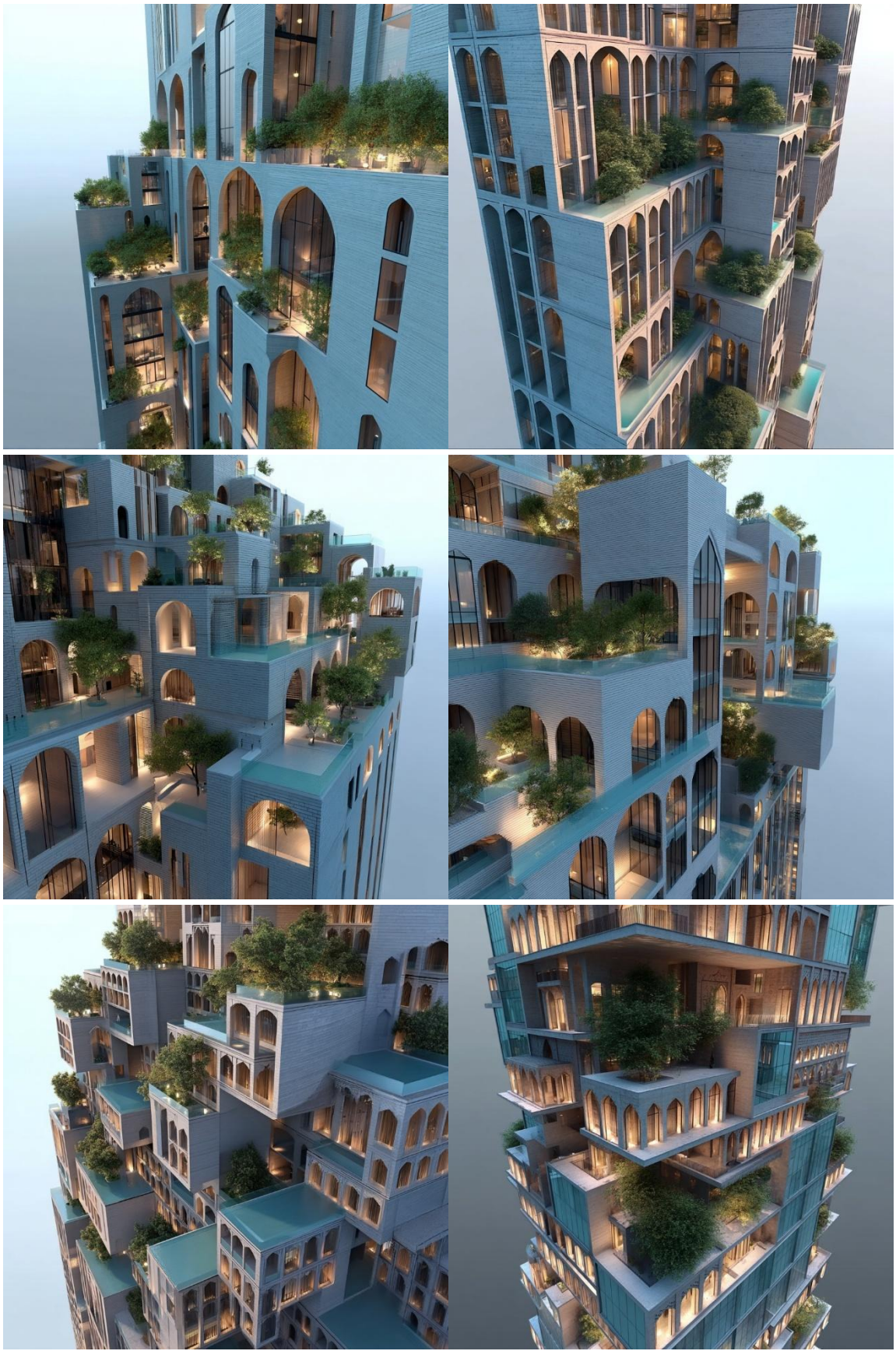
Collection of failed Initial outcomes

