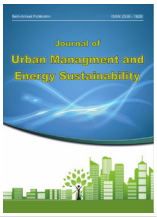
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ORIGINAL RESEARCH PAPER

Privacy in the Iranian House: From Spatial Organization to Structural Compatibility in Contemporary Housing Design

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ABSTRACT

Mahramiyyat (privacy) is a foundational organising principle of Iranian domestic architecture, yet it has been eroded by contemporary mass-housing paradigms, and the existing literature, largely historical, case-specific and based on space syntax, has not translated it into criteria usable in design, construction and building regulations. This review aims to identify the spatial-physical mechanisms that constitute mahramiyyat in the Iranian house and to formulate them as an integrative, operationalisable framework for sustainable contemporary housing. An interpretive systematic review of Persian and international databases was conducted, and sources retained after three-stage screening were examined through directed qualitative content analysis. Findings show that mahramiyyat operates as a multi-layered system rather than a single element: a spatial hierarchy of entry from the hashti and dalan to the courtyard and inner quarters; visual and auditory control in which spatial depth substitutes for physical barriers; and cultural-climatic compatibility, in which the same courtyard organisation secures family privacy and passive environmental performance. Evidence from the extroverted houses of Gilan shows that privacy depends on organisational logic rather than introverted form. As load-bearing walls, openings and intermediary spaces serve both structural and privacy functions, the invasiveness of seismic retrofitting is inversely related to the preservation of privacy mechanisms. The study therefore proposes a four-tier 'privacy–space–construction' framework, comprising foundational principles, design criteria, construction requirements and structural synergy, that adds structural compatibility as a fourth layer. The framework provides a shared language for architects and structural engineers and a basis for measurable privacy criteria in contemporary housing regulations.

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INTRODUCTION

Privacy (mahramiyyat) constitutes one of the foundational organizing principles of Iranian domestic architecture not an additive feature, but a spatial logic that governs the entirety of the house. Historically, this principle has been realized through specific spatial mechanisms: a hierarchy of access (from the hashti and dalan to the courtyard and inner quarters), visual and auditory controls, and the separation of public and private domains (Moazemi & Abdi, 2016). In traditional houses of Yazd, the entrance was designed not directly but through a dalan and hashti with a winding path, preventing direct visual access from the entrance to private spaces and preserving the gendered layering of domains (from male to female territories) (Moazemi & Abdi, 2016). Space syntax research demonstrates that the four-sided configuration in Qajar houses of Shiraz exhibits the highest level of privacy among various spatial patterns (Zangeneh et al., 2021). Furthermore, a study of vernacular houses in Gilan reveals that even within extroverted architecture, privacy is achievable through three key strategies "proportion of mass to space", "spatial hierarchy" and "intelligent access management" and that extroversion does not preclude the realization of privacy (Karimi Shirazi et al., 2025).

Contemporary Iranian architecture, however, has witnessed a systematic erosion of this principle. Research explicitly states that privacy has been sacrificed to economic and social pressures, and the priority for establishing spaces that preserve privacy has gradually diminished, producing houses alien to indigenous culture (Zangeneh et al., 2021). In Pahlavi-era houses, with the elimination of the second courtyard and the reduction of entrances, the privacy of the inner quarters has been diminished, and in some cases the hashti space has been entirely removed (Rastegar & Bemanian, 2019). This condition persists even as research confirms that adherence to privacy principles in housing design not only positively affects quality of life but also strengthens social interaction and reduces social tensions (Shirdel et al., 2025).

From a structural engineering perspective, the persistence of privacy (mahramiyyat) in the Iranian house depends not only on spatial organization but also on the compatibility of the structural system with that organization. Traditional Iranian houses were predominantly constructed with unreinforced masonry load-bearing wall systems; in such a system, thick walls not only resist gravity and lateral loads but simultaneously act as visual and acoustic barriers, thereby intertwining structure and privacy within a single physical entity (Bhattacharya et al., 2014; Memarian & Brown, 2003). This intertwining carries a significant implication for contemporary interventions: any seismic retrofitting measure undertaken without regard for this linkage such as adding thick concrete layers to walls or altering the dimensions and positions of openings may secure structural safety while disrupting the mechanisms of privacy (Bhattacharya et al., 2014). The research problem is therefore not merely one of spatial design, but of identifying low-invasive and compatible structural strategies aligned with the logic of privacy strategies that simultaneously ensure seismic safety and spatial-perceptual continuity (Bhattacharya et al., 2014; ICOMOS, 2003). The problem can be articulated at two levels. At the theoretical level, existing literature on privacy is predominantly historical or case-specific, employing space syntax analysis (Aram & Aram, 2024; Karimi Shirazi et al., 2025; Zangeneh et al., 2021), and lacks an integrative and operationalizable framework for contemporary design and construction. While these studies have quantitatively demonstrated differences in privacy levels across spatial configurations, their findings have not been translated into design criteria usable in construction practice and building regulations. At the practical level, the absence of such a framework has led architects and engineers to treat privacy as a vague cultural preference, readily discarded under the pressure of global mass-housing paradigms.

The necessity of this research stems from the fact that privacy is not merely a heritage value but a functional mechanism for psychological security, family cohesion, and quality of life (Shirdel et al., 2025). Furthermore, the case of Gilan's vernacular architecture demonstrates that privacy is not a specific form but a spatial organizing logic that can be reinterpreted across climates and typologies (Karimi Shirazi et al., 2025). International research employing space syntax also confirms that the spatial configuration of historic Persian houses is deeply rooted in socio-cultural values, with transitional spaces playing a key role in controlling social interactions and preserving privacy (Moosavi et al., 2025). Consequently, developing a framework that translates this logic into actionable design and construction criteria is both a theoretical and a practical imperative.

Accordingly, the central question of this study is: What specific spatial-physical mechanisms constitute the concept of privacy (mahramiyyat) in Iranian domestic architecture, and how can these mechanisms be formulated into an integrative, operationalizable framework for sustainable contemporary design and construction?

