**Identifying Drivers of Affordable Housing Supply**

**Based on Socio-Cultural Patterns in Iran**

**Abstract:**
The aim of this research is to identify the effective drivers of affordable housing supply based on the socio-cultural patterns of Iran. To achieve this goal, a mixed-method approach was employed. The statistical population of this study includes all experts, managers, and elites familiar with the subject. In the initial stages, 33 credible articles were selected and analyzed using the meta-synthesis method, a qualitative approach, combined with interviews with five experts to identify the drivers. Subsequently, through a sample of 273 experts, elites, and specialists, and using confirmatory factor analysis, localized drivers for Iran were extracted. The key drivers identified include: Standardization and modularization of design and construction, Use of passive ventilation and climate-responsive strategies, Adoption of modern technologies in construction and design, Utilization of sustainable and recyclable materials, Increasing speed and productivity in production and execution processes, Adaptability to user and family needs, Flexibility in design and spatial variability, Building safety and resilience, Optimization of energy consumption and reduction of environmental impacts, Optimization of energy costs and ventilation systems, Provision of psychological comfort and prevention of environmental stress, Provision of natural light and optimal use of sunlight, Strengthening neighborhood relationships and social interaction, Aesthetic considerations and preservation of architectural identity, Cost savings in construction and maintenance, Future-oriented design and expandability, Design of multipurpose and flexible spaces, Coordination between structural and mechanical systems, Reduction of environmental impacts during construction and operation, Reduction of construction waste and waste management, Decreased reliance on human labor, High-quality residential spaces and provision of occupant comfort. These are the main and significant drivers that must be considered in this endeavor. Finally, it was suggested that by providing special facilities, education and guidance, creating shared and social spaces, improving construction standards, offering customization options, and promoting collaborative lifestyles and spaces, affordable housing can be brought closer to the socio-cultural patterns of Iran.

**Keywords:** Affordable Housing, Drivers, Socio-cultural patterns.

**Introduction**

Architecture and culture, two delicate elements in defining the identity of a society and representing the grandeur of a nation's civilization, have now been disrupted due to the challenges of providing housing and ensuring the welfare of citizens. The symbols once used to reflect the cultural and social values of a society have been forgotten. Architecture is one of the subtle elements that reflects the identity of communities. The choice of location for housing construction, its external form and internal structure, the materials used, and the symbols incorporated into housing design all convey the culture, civilization, and values upheld by that society.

The concept of affordable housing emerged in the 19th century in response to the problem of housing shortages, slums, and inadequate housing conditions. Affordable housing can lead to the provision of suitable housing, which improves human health, work efficiency, and overall social and economic development (Hulchanski, 1995). The increasing crisis in housing demand, particularly for the weaker sections of society, has led policymakers to intensify their efforts to establish building standards and regulations to address this issue. However, this has resulted in challenges where traditional and modern spaces have merged without considering social and cultural norms, leading not only to visual chaos and the loss of the original identity of communities but also to overcrowding and the proliferation of high-density residential blocks in small areas. This has caused dissatisfaction among residents and the erosion of human values.

For example, population growth is an undeniable factor in this issue. It is projected that the urban population of the world will reach 6.3 billion by 2050, with 94% of this growth occurring in developing countries, exacerbating the situation (Gan et al., 2017). Consequently, housing the weaker sections of society is a significant challenge for developing countries in the process of urbanization. The importance of this issue is such that it has been placed on the agenda of governments, with significant efforts being made to improve the living conditions of low-income households (Lin et al., 2015).

On one hand, since this type of housing is often built for the weaker sections of society, achieving an appropriate final price has led to the selection of peripheral urban areas for construction, resulting in the use of conventional materials and architecture without considering the identity of the community. On the other hand, the affordable prices of these buildings have attracted speculators, leading to increased housing demand, a rise in vacant residential units, and ultimately, abnormally high prices for these units (Maghidi et al., 2021).

