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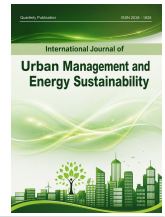

ORIGINAL RESEARCH PAPER

The Interconnection of Structure, Space, and Construction in the Iranian House and Its Reflection in Contemporary Housing

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ABSTRACT

The Iranian house has long integrated structure, space, and construction within a unified tectonic logic. In contemporary Iranian housing, new building systems, regulations, and industrialized processes have separated these systems: structure is often selected after spatial decisions are made, and construction is reduced to implementing drawings, so this unity has become an imitative, concealed, or merely technical pattern. Without understanding this logic, the formal transfer of traditional elements remains ineffective. This study therefore aims to extract the principles and mechanisms of this tripartite interconnection and to develop a conceptual model, relevant to both architecture and civil engineering, for its reflection in contemporary housing. The research is qualitative and fundamental and uses conceptual analysis and theoretical synthesis: the core concepts were decomposed into components, compared to identify shared dimensions, examined for logical relationships, and synthesized into a model. Validity was assessed through conformity with the literature, internal coherence, and peer review; no field data were used. The findings show that the interconnection operates across four layers: semantic–cultural, spatial–physical, structural–tectonic includes, load-bearing logic, span, vernacular materials, and structural expression, and constructional–technical. These layers are linked through five mechanisms: alignment of the load-bearing system with spatial organization, tectonic transparency, spatial–structural flexibility, compatibility of materials and construction techniques, and construction economy. The study concludes that the interconnection is a semantic–technical system whose reflection in contemporary housing depends on reinterpreting its logic rather than replicating its form.

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INTRODUCTION

In Iranian architecture, the house is not merely a shelter; rather, it is an interconnected system of meaning, space, structure, and construction. Within this system, the load-bearing logic, spatial organization, and construction techniques are present as a unified tectonic whole, and structure is not an externally imposed matter but part of the architectural expression (Frampton, 2001). The Iranian house, through elements such as the courtyard, porch, mass and space, hierarchy, privacy, and centrality, establishes a close connection among the physical fabric, structure, and mode of dwelling (Memarian & Brown, 2006). In such a tradition, construction is not merely the implementation of drawings; rather, it is an act in which materials, skill, details, and construction economy serve the continuity of space and meaning (Till, 2009).

With the introduction of new building systems, industrialized regulations, and specialized processes into contemporary Iranian housing, the tripartite interconnection of structure, space, and construction gradually disintegrated. In many contemporary housing projects, spatial decisions are made prior to the selection of the structural system, and construction is reduced to a subsequent and merely technical stage. The result is that the constructive unity among space, structure, and construction, which was a fundamental characteristic of the Iranian house, has turned into an imitative, concealed, or merely technical pattern. On the other hand, existing studies on the Iranian house have often focused on typology, climate, energy, or meaning, and have rarely addressed the development of a conceptual model of the interconnection of structure, space, and construction that is relevant to both architecture and civil engineering (Salama, 2015). Therefore, the central problem of the present study is how the logic of the interconnection of structure, space, and construction in the Iranian house can be reinterpreted, and through what mechanisms this logic can be reflected in the design and construction of contemporary housing.

The significance of the study lies in the fact that the formal transfer of traditional house elements to contemporary housing, without understanding its structural and constructional logic, will be ineffective and incompatible with safety, economic, and construction technology requirements. From an architectural perspective, this study contributes to tectonic transparency and the alignment of spatial organization with the load-bearing system. From a civil engineering perspective, it elevates the understanding of the structure–construction interconnection from a merely computational choice to an integrated decision-making process with architecture. Moreover, the development of a conceptual model can provide a basis for harmonizing the decisions of the architect, structural engineer, and contractor in contemporary housing and can prevent the reduction of the Iranian house to formalism or the reduction of structure to a technical necessity.

Accordingly, the present study, adopting a strategy of conceptual analysis and theoretical synthesis, first extracts the principles and mechanisms of the interconnection of structure, space, and construction in the Iranian house through the decomposition of core concepts, comparative analysis of components, and examination of the logical relationships among dimensions, and then presents a conceptual model for its reflection in contemporary housing. The proposed model is based on principles such as the alignment of the load-bearing system with spatial organization, tectonic transparency, spatial–structural flexibility, compatibility of materials and construction techniques, and construction economy.

MATERIALS AND METHODS

The literature review is organized with the aim of identifying studies conducted in two domains, “the Iranian house” and “the interconnection of structure, space, and construction,” and of determining the existing boundaries of knowledge. In this section, domestic studies related to spatial organization, climate, traditional construction (niyāresh), and contemporary housing

are first reviewed, followed by external studies on tectonics, structure, construction, and design integration. The criteria for selecting studies include direct relevance to the structure–space–construction triad, scholarly credibility, and the availability of bibliographic details.