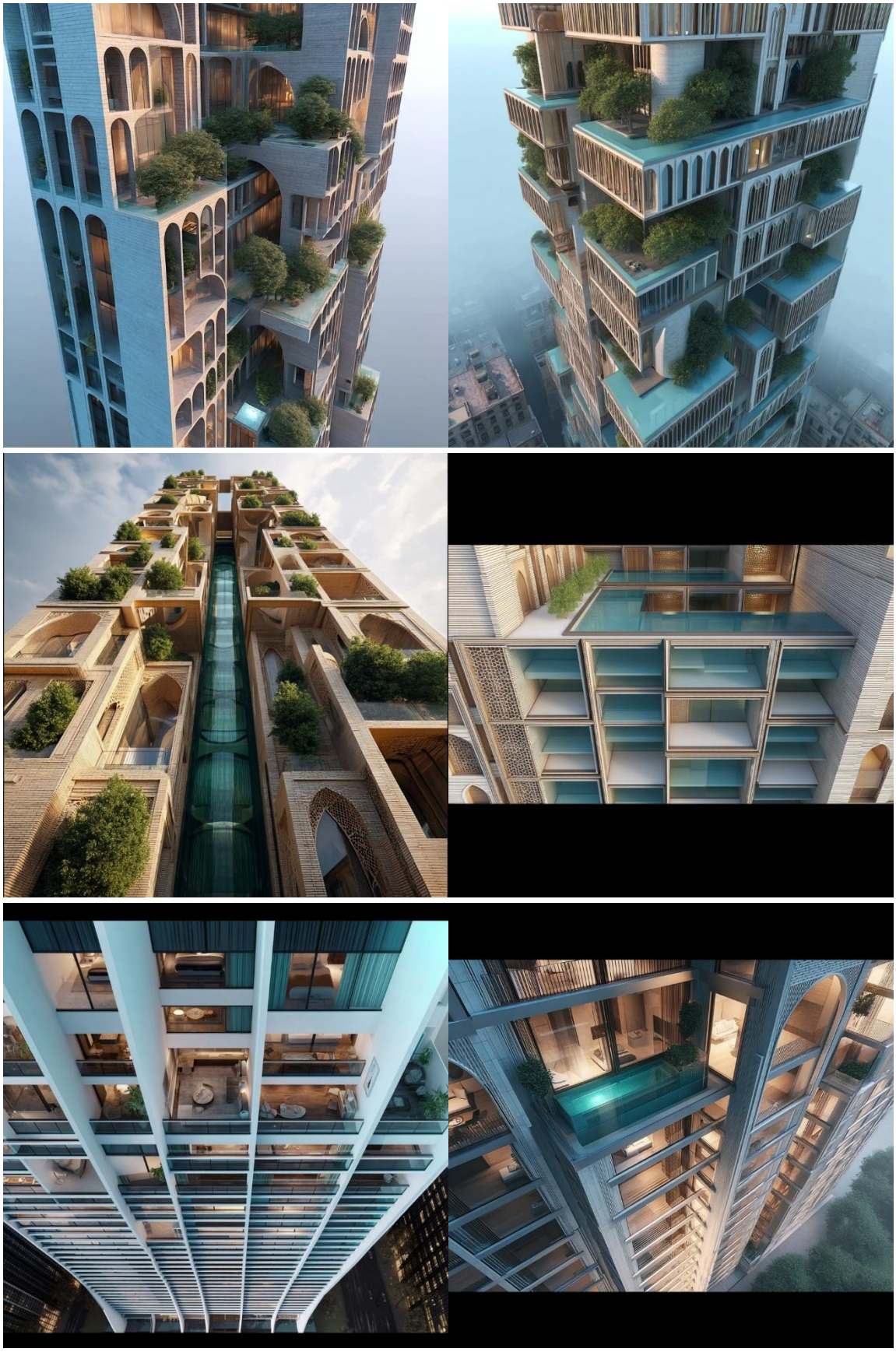




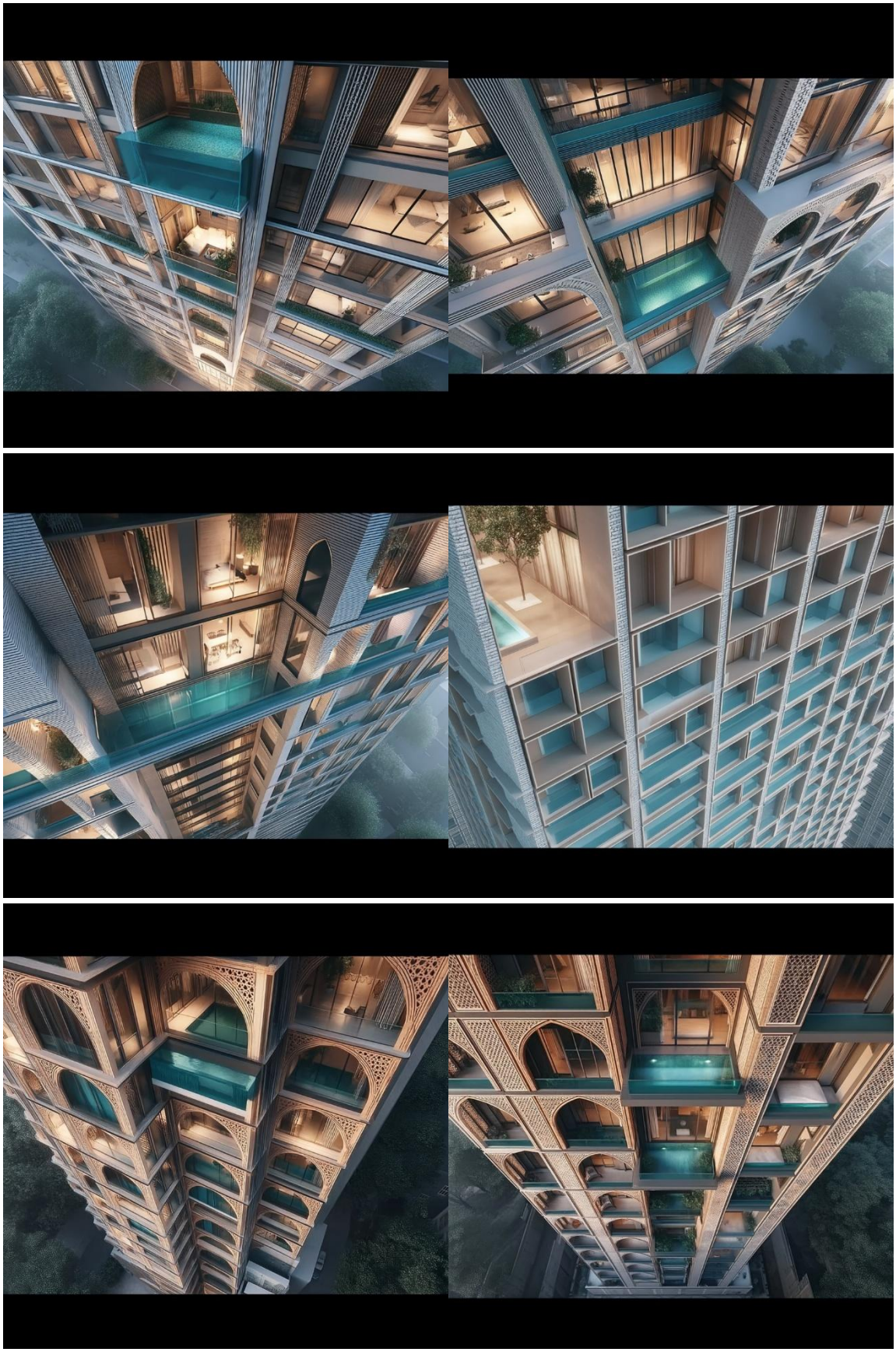