MATERIALS AND METHODS

Research on privacy (mahramiyyat) in Iranian domestic architecture can be categorized into three main streams. The first stream consists of value-oriented cultural studies that explain privacy based on religious texts, Islamic culture, and historical sources, recognizing it as one of the foundational principles of Iranian-Islamic architecture (Shirdel et al., 2025). The second stream comprises quantitative studies, particularly space syntax research, which employ mathematical and computational tools to measure and compare the spatial mechanisms through which privacy is realized in traditional architectural samples (Heidari et al., 2018; Khozaei Ravari et al., 2024; Zangeneh et al., 2021). The third stream includes comparative-analytical studies that examine the transformation of privacy through the transition from traditional houses to contemporary housing, emphasizing the gradual decline of this principle in today's architecture (Rastegar & Bemanian, 2019). A review of these three streams reveals that while each has individually achieved valuable insights, the connection between them remains weak. Value-oriented studies have rarely reached measurable spatial criteria, quantitative studies have often remained at the level of sample description, and comparative studies have largely confined themselves to diagnosing the crisis without offering operational solutions. The following table categorizes and summarizes the most important domestic and international studies. (Tab. 1 and 2)

Table 1: Domestic Studies

No.	Author(s) & Year	Title/Topic	Method	Main Finding	Limitation/Relation to Present Study
1	Zangeneh et al. (2021)	Measuring privacy in spatial configurations of Qajar houses in Shiraz	Quantitative-qualitative, space syntax	Four-sided configuration has the highest privacy; privacy has been sacrificed to economic and social pressures in the contemporary era	Limited to one city and period; lacks a generalizable framework
2	Karimi Shirazi et al. (2025)	Privacy in extroverted houses of Gilan	Descriptive-analytical, space syntax	Three strategies mass-space proportion, hierarchy, and access management realize privacy without introversion	Limited to Gilan; no translation to contemporary design criteria
3	Aram & Aram (2024)	Entrance hierarchy in Qajar houses of Qom	Descriptive-analytical, space syntax	Three mechanisms: intermediary elements (hashti/dalan), central courtyard, domain layering	Limited to entrance; no coverage of the entire spatial system

4	Shirdel et al. (2025)	Recreating privacy in contemporary housing	Qualitative, descriptive-analytical	Privacy positively affects quality of life and social interactions	Theoretical level; lacks spatial operationalization
5	Heidari et al. (2018)	Privacy creation in three Peymoon systems via space syntax	Space syntax	Small Peymoon houses exhibit greater privacy; large Peymoon houses achieve privacy through spatial depth	Limited to Kashan and Isfahan; no construction dimension
6	Rastegar & Bemanian (2019)	Typology of contemporary housing spatial structure based on privacy and hierarchy	Space syntax	Privacy not achieved in 1970s-80s; from 1990s onward, entrance nodes improved privacy	Analytical-descriptive; no design framework
7	Babazadeh Oskouei et al. (2020)	Decline of privacy in contemporary housing	Analytical	Privacy sacrificed to economic and social factors; houses built alien to indigenous culture	Descriptive; no spatial solution
8	Momeni & Naseri (2015)	Preference for traditional over modern houses	Survey	Residents prefer traditional houses	Attitude survey only; no spatial analysis
9	Kazemzadeh Raef & Mirdrikvand (2020)	Recognizing privacy in traditional houses	Analytical-comparative	Privacy divided into public and private levels; visual and auditory privacy affect all typologies	Limited to two samples; no construction dimension

Table 2: International Studies

No.	Author(s) & Year		Method	Main Finding	Limitation/Relation to Present Study
10	Moosavi et al. (2025)	Title/Topic	Space syntax (axial, VGA, isovist)	Spatial configuration rooted in socio-cultural values; transitional spaces key in controlling interactions; advocates culturally-rooted design guidelines for Iranian construction engineering organizations	Descriptive; no operational framework; closest international study to present aim
11	Omidvari & Hamzenejad (2022)	Comparative study of privacy in Middle Eastern Islamic houses	Descriptive-analytical comparative	Separation of private/public domains is the most prominent manifestation; realization varies by climate and culture	Macro-comparative; no construction/building regulations
12	Memarian & Brown (2003)	Socio-cultural concepts in traditional Iranian residential architecture	Analytical-comparative	Privacy in traditional Iranian houses based on introversion and spatial hierarchy; courtyard serves as privacy and family security	Classic foundational study; no operational application for contemporary
13	Bahammam (2006)	Role of privacy in Saudi courtyard house design	Behavioral-cultural analysis	Privacy derived from Islamic teachings; manifested in physical layout of courtyard house	Limited to Saudi context; no quantitative analysis

14	Al-Hagla (2010)	Physical privacy and quality of life in Islamic societies	Analytical-qualitative	Physical privacy plays a key role in quality of life and psychological security	Theoretical; no actionable design model
15	Rapoport (1990)	Role of culture in housing design	Theoretical-conceptual	Privacy is culturally influenced; house is a cultural phenomenon	General theoretical framework; no Iranian context
16	Kamalipour et al. (2012)	Formal composition of vernacular houses in Kerman	Space syntax	Spatial configuration of Kerman vernacular houses analyzable through living space organization	Limited to Kerman; no construction dimension
17	Khozaei Ravari et al. (2024)	Residential spatial configuration for visual privacy in Iranian dwellings	Space syntax	Iranian house layouts became less integrated (1970s-2010s); reduced integration increases segregation and enhances visual privacy; privacy achievable even with reduced scale	Focuses on visual privacy; no social or construction dimensions

Three systematic gaps emerge from the above tables:

Gap 1: Disconnect between quantitative analysis and actionable theoretical framework. Space syntax studies have demonstrated that privacy in traditional houses is measurable through access hierarchy, spatial depth, and transitional spaces (Heidari et al., 2018; Khozaei Ravari et al., 2024; Zangeneh et al., 2021). However, these findings have not been translated into design criteria usable in construction practice and building regulations. In other words, these studies explain "what was" but do not operationally formulate "what should be."