Domestic Studies

Table 1: Summary of Domestic Studies Relevant to the Research

No.	Author/Year	Focus of Study	Method/Data	Key Finding	Relevance to Present Study
1	Memarian & Brown (2006)	Iranian and Arab courtyard houses	Comparative–historical analysis	The courtyard is the core of spatial, climatic, and social organization of the house	Provides a foundation for the spatial–physical and semantic–cultural dimensions
2	Soflaei, Shokouhian, & Shemirani (2016)	Traditional Iranian courtyards as microclimate modifiers	Climatic analysis and examination of orientation, dimensions, and proportions	Courtyard orientation and proportions have a direct effect on thermal comfort	Demonstrates the connection between spatial organization and climatic/constructional logic
3	Foruzanmehr & Vellinga (2011)	Vernacular architecture of Iran and questions of comfort and practicability	Theoretical critique and review of evidence	The value of vernacular architecture lies in the compatibility of construction techniques, materials, and thermal behavior, not merely form	Shifts the "space–construction" connection from the level of form to the level of performance and execution
4	Memarian (1384/2005)	Niyāresh of vaulted structures in Iranian architecture	Structural–historical analysis	The load-bearing logic of vaults and domes is a technical–spatial system, and structure is not separate from space	Provides a foundation for the structural–tectonic dimension
5	Memarian (1387/2008, 1390/2011)	Typology of Iranian housing (extroverted and introverted)	Typological and physical analysis	The spatial organization of the Iranian house is a product of climatic, cultural, and physical compatibility	Provides a foundation for analyzing spatial organization and privacy
6	Golabchi (1384/2005)	Relationship between structure and architecture	Theoretical–applied analysis	Structural decisions have spatial and aesthetic consequences	Reinforces the necessity of dialogue between architect and structural engineer

A review of domestic studies indicates that Iranian research has predominantly focused on typology, climate, spatial organization, traditional construction (niyāresh), and critique of contemporary housing. Memarian's (2005) analysis of vaulted structures, for instance, demonstrates that the load-bearing logic of vaults and domes operates as a technical–spatial system, while his typological studies (2008, 2011) show that the spatial organization of the Iranian house is a product of climatic, cultural, and physical compatibility. Golabchi (2005) further reinforces the spatial and aesthetic consequences of structural decisions. These studies provide a valuable foundation for understanding the Iranian house, but they often do not analyze structure, space, and construction simultaneously within an integrated model. In other words, the domestic literature

addresses "what the Iranian house was" and "what has been lost in contemporary housing" more than "how to reinterpret it tectonically and constructionally."

International Studies

Table 2: Summary of International Studies Relevant to the Research

No.	Author/Year	Focus of Study	Method/Data	Key Finding	Relevance to Present Study
1	Frampton (2001)	Tectonics and the constructive expression of architecture	Historical–theoretical analysis	Structure can become an expression of architecture and spatial experience	Main framework for the structural–tectonic dimension
2	Till (2009)	Architecture as dependent on the construction process	Theoretical analysis	Construction, constraints, and skills are producers of form and meaning	Elevates "construction" from a subsequent stage to the design process
3	Charleson (2015)	Structure as architecture	Case-based and theoretical analysis	Structure and architecture are not two independent domains	Criterion of tectonic transparency and flexibility
4	Sandaker, Eggen, & Cruvellier (2011)	Structural basis of architecture	Structural–architectural analysis	The choice of load-bearing system affects span, light, and spatial experience	Alignment of load-bearing system with spatial organization
5	Deplazes (2018)	Materials, processes, and structures in construction	Technical–constructional analysis	Details and the construction process are the core of architectural formation	Constructional–technical dimension and material compatibility
6	Hartoonian (1994)	Ontology of construction and technique	Philosophical–architectural analysis	Construction technique is not separable from architectural meaning	Connection among meaning, technique, and construction
7	Hillier & Hanson (1984)	Space syntax and the social logic of spatial organization	Syntactic analysis of space	Space is a product and producer of social relations	Analysis of privacy and spatial hierarchy
8	Salama (2015)	Integration of design, technology, and context	Educational–professional analysis	The separation of design, structure, and construction reduces environmental quality	Necessity of a shared conceptual model for architecture and civil engineering

A review of international studies indicates that international literature has provided rich theoretical frameworks for tectonics, space syntax, structure as architecture, construction as process, and design integration. However, these frameworks have often been developed in non-Iranian contexts and have rarely been translated to the specific logic of the Iranian house and contemporary Iranian housing. Moreover, international literature tends to focus on a single domain (either structure, space, or construction), and a tripartite synthesis within a unified model is rarely observed.

Research Gap

The synthesis of the literature review reveals three main gaps:

•The Tripartite Interconnection Gap: Internal studies focus more on spatial organization, climate, typology, and traditional construction, while external studies focus more on tectonics, structure, or the construction process. Few stud-

ies have analyzed structure, space, and construction simultaneously within a unified conceptual model for the Iranian house (Memarian & Brown, 2006; Frampton, 2001; Till, 2009).