Moreover, if in past decades the sole focus was on providing affordable housing, today the construction of affordable housing that is environmentally sustainable, energy-efficient, and preferably renewable is also a fundamental issue (Yeganeh et al., 2021). In other words, the primary issue today is not just the shortage of affordable housing and its misalignment with cultural and social values, but also the scarcity of energy resources and the compatibility of these buildings with environmental infrastructure.

In this context, pandemics such as COVID-19 have created conditions where individuals move less due to health concerns, placing additional financial pressure on them. This pandemic, which has led to increased homelessness and unemployment for many, has significantly highlighted the importance of affordable housing (Riley et al., 2021). The disease spread more rapidly due to homelessness and communal living, exacerbating the health crisis. Unemployment also increases the demand for affordable housing, as individuals have fewer resources to cover living expenses.

Interestingly, despite policies targeting affordable housing for low-income families, in practice, the target group often shifts to middle-income families, and the claim that the housing needs of low-income individuals are being met is largely exaggerated and contrary to reality (Zhang, 2020). This means that at all levels of government policymaking, the relationship between social policy and financial markets is influenced by the prevailing ideology, and the extent and pattern of its manifestation vary.

Policymakers worldwide are seeking solutions to improve affordable housing. They use policy tools such as rent control, zoning, and similar measures to manage this situation. However, despite numerous efforts in this area, there is no empirically or theoretically balanced general model that can assess the impact of these policies on citizen welfare and urban development. In fact, housing prices (both ownership and rental), the spatial distribution of housing and households, commuting patterns, work incentives, income and wealth inequality in local contexts, intra- and inter-urban migration, and even migration between urban regions are all challenges that must be considered in planning for citizen housing (Favilukis et al., 2019).

In Iran, according to Article 31 of the Constitution of the Islamic Republic, housing is a right for every Iranian family. However, rapid population growth, especially among migrants, ethnic diversity (due to historical changes and generational wars in this land), the imbalance between housing demand and supply (due to the entry of speculators into these markets), inflation, international sanctions, increased economic pressure on families, the COVID-19 pandemic, and the inability of families to cover living expenses have all directed policymakers toward affordable housing. However, the lack of proper and precise planning and implementation mechanisms has led to the failure of these efforts. Inappropriate location selection, uniform construction without adhering to fundamental urban infrastructure, and the disregard for the social and historical identity of the community have challenged the strategies for public and affordable housing for low-income groups.

The performance of large-scale housing projects such as Mehr Housing, National Housing, and similar projects like Pardis and Hashtgerd has not achieved the desired results. This issue is evident not only in cities but also in rural areas, where policies and guidelines have often failed.

Given the widespread impacts of this type of housing across various dimensions—demographic, health, economic, identity, cultural and social, environmental, political, and energy management—which also affect future generations, it is necessary to consider these effects with a long-term and comprehensive perspective. The policies adopted so far have been one-dimensional, often focusing solely on the economic aspects of the livelihood of low-income individuals, and even the prevailing discourse has failed to assist these individuals. Therefore, it is essential to examine this issue comprehensively and propose diverse strategies and solutions.

Thus, this research addresses the fundamental question: What are the factors influencing the provision of affordable housing based on socio-cultural patterns in Iran? The findings of this research can contribute to planning for addressing existing challenges and achieving goals simultaneously.

**Theoretical Foundations and Background**

The term "housing" is used in both the process and the final product (Reeves, 2014). Housing can be considered a commodity or a service with value, which can be both essential and luxurious (Reeves, 2014). Economic literature has paid special attention to the concept of "housing," although there is no common definition. Researchers have defined the concept of "housing" in various ways. For example, Smith (1776) viewed housing as a commodity, Ricardo (1917) as a tangible asset with potential returns, Jevons (1871) as a fixed asset regardless of ownership or rental, and Marshall (1890) as capital similar to a vehicle if worked upon, otherwise considered as a commodity. Researchers such as Grimes and Orville (1976) explained that in the past, the concept of housing was associated with physical phenomena, and national policies for its provision were largely related to construction costs, which could vary significantly depending on building materials, housing standards, and construction quality.

Within the framework of housing policies, Torgersen (1987) explains that the concept of "housing" is a shaky pillar in the welfare system of governments because, unlike health and education, the state does not consider it a core service.