Gap 2: Neglect of the construction and civil engineering dimension. Almost all prior studies have been conducted within architecture and have not addressed construction requirements, materials, building regulations, and execution processes as design constraints. Only Moosavi et al. (2025) implicitly emphasize the need for design guidelines for Iranian construction engineering organizations, yet they offer no operational framework themselves.

Gap 3: Absence of an integrative framework for contemporary housing. Existing studies are either descriptive-historical or limited to a specific climate and city. None provides a comprehensive framework that simultaneously integrates the value-based principles of privacy, measurable spatial mechanisms, and contemporary construction requirements into a unified system.

The novelty of the present research lies in developing an integrative "privacy-space-construction" framework that transforms scattered space syntax findings into operationalizable criteria. Unlike previous studies that treat structural retrofitting as a purely technical matter separate from spatial design, this study introduces structural compatibility as the fourth foundational layer, linking the cultural-value dimension of privacy with technical and executive requirements so that the framework is simultaneously usable by architects and civil engineers. Furthermore, it provides a matrix of privacy criteria across four layers access hierarchy, perceptual control, cultural-climatic compatibility, and structural compatibility which can serve as a basis for formulating sustainable housing design regulations in contemporary practice.

Methodology

The present study is fundamental-theoretical in purpose and qualitative in the nature of its data, with an interpretive systematic review as its primary strategy. Rather than quantitatively aggregating findings (meta-analysis), this strategy undertakes an interpretive synthesis and theoretical conceptualization of prior studies in

order to extract an integrative framework from concepts scattered across the two domains of architecture and construction engineering. Unlike a narrative review, in which source selection depends on the researcher's discretion, a systematic review follows a transparent and reproducible procedure, formulating inclusion and exclusion criteria and a search strategy prior to commencement and holding them constant throughout the study (Snyder, 2019). However, since the ultimate aim of this study is not hypothesis testing but the formulation of a "privacy–space–construction" theoretical framework, quantitative meta-analysis is not employed; instead, the focus is on the interpretive synthesis of the spatial mechanisms of privacy and their translation into design and construction criteria. The study population comprises peer-reviewed scientific articles, theses, and authoritative domestic and international documents published between 2000 and 2026 that belong to one of three domains: (a) the concept of privacy (mahramiyyat) and harim in Iranian-Islamic architecture (Kazemzadeh Raef & Mirdrikvand, 2020; Moazemi & Abdi, 2016; Shirdel et al., 2025); (b) spatial analysis of traditional houses using space syntax (Aram & Aram, 2024; Heidari et al., 2018; Karimi Shirazi et al., 2025; Khozaei Ravari et al., 2024; Zangeneh et al., 2021); and (c) contemporary housing design and construction requirements (Bahammam, 2006; Karimi Shirazi et al., 2025; Moosavi et al., 2025; Rastegar & Bemanian, 2019). A systematic search was conducted in domestic databases (IranDoc, Magiran, Noormags, Civilica, and SID) and international databases (Scopus, ScienceDirect, Taylor & Francis, Google Scholar, and PubMed). Search keywords were organized into three thematic categories: in the privacy domain (mahramiyyat, privacy, introversion, andaruni, visual privacy, and their English equivalents) (Kazemzadeh Raef & Mirdrikvand, 2020; Moazemi & Abdi, 2016); in the space syntax domain (space syntax, spatial configuration, spatial depth, access hierarchy, and their English equivalents) (Heidari et al., 2018; Khozaei Ravari et al., 2024; Zangeneh et al., 2021); and in the contemporary housing domain (contemporary housing, apartment, sustainable design, building regulations, and their English equivalents) (Moosavi et al., 2025; Rastegar & Bemanian, 2019). Inclusion criteria were publication in peer-reviewed journals, direct relevance to at least one of the three domains, and availability of the full text; exclusion criteria were non-peer-reviewed conference papers, news and general reports, purely technical studies unrelated to the concept of privacy, and duplicate or non-extractable sources. Screening proceeded in three stages title and abstract review, full-text review, and methodological quality assessment yielding a final set of 18 sources (9 Persian articles, 6 English articles, and 3 foundational theoretical sources) for final analysis.

Data were analyzed using directed qualitative content analysis. In this method, the coding process begins with an initial categorization system derived from the theoretical foundations and literature review, after which new categories are inductively added to or modified within the system during textual analysis (Hsieh & Shannon, 2005). This combined deductive–inductive approach suits the present study because, on the one hand, the initial "privacy–space–construction" framework emerged from the literature review (Heidari et al., 2018; Moazemi & Abdi, 2016; Shirdel et al., 2025), and on the other, it allows emergent categories such as criteria specific to different climatic contexts (Gilan, Yazd, Shiraz) to be added to the framework (Karimi Shirazi et al., 2025; Zangeneh et al., 2021). The initial analytical categories, based on the study's theoretical framework, are: access hierarchy (from the hashti and dalan to the andaruni) (Aram & Aram, 2024; Heidari et al., 2018), perceptual control (visual and auditory privacy) (Kazemzadeh Raef & Mirdrikvand, 2020; Khozaei Ravari et al., 2024), cultural-climatic compatibility (Karimi Shirazi et al., 2025; Omidvari & Hamzenejad, 2022), and construction and execution requirements (Moosavi et al., 2025). The unit of analysis is the meaning unit a sentence, paragraph, or

passage from a source text that relates to one of the above categories (Graneheim & Lundman, 2004). To ensure the trustworthiness of the qualitative research, four criteria were employed: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Credibility was established through peer review and double coding; transferability through thick description of diverse climatic and cultural contexts (houses in Yazd, Shiraz, Gilan, and Qom) (Aram & Aram, 2024; Karimi Shirazi et al., 2025; Zangeneh et al., 2021) and transparency of source selection criteria; dependability through complete documentation of the search, screening, and coding process; and confirmability through maintaining a transparent chain of reasoning from data to conclusion and review by an independent researcher (Lincoln & Guba, 1985).