•The Translation-to-Contemporary-Housing Gap: Existing studies often remain at the level of historical description, formal critique, or climatic analysis and do not provide constructional–structural mechanisms for reflecting the logic of the Iranian house in contemporary housing. In other words, the question "how to reinterpret" has been addressed less than the question "what it was and what became of it" (Foruzanmehr & Vellinga, 2011; Soflaei et al., 2016).

•The Architecture–Engineering Divide: Architectural literature and structural/construction literature have rarely been linked through shared decision-making criteria. As a result, in contemporary housing, spatial decisions are made prior to the selection of the structural system, and construction is reduced to a subsequent stage (Salama, 2015; Sandaker et al., 2011; Charleson, 2015).

Accordingly, the present study, focusing on "the interconnection of structure, space, and construction in the Iranian house" and utilizing the analytical dimensions derived from the theoretical literature, seeks to develop an integrated conceptual model in the findings section that is relevant to both architecture and civil engineering and to provide criteria for the reflection of this interconnection in the design and construction of contemporary Iranian housing.

From the Tripartite of Structure, Space, and Construction to a Tectonic System

The theoretical literature of this study is grounded in three fundamental concepts: structure as a load-bearing system and tectonic expression, space as an experienced social–physical organization, and construction as the process of transforming materials, techniques, and decisions into an architectural work. Within this framework, structure is not an external or imposed matter; rather, in the finest examples of architecture, it becomes part of spatial and cultural expression (Frampton, 2001). At the same time, construction is not merely the final implementation of drawings; it is a set of material, skill-based, and economic decisions that shape form and meaning (Till, 2009). Accordingly, the theoretical literature seeks to analyze the tripartite interconnection not as three separate domains but as a unified system.

The House as a Semantic–Spatial System and Space Syntax and Physical Organization

In studies of the house and vernacular architecture, the house is not merely a shelter; it is a system of meaning, privacy, hierarchy, and mode of dwelling. Oliver (2006) demonstrates that vernacular architecture is a product of cultural, climatic, and technical compatibility and cannot be reduced merely to form or ornament. Asquith and Vellinga (2006) also emphasize the necessity of theoretical reinterpretation of vernacular architecture, regarding it not as a remnant of the past but as living knowledge for addressing contemporary issues. In the Iranian context, Memarian and Brown (2006) show that the courtyard in Iranian and Arab houses is not a marginal space but the core of the house's climatic, social, and spatial organization. From this perspective, the spatial organization of the Iranian house is, above all, a product of cultural, climatic, and physical logic.

Hillier and Hanson (1984), in The Social Logic of Space, provide a theoretical framework for analyzing the relationship between spatial organization and social structure. In this view, space is not a neutral container but a product and producer of social relations. This framework is also illuminating for analyzing the Iranian house, as privacy, hierarchy, centrality, and the interconnection of spaces can be analyzed as a syntactic system. However, Hillier and Hanson (1984) focus more on spatial organization and do not directly incorporate the load-bearing system and construction techniques into their analysis a gap that the present study seeks to address through

the tripartite interconnection of structure, space, and construction.

Tectonics: Structure as Architectural Expression and Structure and Space: From Separation to Integration

The concept of tectonics in architecture explains the interconnection of materials, construction technique, and form within a cultural–technical whole. Frampton (2001), in Studies in Tectonic Culture, demonstrates that structure can become an expression of architecture and enrich spatial experience. In this view, structure is not merely a means of stability; it is the language of architecture. Hartoonian (1994), in Ontology of Construction, also emphasizes the ontological interconnection of construction, technique, and architecture, demonstrating that construction technique cannot be separated from architectural meaning. Charleson (2015), in Structure as Architecture, emphasizes that structure and architecture cannot be regarded as two independent domains; rather, structural decisions have spatial and aesthetic consequences. From this perspective, "tectonic transparency" meaning the legibility of load-bearing logic in form and space is one of the criteria of architectural quality. Sandaker, Eggen, and Cruvellier (2011), in The Structural Basis of Architecture, emphasize the interaction between the load-bearing system and spatial organization, demonstrating that the choice of structural system has direct consequences for spans, height, light, flexibility, and spatial experience. MacDonald (2001), in Structure and Architecture, also demonstrates that structure can be understood as part of the architectural design process rather than merely a final calculation. In contemporary Iranian housing, spatial decisions are often made prior to the selection of the structural system, and structure appears as an imposed constraint. This separation leads to a decline in spatial and tectonic quality.