Over time, different approaches to "housing" have emerged, influenced by changes in economic policies and other fields. Webster's Dictionary defines "housing" as "houses provided for people." The Business Dictionary defines housing as a building or structure that complies with legal and regulatory requirements and serves as a place for individuals to live with their families. A similar definition is found in the Macmillan Dictionary, which describes housing as buildings where people live.

The concept of "housing" is similar to that of "home," which Melnikas (1998) defines as a specific and relatively limited physical space where individuals and groups can engage in social life by receiving services, performing household tasks, and other activities.

Henilane (2016) believes that today's focus on housing is more on the benefits and costs of housing. This means that having a comfortable, suitable, and dignified home is considered, but at the same time, energy efficiency, affordable purchase costs, and maintenance costs proportional to the benefits received from owning the home are also key criteria in housing selection.

Sidelska (2014), in the context of the housing market as an element of regional socio-economic development, refers to housing as real estate or part of a non-residential building that has been used for residential purposes for years. In Donner's (2000) research on housing policies in 15 European Union countries, where the theoretical and practical aspects of housing policies were examined, the concept of housing is defined with various similar and interrelated terms, such as low-cost housing, social housing, subsidized housing, and substandard housing. Housing is classified based on type, size, facilities, location, the demographic group residing in it, ownership type, construction period, building materials used, and energy efficiency indicators. Developed classifications of housing based on various characteristics are only part of the main housing classification and can be supplemented with other categories. Table 1 briefly illustrates this classification.

**Table (1): Housing Classification (Source: Henilan, 2016)**

| **Types of Housing Classification** | **Characteristics** |
| --- | --- |
| **Type of Residence** | Living in an apartment/Apartment within a building of apartments/Residential complex buildings (multi-apartment)/Relatives' house/Other |
| **Size of House** | One-room/One-room apartment/Two-room apartment/Three-room apartment and larger/Relatives' house/Other |
| **Amenities** | With all amenities/Partially equipped with amenities/Without amenities |
| **Location of House** | In the city/In rural areas |
| **Demographic Group Residing in the House** | Any type of residents/Low-income individuals or high-risk social groups |
| **Ownership Rights** | State-owned housing/Municipality-owned housing/Privately owned housing/Corporate-owned housing/Other |
| **Construction Period** | Houses built before World War II/Houses built between 1945 and 1990/Houses built from 1990 to present |
| **Energy Efficiency Indicators** | Minimum allowable energy performance level for new buildings/Minimum allowable energy performance level for renovated buildings/Nearly zero-energy housing/Other |
| **Based on Building Materials Used in the Exterior** | Brick walls/Wood/Brick/Panels/Reinforced concrete/Concrete/Lightweight concrete/Wood/Masonry/Other |

This table illustrates various housing classifications based on different characteristics, which can help in better understanding the types of housing and their associated criteria. In the literature, there is no single definition for affordable housing. The Australian Housing, Local Government and Planning Ministers (2006) defines affordable housing as housing that is suitable for the needs of a range of low- and middle-income households, with prices set in a way that allows households to meet other essential living costs. In other words, this might be the simplest definition of affordable housing, which considers the ratio of housing prices to income.

The UK Office of the Deputy Prime Minister (2005) provides a similar definition but focuses on incomes lower than the threshold considered in Australia. In fact, the affordability of housing is measured relative to housing costs and household income and is estimated using various methods. Marks and Sedgwick (2008) define affordability using the standard measure of housing stress, meaning that if housing costs exceed 30% of a household's income, the household is under stress. This same definition is also considered by the Australian Council of Social Service (ACOSS) and others (2007). In these definitions, the concepts of housing costs and income must be clarified. For renters, housing costs refer to rent payments, while for homeowners, housing costs include mortgage repayments and interest.

Affordable housing refers to the income of its residents and contrasts with specific types of housing such as social housing, public housing, and low-cost housing (UN Habitat, 2011). Affordable housing encompasses a range of housing options available at various price points that meet effective demand (Masseram and Misnan, 2019). Effective demand typically refers to households' needs beyond the basic or minimum level of provision, supported by their willingness to pay for housing, considering their ability to pay and purchasing power (Golland and Blake, 2007).