The study also has specific methodological limitations. First, despite the systematic strategy, source selection in qualitative research inevitably involves degrees of researcher interpretation (Snyder, 2019). Second, some prior studies are confined to a single climate or city (Aram & Aram, 2024; Karimi Shirazi et al., 2025; Zangeneh et al., 2021), and generalizing their findings to the contemporary context requires conceptual localization, which is addressed in the findings and discussion sections. Third, as this is a review study, the validity of the findings depends on the quality of the primary sources, and empirical testing of the proposed framework in future research is essential (Snyder, 2019).

Privacy as a Multi-Layered System

Privacy (mahramiyyat) in Iranian domestic architecture is neither an additive feature nor a merely abstract cultural value; it is an organizing system that governs the entirety of the house. The concept operates in two domains: physically, it establishes principles that ensure the security and safety of space; semantically, it confers dignity and value upon space such that the individual attains tranquility within it (Moazemi & Abdi, 2016). A "private" (muharram) space is thus one that provides the material and spiritual conditions for realizing privacy in all its dimensions (Moazemi & Abdi, 2016). This dual definition marks the starting point of the present framework: privacy is not merely visual control, but a combination of spatial organization, perceptual control, and cultural meaning-making. The following sections examine the four constituent layers of this system (spatial hierarchy, perceptual control, cultural-climatic compatibility, and structural precondition) and conclude with the formulation of an integrative "privacy–space–construction" framework.

Layer One: Spatial Hierarchy and Introversion

This layer constitutes the most fundamental physical mechanism for realizing privacy in the Iranian house. Pirnia (as cited in Shirdel et al., 2025), drawing on six-thousand-year-old archaeological evidence, documented introversion in Iranian house plans and described the andaruni as a space where "the woman or child lived, constructed so that the woman could work comfortably and no one would see her" (Shirdel et al., 2025). In larger houses, private and public life were elegantly separated by elements such as the andaruni, biruni, courtyard, corridor, and hashti (Shirdel et al., 2025; Varmaghani, 2018). Spatial hierarchy, as the governing principle of this separation, manifests in a seven-stage sequence of entry: jolokhan, pish-varudi, varudi, hashti, dalan, courtyard, corridor, and subsequently other functional spaces. This pattern is repeated across virtually all traditional Iranian buildings, symbolically embodying privacy in the building's physical form (Shirdel et al., 2025). Space syntax research corroborates this: in traditional houses, courtyards and corridors between the andaruni and biruni exhibit the lowest depth and highest agent movement, while rooms, services, and private spaces exhibit the greatest depth (Moosavi et al., 2025). (Tab. 3)

Table 3: The Seven-Stage Entry Sequence in the Traditional Iranian House and the Privacy Function of Each Stage

Stage	Spatial Element	Privacy Function
1	Jolokhan	Urban-residential interface; mental preparation for entry
2	Pish-varudi	Visual buffer from the public passage
3	Varudi	Physical access control
4	Hashti	Path rotation and blocking direct sightlines
5	Dalan	Extended, winding path; increased spatial depth
6	Courtyard	Semi-private domain; spatial organizing core
7	Corridor and functional spaces	Access to private domains (andaruni)

Crucially, recent research demonstrates that privacy depends not on introversion as a specific form, but on spatial organizing logic. A study of the extroverted houses of Gilan shows that despite extroversion and the absence of a closed central courtyard, these houses preserve their privacy model through three strategies: "mass-to-space proportion," "spatial hierarchy," and "controlled access management" (Karimi Shirazi et al., 2025). In these houses, the closer the structural pattern is to a square shape (as in the Mohtasham and Amini houses), the higher the level of privacy, because the distribution of spaces around a central core reinforces spatial hierarchy (Karimi Shirazi et al., 2025). This finding carries a significant implication: privacy is a functional principle, not a historical form, and can therefore be reinterpreted across spatial patterns, including contemporary housing.

Layer Two: Perceptual Control (Visual and Auditory Privacy)

The second layer comprises the mechanisms of perceptual control that complement spatial hierarchy. Research indicates that privacy in traditional houses is divided into public and private levels, with privacy operating in two modes visual and auditory affecting all typologies (Kazemzadeh Raef & Mirdrikvand, 2020). Physically, this control was achieved through elements such as distinct door knockers (separating the sounds of male and female visitors), the height and orientation of openings, and visual barriers (curtains, mashrabiya, wooden lattices) (Karimi Shirazi et al., 2025). Space syntax studies introducing the "visual privacy" index show that the spatial configuration of Iranian houses became progressively less integrated from the 1970s to the 2010s, and this reduced integration increased visual privacy (Khozaei Ravari et al., 2024). In other words, even with reduced dwelling scale, visual privacy can be preserved through increased depth and spatial segregation. This aligns with comparative findings between traditional and modern houses: in traditional houses, privacy is secured not merely by doors and walls but by spatial configuration and the presence of intermediary spaces (typically corridors), whereas in modern houses, many private spaces are protected only by a door that, when opened, exposes the interior (Moosavi et al., 2025). (Fig. 1)

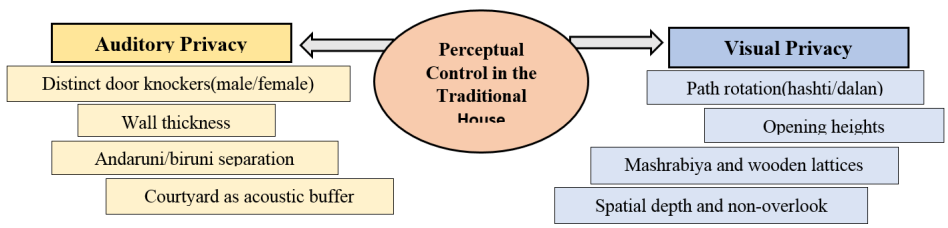


Figure 1: Two Mechanisms of Perceptual Control in the Traditional House

Layer Three: Cultural-Climatic Compatibility

The third layer situates privacy within its cultural and climatic context. Comparative studies reveal that the realization of privacy varies across Middle Eastern Islamic countries: through courtyard separation in Isfahan, and through floor separation in Damascus and Sanaa (Omidvari & Hamzenejad, 2022). This diversity indicates that privacy is not a universal rule with a fixed form, but a logic that finds different physical expressions in each context.