Construction as Process, Not a Subsequent Stage and Integration of Design, Structure, and Construction

Till (2009), in Architecture Depends, regards architecture as dependent on processes, constraints, skills, and constructional decisions. This view elevates construction from a subsequent and merely technical stage to the level of a producer of meaning and form. Deplazes (2018), in Constructing Architecture, also demonstrates that materials, construction processes, and details are not marginal matters but the core of architectural formation. In the Iranian house, too, construction techniques, local materials, the skill of master builders, and construction details have been part of the architectural identity. Therefore, the analysis of the interconnection of structure and space remains incomplete without the inclusion of "construction." Construction is the intermediary link between design thought and material reality and can simultaneously orient structure, space, and meaning (Till, 2009; Deplazes, 2018). Salama (2015) emphasizes the necessity of integrating design, technological, and contextual decisions in architectural education and practice, demonstrating that the separation of design, structure, and construction domains leads to a decline in the quality of the built environment. From a methodological perspective, this study reinforces the necessity of developing a conceptual model for the harmonization of architecture and civil engineering. Accordingly, the conceptual model of the research must simultaneously address the language of the architect, the structural engineer, and the contractor. MacDonald (2001) also demonstrates that understanding structure as part of design requires a shared dialogue between the architect and the structural engineer.

Vernacular Architecture, Sustainability, and Practicability

Foruzanmehr and Vellinga (2011), critiquing the romanticization of vernacular architecture, emphasize that the value of vernacular architecture lies not only in its form and appearance but in the compatibility of construction techniques, materials, thermal behavior, and practicability. This perspective is important for the present study because it shifts the "space–construction"

interconnection from the level of form to the level of performance, execution, and sustainability. Soflaei, Shokouhian, and Shemirani (2016), in a study of traditional Iranian courtyards, also demonstrate that the orientation, dimensions, and proportions of the courtyard play a direct role in microclimate modification and thermal comfort. These findings indicate that the spatial organization of the Iranian house is interconnected with climatic and constructional logic and cannot be reproduced merely as a formal pattern.

Analytical Dimensions Derived from the Literature

The review of the literature indicates that existing studies have addressed the tripartite interconnection in a fragmented manner and within specific dimensions. Table 3 summarizes these dimensions along with the key sources for each dimension. These dimensions serve as an analytical lens in the subsequent stages of the research for examining the Iranian house and its reflection in contemporary housing.(Tab. 3)

Table 3: Analytical Dimensions of the Interconnection of Structure, Space, and Construction Derived from the Theoretical Literature

Analytical Dimension	Key Components	Key Sources
Semantic–cultural	Privacy, hierarchy, centrality, light, mode of dwelling, cultural compatibility	Memarian & Brown (2006); Oliver (2006); Asquith & Vellinga (2006)
Spatial–physical	Spatial organization, mass and space, courtyard and porch, flexibility, space syntax	Hillier & Hanson (1984); Memarian & Brown (2006); Soflaei et al. (2016)
Structural–tectonic	Load-bearing logic, span, materials, structural expression, tectonic transparency	Frampton (2001); Hartoonian (1994); Charleson (2015); Sandaker et al. (2011)
Constructional–technical	Construction techniques, details, skill, construction economy, practicability	Till (2009); Deplazes (2018); Foruzanmehr & Vellinga (2011)

Potential Mechanisms of Interconnection in the Theoretical Literature

In addition to the dimensions, the theoretical literature also proposes mechanisms that can explain the tripartite interconnection. Table 4 presents these mechanisms along with their relevant sources. These mechanisms have been discussed in the literature separately and within different specialized domains and have not yet been synthesized within a unified system for the Iranian house.(Tab. 4)

Table 4: Potential Mechanisms of the Interconnection of Structure, Space, and Construction in the Theoretical Literature

Mechanism	Brief Description	Key Sources
Alignment of the load-bearing system with spatial organization	Compatibility of structural choice with spans, light, and spatial flexibility	Sandaker et al. (2011); MacDonald (2001)
Tectonic transparency	Legibility of load-bearing logic in form and details	Frampton (2001); Charleson (2015); Hartoonian (1994)
Spatial–structural flexibility	Possibility of change and multi-functionality of space within the structural framework	Charleson (2015); Hillier & Hanson (1984)
Compatibility of materials and construction techniques	Compatibility of materials, details, and execution with space and meaning	Deplazes (2018); Oliver (2006); Foruzanmehr & Vellinga (2011)
Construction economy	Feasibility of the interconnection within economic and constructional constraints	Till (2009)

Contemporary Iranian Housing: Rupture and Reinterpretation and Theoretical Synthesis

In contemporary Iranian housing, the dominance of apartment patterns, industrialized regulations, new building systems, and specialized processes has caused a rupture in the tripartite interconnection of structure, space, and construction. Existing critiques often focus on "form" and "meaning" and pay less attention to the structural and constructional logic embedded in the pattern of the Iranian house. The result is that the transfer of traditional house elements to contemporary housing often leads to formal imitation without reinterpreting its tectonic and constructional logic (Memarian & Brown, 2006; Foruzanmehr & Vellinga, 2011). On the other hand, civil engineering and construction literature also pays less attention to the language of architecture and meaning. As a result, two parallel literatures have emerged: architectural literature, which focuses more on space and meaning, and structural/construction literature, which focuses more on safety, economy, and technology. The review of the literature indicated that the analysis of the interconnection of structure, space, and construction in the Iranian house requires four analytical dimensions: semantic–cultural, spatial–physical, structural–tectonic, and constructional–technical. Additionally, five potential mechanisms of interconnection can be identified in the literature. These dimensions and mechanisms serve as the analytical lens of the research, and their synthesis into an integrated conceptual model will be presented in the findings section.