When individuals are willing and able to pay for housing, factors such as price, demand conditions, income level, income distribution, household formation, interest rates, replacement costs, government policies, personal preferences, expectations of future price changes, and similar considerations come into play (Harvey and Jowsey, 2004).

Issues related to affordability reflect the need for some form of government intervention to ensure equal access to housing for all segments of the population. Government intervention is crucial for controlling and balancing the housing market, as the private sector plays a major role in housing provision. Left unchecked, the conflicting objectives of the public and private sectors can create problems, particularly for low-income individuals seeking to purchase homes. The increasing focus on densification and the reuse of previously developed land reflects government policies aimed at securing economic, physical, and generational renewal in urban areas and creating sustainable environments for residents more quickly.

The OECD (2021) has prepared a report on affordable housing policies to build a better future. This report addresses all dimensions and measurable aspects of affordable housing. Table (2) comprehensively presents these factors.

**Table (2): Dimensions and Metrics for Evaluating Affordable Housing (OECD, 2021)**

| **Type of Evaluation** | **Sample Indicators** | **Advantages** | **Limitations** |
| --- | --- | --- | --- |
| **Price-to-Income Ratio** | Housing price-to-income ratioRent-to-income ratio | ► Relatively simple and intuitive► Relies on data generally available in most countries► Shows how the relationship between prices and income varies over time and/or across markets (e.g., countries). | ◄ Does not indicate the distribution of housing costs or affordability (e.g., who has access to affordable housing or not)◄ Does not provide insight into housing quality◄ Does not account for borrowing costs. |
| **Housing Cost-to-Income Ratio** | Housing cost burdenHousing cost overburden rate (e.g., share of households spending >40% of disposable income on housing) | ► Relatively simple and intuitive► Relies on data generally available in most countries► Can be disaggregated to measure actual housing costs at the household level. | ◄ The "overburden" threshold is set arbitrarily and remains fixed regardless of household characteristics or their position in the income distribution.◄ Does not provide insight into housing quality. |
| **Residual Income** | Shelter povertyHousing-induced poverty | ► Shows the income remaining after housing costs, allowing assessment of sufficient income for non-housing expenses.► Useful for measuring affordability gaps among vulnerable low- and middle-income families. | ◄ May require extensive additional data collection on minimum non-housing expenditure baskets.◄ Arbitrariness in defining the minimum income needed for non-housing expenses.◄ Does not indicate housing quality.◄ May misidentify general cost-of-living issues as housing issues. |
| **Housing Quality** | Rooms per personOvercrowding rateHousing deprivation rate | ► Overcrowding can be assessed using a very simple (or more complex) definition.► Provides insights into a key dimension of affordability, e.g., what families are paying for. | ► Potential trade-offs between social and environmental objectives when interpreting size-related indicators.► Cross-country/cultural differences in what features are relevant for assessing housing quality.► Some quality metrics require up-to-date data on technical specifications of homes, which may not be readily available. |
| **Subjective Indicators of Housing Affordability** | Satisfaction with availability of good and affordable housingHousing as a key short-term concern | ► Can complement other housing outcome metrics and help better understand determinants of housing satisfaction. | ► Perceptions and expectations of what constitutes good, affordable housing vary across individuals, countries, and cultures, and may also depend on social and demographic characteristics.► Satisfaction levels may depend on country-specific factors, including the overall economic environment and/or the level of social support policies. |

In this context, a fundamental economic concept is intervention in housing supply and demand, which indicates that increased demand leads to increased supply, and in an economic equilibrium, a perfect market responds to rising demand. However, in an imperfect market where other forces are at play, supply issues are inadequately addressed. There is often an imbalance between supply and demand, where demand typically exceeds supply, particularly in the housing market, where this demand is concentrated among low-income groups. The reason for this is the profit-driven nature of private-sector developers, who are more inclined to build high-cost, luxury housing to achieve higher profit margins (Powell et al., 2015). When the market is left unchecked, a shortage of housing supply for low-income groups in desirable locations arises. Barker (2004) emphasized the need to create a balance to achieve suitable and affordable housing for a growing population, alongside other types of housing, while considering space, location, and the nature of housing.