In the Iranian context, this compatibility operates at two levels. At the cultural level, the table of cultural values and behavioral patterns shows that privacy is linked to concepts such as modesty (hijab), introversion, and the differentiation of boundaries, manifesting in house form as "defined spatial connections" and "observance of access hierarchy from public to private space" (Karimi Shirazi et al., 2025). At the climatic level, the central courtyard is not only a privacy unit but also a climatic regulation unit: a study of the Tabatabai House in Kashan demonstrates that this house, with its central courtyard, wind tower, sunken chamber (sardab), and thick earthen walls, achieves thermal comfort without any mechanical system, reducing energy consumption by up to 78% compared to an equivalent modern house [citation required]. Thus, privacy and climatic sustainability in traditional Iranian architecture are two sides of the same coin: the same spatial organization that secures family privacy simultaneously optimizes access to light, air, and energy.

Layer Four: The Structural Precondition of Privacy

The three preceding layers spatial hierarchy, perceptual control, and cultural-climatic compatibility can only be realized in practice if the structural system permits their preservation. In the traditional house, this condition was naturally satisfied: load-bearing masonry walls simultaneously carried loads and carried boundaries, and their thickness and alignment secured both structural stability and visual and acoustic control (Bhattacharya et al., 2014; Memarian & Brown, 2003). In other words, in traditional architecture, structure and privacy were not two parallel systems but a single system with two functions.

This functional unity comes under tension when confronted with contemporary retrofitting requirements. Conventional masonry strengthening methods such as shotcrete, added concrete jacketing, or replacement of openings typically involve increased mass and altered geometry and can change the opening-to-wall ratio, the depth of intermediary spaces, and the quality of surfaces; precisely the factors on which the perceptual control of privacy depends (Bhattacharya et al., 2014). By contrast, low-invasive approaches such as grout injection, fiber-reinforced polymers (FRP), local bracing, and cable-net systems seek to increase structural capacity without significant alteration of geometry and surfaces, thereby preserving spatial-perceptual continuity (Bhattacharya et al., 2014; ICOMOS, 2003). The fourth layer of the present framework therefore introduces structural compatibility as a precondition for the realization of the other three layers, with its principal criterion being the ratio between the increase in structural capacity and the degree of manipulation of the geometry, surfaces, and openings of privacy-related spaces. (Tab. 4)

Table 4: Comparison of Retrofitting Approaches from the Perspective of Their Effect on Privacy

Retrofitting approach	Increase in structural capacity	Degree of geometric/ surface manipulation	Effect on privacy	Ref.
Shotcrete and concrete jacketing	High	High	Potential disruption of depth and surfaces	Bhattacharya et al., 2014
FRP and NSM	Moderate to high	Low	Relative preservation of mechanisms	

Grout injection and local bracing	Moderate	Low	Compatible with intermediary spaces	
Cable-net and light bracing	Moderate	Very low	Highest compatibility	Bhattacharya et al., 2014; ICOMOS, 2003

Formulation of the Integrative "Privacy–Space–Construction" Framework

Based on the four interconnected layers established above (spatial hierarchy, perceptual control, cultural-climatic compatibility, and structural precondition), the theoretical framework is formulated as a four-tier system that bridges the conceptual and the operational:

•Tier One: Foundational Principles. The four principles "spatial hierarchy", "perceptual control", "cultural-climatic compatibility" and "structural compatibility" are identified as the constituent principles of privacy. These principles are rooted in the Iranian architectural tradition while being measurable through quantitative space syntax findings (Karimi Shirazi et al., 2025; Khozaei Ravari et al., 2024; Shirdel et al., 2025).

•Tier Two: Operationalizable Criteria. Each principle is translated into a set of design criteria. Spatial hierarchy yields criteria of "entry sequence", "spatial depth" and "domain separation"; perceptual control yields "non-overlook", "auditory control" and "visual barriers"; cultural compatibility yields "consistency with lifestyle patterns", "use of courtyard/intermediary open space" and "climatic performance"; and structural compatibility yields "low-invasive retrofitting", "preservation of opening-to-wall ratio" and "maintenance of intermediary space depth" (Karimi Shirazi et al., 2025; Kazemzadeh Raef & Mirdrikvand, 2020; Moosavi et al., 2025).

•Tier Three: Construction and Execution Requirements. To be realized in practice, Tier Two criteria must be translated into construction requirements: courtyard-to-mass ratio, minimum spatial depth for private spaces, orientation of openings, and climate-compatible materials and techniques.

•Tier Four: Structural Synergy and Integrity. This tier acts as the material glue of the framework. It ensures that the execution of Tier Three does not violate the criteria of Tier Two. It encompasses the selection of low-invasive structural interventions (FRP, grout injection, local bracing) and the evaluation of their impact on the geometry, openings, and surfaces of privacy-related spaces (Bhattacharya et al., 2014; ICOMOS, 2003). This tier constitutes the link between the framework and civil engineering and building regulations a link largely neglected in prior research and the principal novelty of the present framework (Omidvari & Hamzenejad, 2022; Rastegar & Bemanian, 2019).