Methodology

The present study is qualitative in nature, fundamental in purpose, and adopts conceptual analysis and theoretical synthesis as its research strategy. In this approach, rather than collecting field data, the researcher engages in the logical analysis of concepts, the decomposition of their constituent dimensions, the comparison of relationships among them, and the synthesis of a coherent conceptual framework. Conceptual analysis is appropriate when the research problem concerns understanding the complex relationships among abstract concepts and the aim is to develop a theoretical framework or model rather than to test hypotheses or achieve statistical generalization (Jabareen, 2009). Theoretical synthesis is a process in which scattered dimensions from various sources are reorganized into a coherent whole, and the researcher explains the causal or structural relationships among dimensions through logical reasoning (Groat & Wang, 2013). The research process is organized into eight stages. Stage One: Defining the problem and research questions. The problem is how the interconnection of structure, space, and construction in the Iranian house can be analyzed and through what mechanisms this interconnection can be reflected in contemporary housing. Stage Two: Selecting sources. The sources include credible theoretical texts on tectonics, structure and architecture, space syntax, construction and execution, the Iranian house, and contemporary housing, which were introduced in the literature review and theoretical literature sections. Stage Three: Conceptual analysis of core concepts. The three concepts of "structure," "space," and "construction" are decomposed into their constituent components so that the hidden dimensions of each concept are revealed. Stage Four: Identifying shared dimensions. The components of the three concepts are compared in a comparative matrix, and shared and complementary dimensions are extracted. Stage Five: Analyzing relationships. The logical relationships among dimensions (alignment, synergy, conflict, conditionality) are analyzed. Stage Six: Synthesizing the model. The dimensions and relationships are organized into a multi-layered conceptual model. Stage Seven: Extracting mechanisms and criteria. From the relationships among layers, the mechanisms of interconnection and the criteria for applicability are extracted. Stage Eight: Content validation. The model is evaluated and revised through conformity with the literature, peer review, and

expert judgment (without claiming field data).

The method of conceptual analysis in this study is based on three fundamental operations: decomposition, comparison, and synthesis. In the decomposition stage, each concept is broken down into its constituent components; for example, the concept of "structure" is decomposed into load-bearing logic, span, materials, and structural expression. In the comparison stage, the components of different concepts are placed in a comparative matrix to reveal their overlaps and distinctions. In the synthesis stage, compatible components are organized into coherent layers, and the relationships among layers are explained. These three operations constitute the methodological core of constructing a conceptual framework (Jabareen, 2009).

The validity of research in the conceptual analysis approach is assessed on the basis of content validity, logical coherence, and reflexivity, rather than statistics or data saturation. Content validity is ensured through the conformity of the model's components with concepts derived from credible literature. Logical coherence is evaluated by examining the internal consistency of relationships among layers and mechanisms. Reflexivity is provided through a transparent description of the analytical process and the presentation of explicit criteria for the model (Lincoln & Guba, 1985). To reduce bias, theoretical triangulation (drawing on multiple independent theoretical frameworks) and peer review are employed. Additionally, for transparency, the chain of analytical decisions from concept decomposition to model synthesis is presented in tabular form.

The limitations of this approach include dependence on the researcher's interpretation, the absence of field testing of the model, and limited empirical generalizability. These limitations are mitigated by clarifying the analytical process, citing credible sources, and presenting explicit criteria for the model. It is also recommended that future research test and empirically validate the present model with field data (interviews, case studies, and surveys).

FINDINGS AND CONCLUSION

The findings of the present study are the outcome of conceptual analysis and theoretical synthesis, and no field data, interviews, or empirical testing were used. In this section, the analytical process is presented in five stages: (1) decomposition of the core concepts into their constituent components; (2) comparative analysis of the components and identification of shared dimensions; (3) analysis of the logical relationships among dimensions; (4) synthesis of the four-layer conceptual model; and (5) extraction of mechanisms and criteria for applicability. All tables and the model presented herein are the output of the researcher's logical reasoning based on concepts derived from the theoretical literature. The correspondence of terminology with the theoretical literature serves merely for conceptual coherence and does not constitute the reproduction of others' data or conclusions.

Decomposition of Core Concepts into Constituent Components

The first stage of conceptual analysis was the decomposition of the three concepts of "structure," "space," and "construction" into their constituent components. This decomposition was carried out on the basis of the logical analysis of existing definitions and theories and was reformulated in the researcher's own language. Table 5 presents the result of this decomposition. (Tab. 5)

Table 5: Decomposition of Core Concepts into Constituent Components(Source: Authors)

Core Concept	Constituent Components	Analytical Question for Each Component
Structure	Load-bearing logic, span, materials, structural expression	How does structure transmit loads, and how does it express itself?