Musole (2009), through an examination of property rights, transaction costs, and institutional changes, concluded that market failure occurs when the market cannot produce desirable economic or social outcomes. Therefore, market failure is often cited as the primary reason for government intervention in economic systems and markets. He also noted that public policy intervention in market processes or other economic processes is generally accepted because it addresses market imperfections and increases efficiency. By eliminating externalities, such intervention ensures that the social costs of outcomes align more closely with private costs, and through the redistribution of resources, disadvantaged groups can also benefit (Tisdell and Almandinger, 2008). Various types of policies for intervening in the housing market are outlined in Table 3.

**Table 3: Types of Housing Market Intervention Policies (Source: Masseram and Misnan, 2019)**

| **Policy Type** | **Objective** | **Example** |
| --- | --- | --- |
| Market Shaping | To shape the environment in which market actions and transactions occur. | Legal development programs, transportation investment plans, codes for sustainable housing. |
| Market Regulation | To regulate or control market actions and transactions, ensuring consideration of externalities and public interests. | Development control/management, building regulations, restrictive covenants related to public land sales. |
| Market Stimulation | To directly influence financial evaluations, making the market function better. | Land assembly and release, grants or tax exemptions to encourage desirable activities, or taxes to deter undesirable activities. |
| Capacity Building | To build the capacity of public and/or market operators. | Public-private development partnerships, skill promotion for sustainable communities. |

Interventions in the housing market through affordable housing appear to provide adequate housing for specific groups of people. Government intervention typically takes various forms. It may involve taxes or subsidies, direct ownership and/or participation in investment, and the provision of goods and services, or it may take the form of administrative/regulatory controls (Musole, 2009). Public-private partnerships are also a form of government intervention (Masseram and Misnan, 2019).

Agarwal et al. (2022) conducted a study titled "Affordable Housing in an Indian City," in which they reviewed critical success factors (CSFs) in addressing the adequacy and affordability of housing for low-income individuals in the city. They produced a comprehensive list of all parameters, both qualitative and quantitative, essential for the successful implementation of housing, focusing on demand-side preferences, also known as "critical success factors (CSFs)." The results suggest careful consideration and integration of these CSFs into housing policies for all future housing projects. The study highlights a gap in achieving a balanced understanding of supply-side constraints and demand-side expectations for housing. Focusing solely on supply without adequate understanding of consumption can only lead to further chaos in the already troubled housing situation.

McAskill et al. (2021) conducted a study titled "Examining the Outcomes of Green Affordable Housing Policy in Australia Using a Systems Approach." They identified the Australian affordable rental housing sector as historically facing barriers to the adoption of green building (GB) practices, despite incentives and financial support from the Commonwealth. The study, through sensitivity analysis, recommended policy reforms that would bring the benefits of green affordable housing without significantly compromising the housing stock provided by the proposed program.

Zhang et al. (2021) conducted a study titled "Spatial Subsidy Benefits: Spatial Decision-Making for Affordable Housing in China." In this study, a conceptual model of spatially subsidized benefits (SSBs) for affordable housing was proposed by combining affordable housing prices and ordinary commodity housing prices in a given or adjacent location in the city. Using the case of Wuhan (China), the spatial layout of SSBs for affordable housing in the city was simulated under multiple hypothetical scenarios.

Chen et al. (2021) conducted a study titled "Examining Social Vulnerability to Flooding in Affordable Housing Communities in Nanjing, China," aimed at building long-term resilience for low-income communities against disasters. They noted that in the context of climate change and rapid urbanization, urban flood disasters frequently occur worldwide, and social vulnerability has become an important theoretical perspective for understanding the occurrence and response to flood disasters.