FINDINGS AND DISCUSSION

In sum, privacy in the Iranian house is a four-layered system comprising spatial hierarchy (physical), perceptual control (sensory), cultural-climatic compatibility (meaning and context), and structural compatibility (material precondition). Contrary to common assumption, this system is not contingent on introverted form; it can be realized in extroverted configurations through reliance on hierarchy and controlled access, provided that the structural interventions respect the spatial integrity (Karimi Shirazi et al., 2025). The four-tier framework translates this system from the conceptual level to the level of construction requirements, bridging the theoretical analysis of privacy and its practical application in contemporary housing design and construction. (Fig. 2)

Content analysis of the 18 selected sources (9 Persian articles, 6 English articles, and 3 foundational theoretical sources) yielded findings across five themes: (1) spatial hierarchy mechanisms in the traditional house; (2) perceptual control mechanisms (visual and auditory); (3) cultural-climatic compatibility of privacy; and (4) the

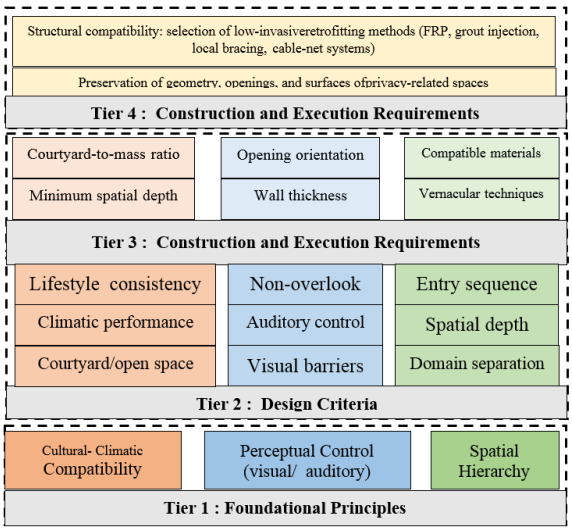


Figure 2: The Four-Tier"Privacy–Space–Construction" Framework

transformation of privacy in the transition to contemporary housing and its implications for the "privacy–space–construction" framework; and (5) the structural mechanisms of privacy preservation. The findings of each theme are presented below and documented with textual evidence.

Findings on Spatial Hierarchy Mechanisms

Findings indicate that privacy in the traditional Iranian house is realized through a multi-stage spatial sequence that gradually controls entry from the public passage to the private domain. This sequence comprises the jolokhan, pish-varudi, varudi, hashti, dalan, courtyard, and corridor, and is repeated across all traditional buildings (Shirdel et al., 2025). Space syntax analysis confirms that in traditional houses, courtyards and corridors between the andaruni and biruni exhibit the lowest depth and highest movement, while rooms and private spaces exhibit the greatest depth (Moosavi et al., 2025). This depth structure provides a functional mechanism for domain separation. More importantly, privacy is not contingent on introversion. A study of the extroverted houses of Gilan shows that despite the absence of a closed central courtyard, these houses preserve their privacy model through three strategies: "mass-to-space proportion," "spatial hierarchy," and "controlled access management" (Karimi Shirazi et al., 2025). In these houses, the closer the structural pattern is to a square, the higher the level of privacy, because the distribution of spaces around a central core reinforces hierarchy (Karimi Shirazi et al., 2025). This finding carries a clear implication for contemporary housing: privacy is a functional principle that can be reinterpreted across spatial patterns, not a historical form that manifests only in the courtyard house. (Tab. 5)

Table 5: Comparison of Spatial Hierarchy Mechanisms across Three Iranian House Typologies

Typology	Climatic Example	Primary Privacy Mechanism	Space Syntax Indicator	Ref.
Introverted courtyard	Yazd, Kashan, Shiraz	Courtyard as organizing core; hashti–dalan–courtyard sequence	Greatest depth in private spaces; lowest visual integration	Moosavi et al., 2025; Shirdel et al., 2025; Zangeneh et al., 2021
Four-sided	Shiraz (Qajar)	Symmetry and distribution around courtyard; domain layering	Highest privacy level among typologies	Zangeneh et al., 2021
Extroverted	Gilan (plains)	Mass-to-space proportion; hierarchy; access management	Privacy through near-square form and central core	Karimi Shirazi et al., 2025

Findings on Perceptual Control Mechanisms

Findings indicate that perceptual control in the traditional house operates in two modes visual and auditory both affecting all domains of the house (Kazemzadeh Raef & Mirdrikvand, 2020). Visually, mechanisms such as path rotation in the

hashti and dalan, the height and orientation of openings, mashrabiya and wooden lattices, and increased spatial depth prevent visual overlook (Karimi Shirazi et al., 2025; Moosavi et al., 2025). Auditorily, distinct door knockers (separating the sounds of male and female visitors), wall thickness, and the courtyard as an acoustic buffer are employed (Karimi Shirazi et al., 2025; Kazemzadeh Raef & Mirdrikvand, 2020).

The key finding of this theme is that spatial configuration is an effective substitute for physical barriers. Space syntax studies show that the configuration of Iranian houses became progressively less integrated from the 1970s to the 2010s, and this reduced integration increased visual privacy (Khozaei Ravari et al., 2024). In other words, even with reduced dwelling scale, visual privacy can be preserved through increased depth and spatial segregation. By contrast, in modern houses, many private spaces are protected only by a door that, when opened, exposes the interior (Moosavi et al., 2025). This difference indicates that contemporary privacy depends less on elements (doors, walls, curtains) than on spatial organization. (Fig. 3)