Space	Organization, privacy, hierarchy, flexibility	How is space organized, and how is it experienced?
Construction	Techniques, details, skill, construction economy	How does construction transform materials into a work?

The analysis shows that all three concepts have components that, at first glance, belong to separate specialized domains but in practice overlap with one another. For example, "span" in structure is related to "organization" in space and "details" in construction. This overlap is the starting point of synthesis.

Comparative Analysis and Identification of Shared Dimensions

In the second stage, the components of the three concepts were compared in a comparative matrix. The aim was to identify the cells of the matrix in which the three concepts converge. Table 6 presents the result of this comparison.

Table 6: Comparative Matrix of the Components of Structure, Space, and Construction(Source: Authors)

Structural Component	Spatial Component	Constructional Component	Shared Dimension
Load-bearing logic	Organization	Techniques	Structural alignment
Span	Hierarchy	Details	Scale compatibility
Materials	Privacy	Skill	Material–cultural compatibility
Structural expression	Flexibility	Construction economy	Continuity and efficiency

The analysis of the matrix shows that the shared dimensions can be organized into four categories:

•Semantic–cultural dimension: privacy, hierarchy, and mode of dwelling, which are formed at the intersection of "space" and "materials/skill."

•Spatial–physical dimension: organization, flexibility, and scale, which are formed at the intersection of "space" and "span/details."

•Structural–tectonic dimension: load-bearing logic, span, and structural expression, which are formed at the intersection of "structure" and "space."

•Constructional–technical dimension: techniques, details, skill, and economy, which are formed at the intersection of "construction" and "structure/space."

•These four dimensions constitute the basis of the model's layers and demonstrate that the tripartite interconnection is not a linear relationship but a multidimensional intersection.

Analysis of the Logical Relationships among Dimensions

In the third stage, the logical relationships among the four dimensions were analyzed. The analysis revealed four types of relationships among the dimensions: alignment (mutual reinforcement), conditionality (being a prerequisite), conflict (mutual limitation), and synergy (mutual enabling). Table 7 presents examples of these relationships with their logical explanations. (Tab. 7)

Table 7: Logical Relationships among the Four Dimensions(Source: Authors)

Type of Relationship	Source Dimension	Target Dimension	Logical Explanation
Alignment	Structural–tectonic	Spatial–physical	Compatibility of span with spatial organization reinforces spatial flexibility
Alignment	Semantic–cultural	Spatial–physical	Privacy and hierarchy orient the organization of space
Conditionality	Semantic–cultural	Structural–tectonic	The realization of privacy necessitates the selection of an appropriate load-bearing system

Conditionality	Constructional–technical	Structural–tectonic	Practicability of execution is a prerequisite for the realization of structural expression
Conflict	Constructional–technical	Structural–tectonic	Construction economy constraints can limit structural expression
Synergy	Spatial–physical	Constructional–technical	Spatial flexibility makes possible a diversity of construction techniques

The analysis of relationships shows that the four dimensions are not independent but are situated within a network of mutual relationships. This network constitutes the internal logic of the model. An important point is that the "conflict" and "conditionality" relationships demonstrate that the tripartite interconnection is not a static system but a dynamic one in which a decision in one dimension can reinforce or constrain another dimension.

Synthesis of the Four-Layer Conceptual Model

The final synthesis organizes the four dimensions into four layers and the relationships among them into five mechanisms of interconnection. The conceptual model of the study is presented in Table 8. This model is a four-by-five matrix: four layers in the columns and five mechanisms in the rows. Each cell of the matrix shows how a mechanism is realized within a layer. The content of each cell is the product of the researcher's logical reasoning based on the analysis of relationships among dimensions.

Table 8: Four-Layer–Five-Mechanism Conceptual Model of the Interconnection of Structure, Space, and Construction (Source: Authors)

Mechanism / Layer	Semantic–cultural	Spatial–physical	Structural–tectonic	Constructional–technical
Alignment of the load-bearing system with spatial organization	Compatibility of load-bearing axes with privacy and hierarchy	Compatibility of span with spatial subdivision	Alignment of beam direction with spatial axis	Compatibility of construction method with spatial subdivision
Tectonic transparency	Legibility of structure in the perceptual experience of space	Expression of structure in intermediate spaces	Material expression of materials and load-bearing logic	Legibility of construction details in form
Spatial–structural flexibility	Continuity of meaning in change of use	Possibility of changing spatial organization	Possibility of changing spans and openings	Possibility of changing details without changing structure
Compatibility of materials and construction techniques	Compatibility of materials with mode of dwelling	Compatibility of materials with spatial quality	Selection of materials based on load-bearing logic	Compatibility of construction technique with materials
Construction economy	Cultural justification of cost	Economic optimization of spatial organization	Optimization of span and section	Optimization of details and construction time