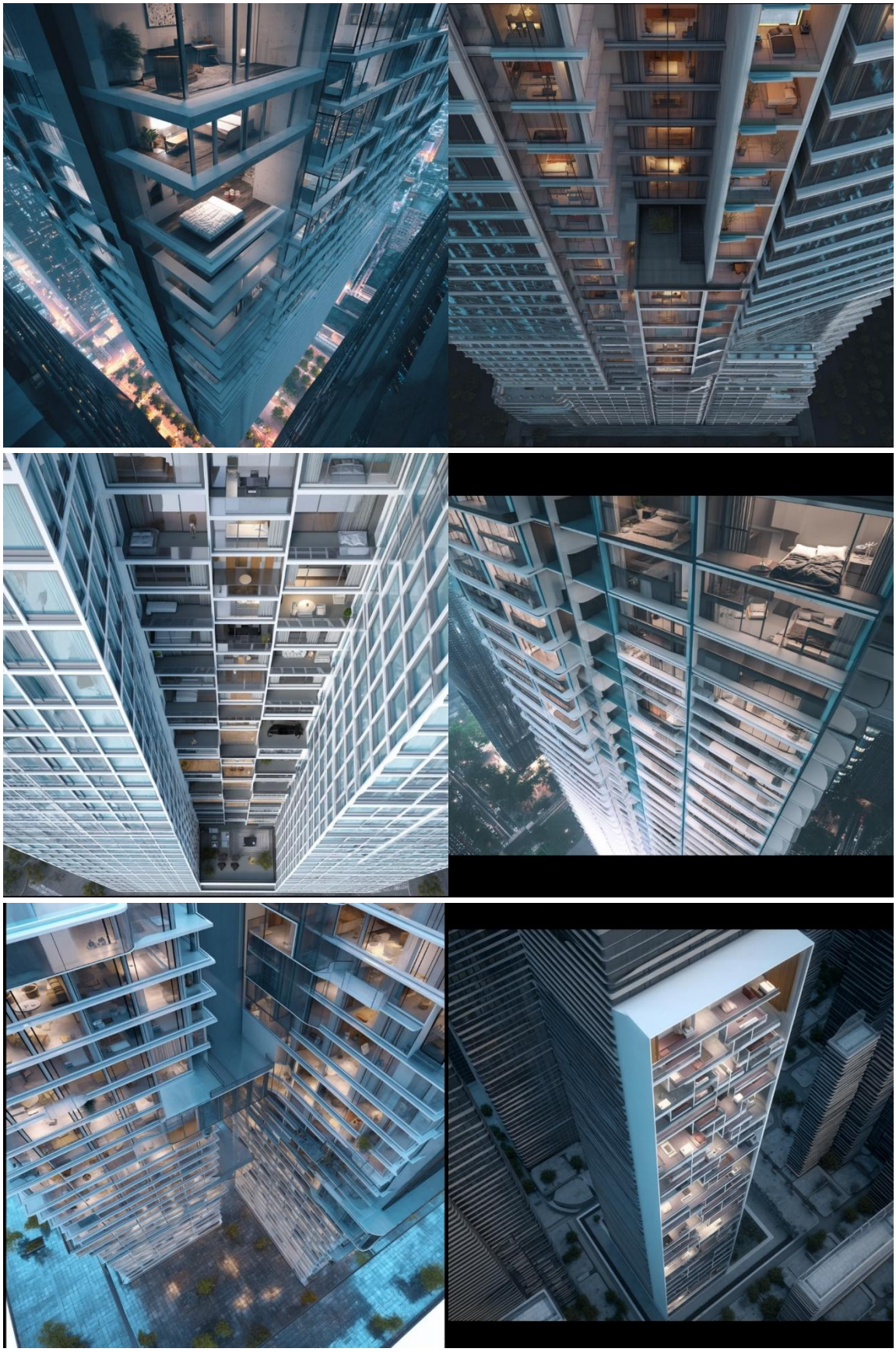


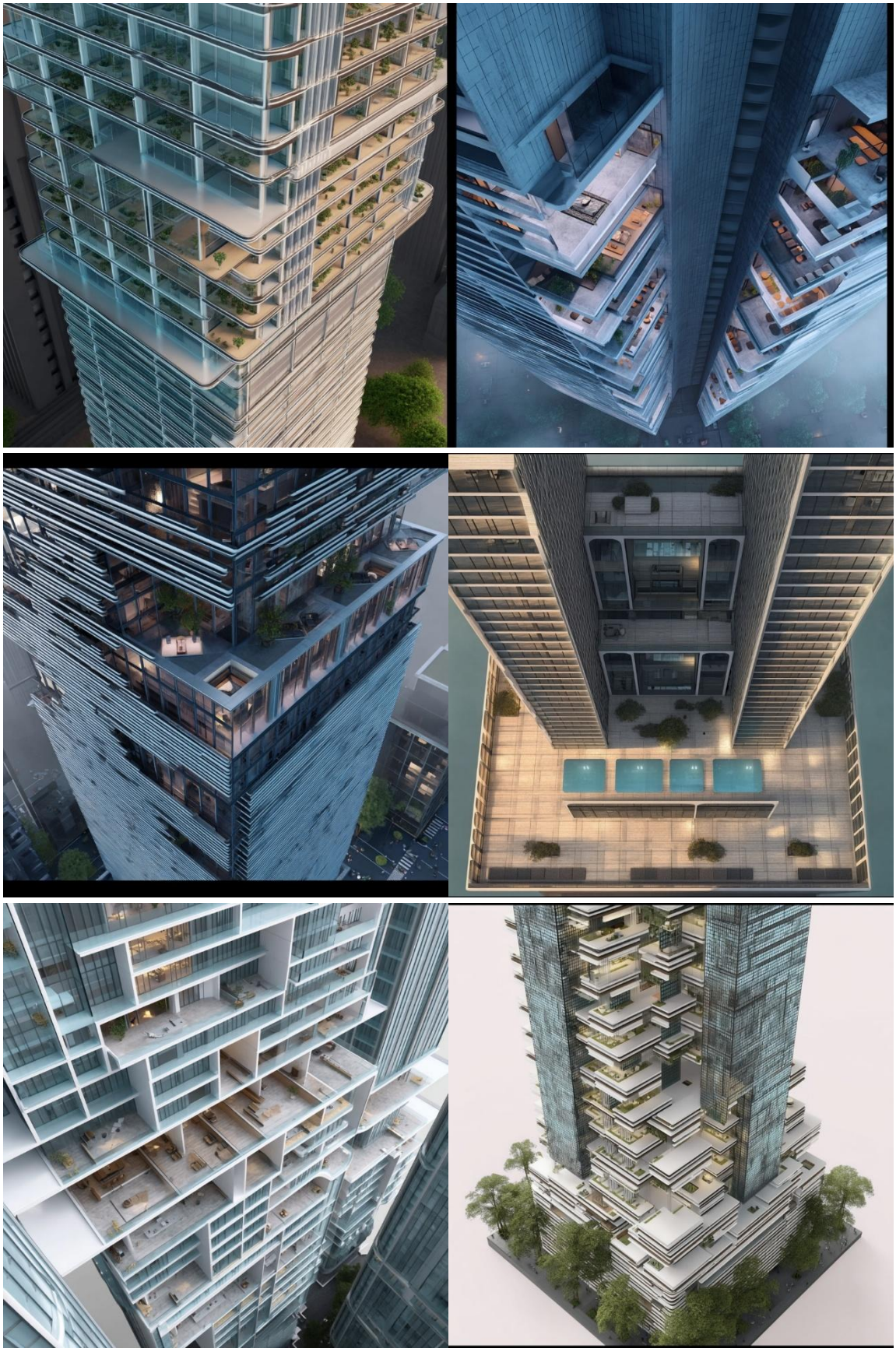












Outcomes in process of refinement related to concept of
traditional house in a vertical context as a unit of an appartement