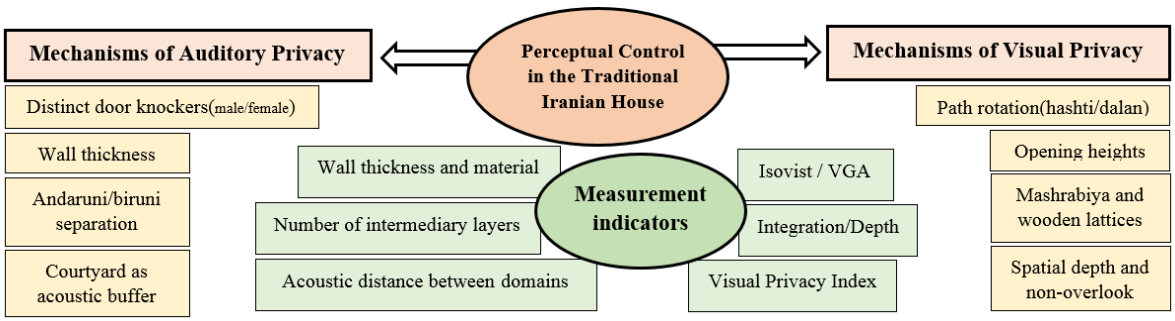


Figure 3: Perceptual Control Mechanisms and Their Measurement Indicators

Findings on Cultural-Climatic Compatibility

Findings indicate that privacy is not a universal rule with a fixed form, but a logic that finds different physical expressions in each context. A comparative study of Middle Eastern Islamic houses shows that the separation of private and public domains is the most prominent manifestation of privacy, yet its realization varies: through courtyard separation in Isfahan, and through floor separation in Damascus and Sanaa (Omidvari & Hamzenejad, 2022). This diversity indicates that a privacy framework must be context-based, not form-based.

Culturally, the table of cultural values and behavioral patterns shows that privacy is linked to concepts such as modesty (hijab), introversion, and the differentiation of boundaries, manifesting in house form as "defined spatial connections" and "observance of access hierarchy from public to private space" (Karimi Shirazi et al., 2025). Climatically, findings show that the central courtyard is not only a privacy unit but also a climatic regulation unit: the Tabatabai House in Kashan, with its central courtyard, wind tower, sunken chamber, and thick earthen walls, achieves thermal comfort without mechanical systems, with energy consumption up to 78% lower than an equivalent modern house. Thus, privacy and climatic sustainability in traditional Iranian architecture are two sides of the same coin: the same spatial organization that secures family privacy simultaneously optimizes access to light, air, and energy. (Tab. 6)

Findings on Transformation of Privacy in Contemporary Housing and Its Implications

Findings indicate that privacy in contemporary Iranian housing has undergone systematic erosion. Research explicitly states that privacy has

Table 6: Cultural-Climatic Compatibility of Privacy across Different Contexts

Context	Cultural Mechanism	Climatic Mechanism	Implication for Framework
Isfahan	Courtyard separation; introversion	Central courtyard, wind tower, sunken chamber	Privacy = climatic regulation
Damascus & Sanaa	Floor separation	Courtyard and tiered openings	Privacy = vertical organization
Gilan	Hierarchy and access management	Veranda and intermediary spaces	Privacy = access logic
Yazd	Hashti and dalan; gendered layering	Thick earthen walls, sabat (covered passage)	Privacy = depth and shading

been sacrificed to economic and social pressures, and the priority for establishing spaces that preserve privacy has gradually diminished, producing houses alien to indigenous culture (Zangeneh et al., 2021). In Pahlavi-era houses, with the elimination of the second courtyard and the reduction of entrances, the privacy of the inner quarters has been diminished, and in some cases the hashti space has been entirely removed (Rastegar & Bemanian, 2019). A typological study of contemporary housing also shows that in the 1970s and 1980s, hierarchy and privacy were not provided, whereas from the 1990s onward, the creation of nodes at the entrance space established greater privacy (Rastegar & Bemanian, 2019). Nevertheless, a promising finding is that privacy is regenerable. The visual privacy index shows that even with reduced dwelling scale, visual privacy can be preserved through increased depth and spatial segregation (Khozaei Ravari et al., 2024). Moreover, research confirms that adherence to privacy principles in housing design not only positively affects quality of life but also strengthens social interaction and reduces social tensions (Shirdel et al., 2025). These findings carry a clear implication for the "privacy–space–construction" framework: regenerating privacy in contemporary housing is possible not through a return to traditional form, but through reinterpreting principles (hierarchy, perceptual control, compatibility) within new spatial configurations.

Findings on the Structural Mechanisms of Privacy Preservation

The findings of this theme indicate an inverse relationship between the degree of invasiveness of structural intervention and the degree of preservation of privacy mechanisms. In traditional houses, wall thickness, the dimensions and positions of openings, and the depth of intermediary spaces serve simultaneously structural and privacy functions (Bhattacharya et al., 2014; Memarian & Brown, 2003). Consequently, any intervention that alters these parameters inevitably affects one of the privacy mechanisms. Case studies of retrofitting historic buildings in Iran indicate that low-invasive methods such as FRP, grout injection, and local bracing produce less change in the geometry and surfaces of space compared with heavy methods and are therefore more compatible with the logic of privacy (Bhattacharya et al., 2014; ICOMOS, 2003). By contrast, methods involving the addition of thick layers or the closing of openings, while increasing structural safety, can disrupt spatial depth, entry sequence, and perceptual control (Bhattacharya et al., 2014). More importantly, structural compatibility is not a purely technical choice but a value-laden decision. Choosing between shotcrete and FRP, or between closing an opening and locally strengthening it, appears to be an engineering decision about load capacity, but in practice it determines which privacy mechanism is preserved and which is sacrificed. This finding carries a clear implication for the "privacy–space–construction" framework: the evaluation of retrofitting scenarios should not be based solely on structural indicators (shear capacity,

ductility, drift) but should simultaneously assess their effect on the three privacy mechanisms spatial depth and sequence, visual-auditory control, and cultural-climatic continuity. In other words, the criterion of optimality in retrofitting historic houses is a combination of structural safety and privacy preservation, not the mere maximization of structural capacity (ICOMOS, 2003). (Fig. 4 and 5)