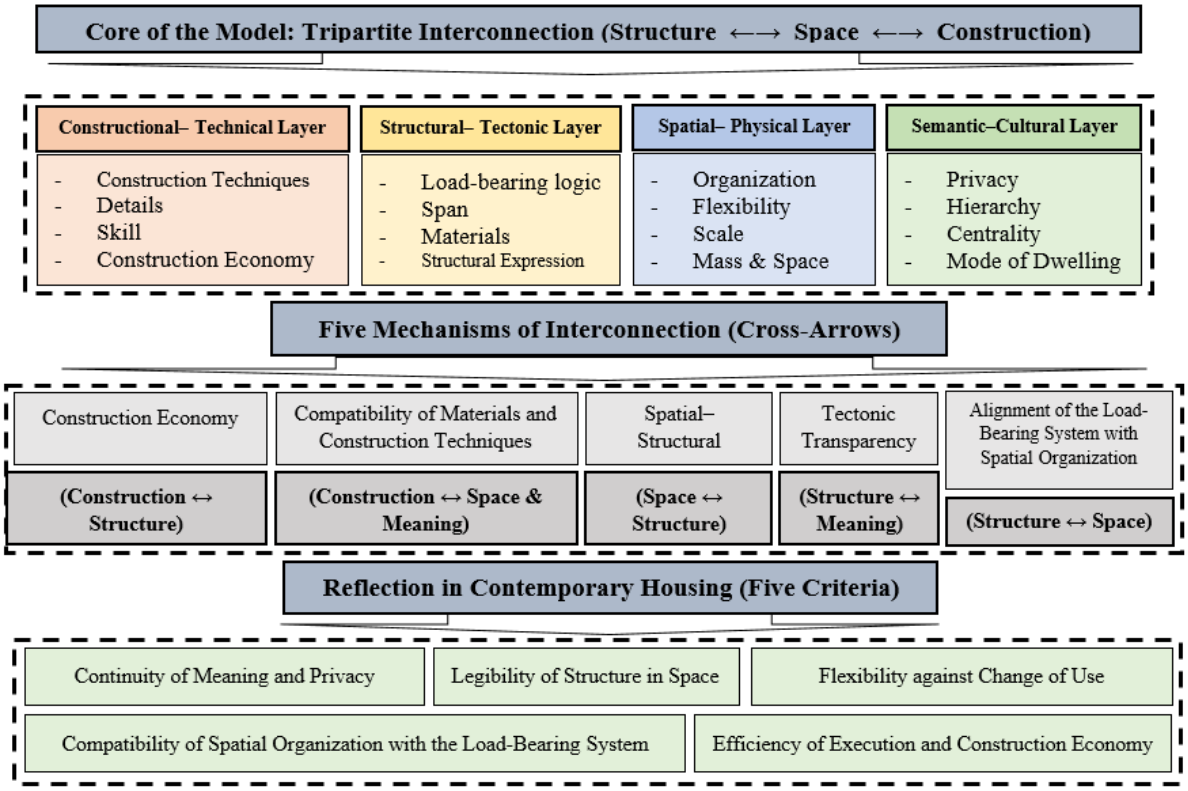

Figure 1: Four-Layer–Five-Mechanism Conceptual Model of the Interconnection of Structure, Space, and Construction in the Iranian House and Its Reflection in Contemporary Housing (Source: Authors)

The model shows that the tripartite interconnection of structure, space, and construction is a multi-layered and multi-mechanism system, and its realization requires simultaneity of decision across all layers and through all mechanisms. The model also shows that a rupture in one cell of the matrix propagates to other cells; for example, weakness in the mechanism of "alignment of the load-bearing system with spatial organization" in the spatial–physical layer leads to weakness in "tectonic transparency" in the structural layer and "material compatibility" in the constructional layer. This finding confirms the internal logic of the model.

Extraction of Criteria for Applicability in Contemporary Housing

Based on the conceptual model, criteria were extracted for the applicability of the interconnection in the design and construction of contemporary housing. These criteria were formulated through the analysis of relationships among layers and with a focus on the conditions of contemporary housing (the dominance of apartment patterns, new building systems, and specialized separation). Table 9 presents these criteria along with their measurement indicators and associated layers.(Tab. 9)

Table 9: Criteria for the Applicability of the Model in Contemporary Housing (Source: Authors)

Criterion	Measurement Indicator	Associated Layer
Legibility of structure in space	Capacity to perceive load-bearing logic through spatial experience	Structural–tectonic

Compatibility of spatial organization with the load-bearing system	Compatibility of spatial subdivision with spans and structural axes	Spatial–physical
Efficiency of execution and construction economy	Realization of the interconnection within actual cost and time constraints	Constructional–technical
Continuity of meaning and privacy	Preservation of hierarchy and territoriality in contemporary housing	Semantic–cultural
Flexibility against change of use	Possibility of changing spatial organization without changing structure	Spatial–structural

The logical analysis shows that in contemporary housing, the criterion of "efficiency of execution and construction economy" carries the greatest weight in decision-making, while the criterion of "legibility of structure in space" carries the least weight; whereas in the Iranian house, these two criteria were balanced. This imbalance is identified as one of the main reasons for the rupture of the tripartite interconnection in contemporary housing. In other words, the model shows that the contemporary rupture has occurred not due to a lack of technical knowledge but due to a shift in the weight of criteria.

Content Validation of the Model

The conceptual model was subjected to content validation in three ways: first, conformity with the literature; the components of each layer were compared with concepts derived from credible theoretical sources, and their correspondence was confirmed. Second, internal coherence; the relationships among layers and mechanisms were examined for logical consistency, and no internal contradiction was observed. Third, peer review; the structure of the model was subjected to expert opinion, and minor revisions were made in the naming of certain mechanisms. Table 10 summarizes this validation.

Table 10: Summary of the Content Validation of the Model (Source: Authors)

Evaluation Component	Criterion	Result
Conformity with the literature	Correspondence of components with theoretical concepts	Confirmed
Internal coherence	Logical consistency of relationships among layers and mechanisms	Confirmed
Adequacy of layers	Coverage of the dimensions of the three core concepts	Confirmed
Adequacy of mechanisms	Coverage of relationships among dimensions	Confirmed with minor revision
Applicability	Relevance to contemporary housing issues	Confirmed, conditional on future field testing

Table 10 is the product of content evaluation based on conformity with the literature, logical coherence, and peer review, and no field data or Delphi figures are presented therein. This validation confirms the content validity of the model, not its empirical validity. Empirical testing of the model is left to future research.

RESULTS AND CONCLUSION

The present study aimed to reinterpret the interconnection of structure, space, and construction in the Iranian house and to develop a conceptual model for its reflection in contemporary Iranian housing. Based on the method of conceptual analysis and theoretical synthesis, the core concepts were decomposed into their constituent components, the shared dimensions of the three concepts were identified, the logical relationships among dimensions were analyzed, and finally, the four-layer–five-mechanism conceptual mod-

el was presented as the final synthesis. The findings demonstrated that the interconnection of structure, space, and construction in the Iranian house is not merely a physical characteristic but a multi-layered and multi-mechanism system in which structure serves space and construction serves the continuity of meaning.

The proposed model constitutes the main theoretical contribution of the study. This model shows that the tripartite interconnection is organized into four layers semantic–cultural, spatial–physical, structural–tectonic, and constructional–technical and is realized through five mechanisms: alignment of the load-bearing system with spatial organization, tectonic transparency, spatial–structural flexibility, compatibility of materials and construction techniques, and construction economy. The four-by-five matrix of the model enables the simultaneous analysis of layers and mechanisms and demonstrates that a rupture in one cell of the matrix propagates to other cells. This feature distinguishes the model from linear and one-dimensional frameworks.

Another finding of the study is that the rupture of the tripartite interconnection in contemporary housing has occurred not due to a lack of technical knowledge but due to a shift in the weight of criteria. In contemporary housing, the criterion of "efficiency of execution and construction economy" carries the greatest weight, and the criterion of "legibility of structure in space" carries the least weight; whereas in the Iranian house, these two criteria were balanced. This finding has an important implication for design and construction: the reflection of the tripartite interconnection in contemporary housing requires a redistribution of the weight of criteria and the restoration of "legibility of structure in space" to its proper position.

From the perspective of theoretical implications, the present model establishes a connection between two parallel literatures: architectural literature, which focuses on space and meaning, and structural/construction literature, which emphasizes safety, economy, and technology. The model shows that these two literatures are not only inseparable but can be analyzed within a shared matrix. From the perspective of practical implications, the model can provide a basis for harmonizing the decisions of the architect, structural engineer, and contractor in contemporary housing and can serve as a framework for evaluating housing projects. From the perspective of educational implications, the model reinforces the necessity of integrated education in architecture, structure, and construction.

The present study also has limitations. First, the method of conceptual analysis and theoretical synthesis depends on the researcher's interpretation and may lead to a different organization of layers and mechanisms in other studies. Second, the present model has content validity, but its empirical validity has not been tested. Third, the generalizability of the findings to all types of contemporary Iranian housing is limited, and the model should be tested in different contexts (climatic, economic, and cultural). Fourth, the model focuses more on the conceptual dimension and does not fully cover quantitative dimensions (such as cost, time, and energy efficiency).

Accordingly, the research recommendations are as follows: (1) empirical testing of the model with field data (expert interviews, case studies, and surveys) in future research; (2) development of quantitative indicators for measuring the criteria of applicability; (3) examination of the model's application in various types of contemporary housing (apartment, villa, and Mehr housing); (4) examination of the model's relationship with sustainability and energy efficiency dimensions; and (5) extension of the model to other types of Iranian architecture (such as mosques, schools, and bazaars). The present study is a first step in the tectonic and constructional reinterpretation of the Iranian house and is hoped to pave the way for further research in this domain.

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