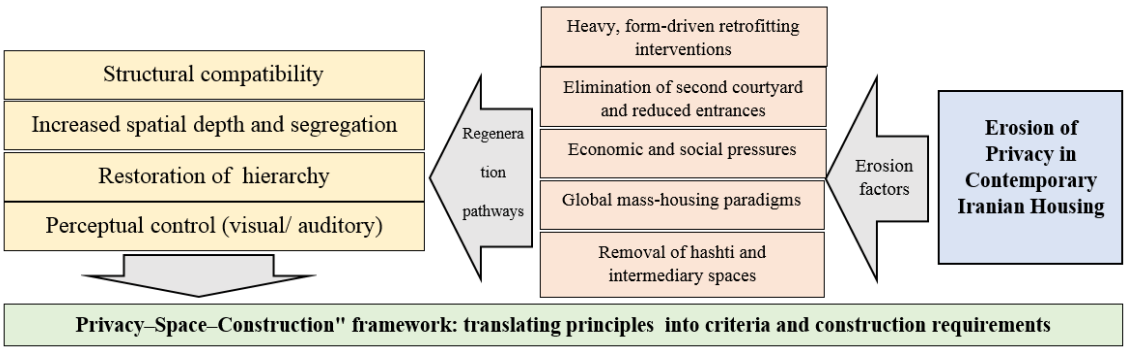


Figure 4: Erosion of Privacy in Contemporary Housing and Pathways to Regeneration

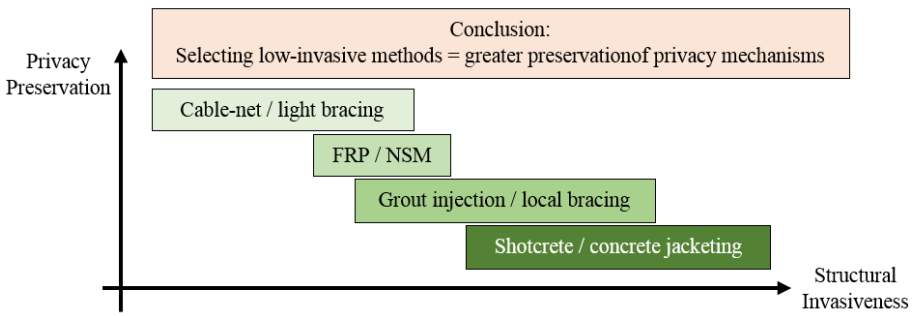


Figure 5: Relationship between the Structural Invasiveness of Retrofitting Methods and the Preservation of Privacy

Synthesis of Findings

In sum, the findings indicate that: (a) privacy in the traditional house is realized through a multi-stage spatial sequence, visual and auditory perceptual control, and cultural-climatic compatibility; (b) privacy is not contingent on introverted form and can be realized in extroverted configurations through hierarchy and access management; (c) spatial configuration is an effective substitute for physical barriers in securing privacy and can be preserved even with reduced housing scale; and (d) the erosion of privacy in contemporary housing stems from the gradual removal of spatial mechanisms rather than merely a change in lifestyle, and its regeneration is therefore possible through reinterpreting principles not returning to form; and (e) the invasiveness of structural interventions is inversely related to the preservation of privacy mechanisms. These findings provide the empirical basis for the final formulation of the "privacy–space–construction" framework and the development of its construction and execution requirements.

This study demonstrates that privacy (mahramiyyat) in Iranian domestic architecture operates fundamentally as a four-layered organizing system rather than a mere physical feature or an abstract cultural value. By integrating spatial hierarchy, perceptual control, cultural-climatic compatibility, and structural preconditions, the research moves beyond the prevailing dualism that treats privacy as an isolated spatial element. The findings reveal that privacy is pri-

marily a logic of spatial organization rather than a rigid reliance on the introverted form or the central courtyard. Evidence from the extroverted houses of Gilan confirms that equivalent levels of privacy can be achieved through mass-to-space proportions, hierarchical sequencing, and access management. Therefore, regenerating privacy in contemporary housing requires reinterpreting its underlying principles within new spatial configurations, rather than merely replicating traditional forms. Furthermore, the study establishes that spatial configuration serves as an effective substitute for physical barriers. Space syntax analyses indicate that visual privacy can be maintained through increased depth and spatial segregation, even in reduced dwelling scales. This contrasts with contemporary housing, where private spaces are often protected solely by doors, rendering privacy fragile. The core issue is conceptual: privacy must be understood as an "organization" of space, not merely an "element" within it.

Crucially, the research highlights the intersection of privacy and climatic sustainability. Traditional spatial organizations such as central courtyards, wind towers, and thick walls simultaneously secure family privacy and optimize energy use, reducing consumption by up to 78%. This overlap suggests that privacy should not be framed as a cultural cost against technical efficiency, but as a sustainable design strategy addressing both social and environmental dimensions. However, the systematic erosion of privacy in contemporary housing stems from the removal of spatial mechanisms and the failure to translate privacy principles into construction requirements and building regulations. The most significant gap lies in bridging theoretical knowledge with design and construction processes. Consequently, the study introduces the four-tier "privacy-space-construction" framework, which incorporates the structural layer as a fundamental precondition. This framework reveals that structural interventions are not neutral technical matters; the choice of retrofitting method whether heavy and form-driven or low-invasive directly determines the preservation or sacrifice of privacy mechanisms.

In conclusion, this research provides a shared language among architects, conservationists, and structural engineers. It argues that the optimality criterion in housing design must combine structural safety with spatial continuity and cultural integrity. By moving from foundational principles to design criteria, construction requirements, and structural synergy, the framework offers a theoretical basis for formulating contemporary sustainable housing regulations, liberating professionals from the false dichotomy of "tradition versus modernity." While the framework is theoretical and requires empirical validation, it establishes a coherent foundation for future interdisciplinary research and policy-making.

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