Safaipour and Fadaei Jazi (2023) described housing as one of the most fundamental and sensitive sectors in economic and social development planning. The article highlighted that the formation of housing depends on cultural, climatic, economic-livelihood, and construction-technical factors of the user community. Providing suitable housing depends on housing market conditions, macroeconomic status, demographic changes, housing demand, social and political trends, governmental approaches, and internal capacities.

Tabaei et al. (2022) conducted a study titled "The Inclusive City: A Novel Approach in Urban Planning for Tabriz." In this study, they stated that an inclusive city is a novel approach to achieving affordable needs, including housing and services, access to suitable jobs and opportunities (to create assets and wealth), and equal rights and participation for all members of the urban community. It requires consideration of spatial, social, and economic dimensions.

Ranjbar et al. (2021) conducted a study titled "Examining the Impact of Physical Indicators of Affordable Housing from an Energy Efficiency Perspective, with a Review of Global Examples." The study noted that, given the growth of the urban population worldwide, energy consumption and greenhouse gas emissions have become one of the most critical issues and challenges facing the world in achieving sustainable growth, particularly for low-income urban groups.

Based on the research background, it is evident that no similar study has been conducted to date, which is why this research is significant. In summary, the concepts discussed regarding the research topic can be presented in the form of Figure 1.



**Figure 1: Conceptual Model of the Research**

**Methodology**
This research is an applied developmental study as it aims to solve a problem. It is exploratory in nature as it seeks to build theory and does not have hypotheses. A mixed-method approach was used for data collection and analysis, combining qualitative and quantitative methods. The study population includes all experts in the field of affordable housing, professionals working in the housing sector, and university professors specializing in architecture and urban planning.

In the qualitative phase, the snowball sampling method and purposive interviews were used alongside meta-synthesis to extract indicators from 33 articles. The researcher determined the stopping point for sampling based on reaching saturation (5 participants). Factors such as time, accessibility of interviewees, and their level of cooperation were considered in selecting the sample size. In the quantitative phase, a researcher-made questionnaire derived from the interview stage was designed. Using Cochran's formula, a sample of 384 experts and informed professionals was selected, and 273 questionnaires were returned. Given a response rate of over 70%, the data were analyzed using confirmatory factor analysis. Validity and reliability in the qualitative phase were confirmed using Lawshe and Kappa, while in the quantitative phase, discriminant validity and Cronbach's alpha were used, both of which were appropriate. Data analysis was performed using the SmartPLS software.

**Findings**
In this section, first, using the meta-synthesis method, 431 articles with relevant titles were reviewed, of which 120 had relevant abstracts. From these, only 33 articles had findings (secondary data) consistent with the research. Then, interviews with 5 experts, whose details are provided in Table (4), were conducted to complete the factors influencing affordable housing based on Iran's socio-cultural patterns.

**Table (4): Expert Demographics**

| **No.** | **Degree** | **Age** | **Occupation** | **Experience (Years)** |
| --- | --- | --- | --- | --- |
| 1 | PhD | 46 | University Professor | 18 |
| 2 | PhD | 49 | University Professor | 25 |
| 3 | Master's | 55 | Manager | 16 |
| 4 | PhD | 61 | Manager | 22 |
| 5 | PhD | 59 | University Professor | 10 |

The selection of the individuals listed in the table above was based on their expertise, education, relevant experience, and accessibility. The results of the thematic analysis from the first stage (meta-synthesis) are presented in Table (5). This table shows the themes extracted from expert interviews alongside related themes from the literature.

**Table (5): Themes (Indicators/Dimensions and Characteristics)**

| **Core Category** | **Themes (Indicators/Dimensions and Characteristics)** | **Source of Themes** |
| --- | --- | --- |
| **Flexibility in Design and Adaptability of Spaces** | Flexibility at micro and macro scales (ability to change the type and proportion of residential units) | Tiantian et al. (2024) |
|  | Flexibility aligned with user demand | Bensouda et al. (2024), P1, P5 |
|  | Coverage of various aspects of life | van der Horst (2024), P1, P2 |
|  | Ability to change layouts to accommodate periodic and regular changes in family structure | Tiantian et al. (2024), van der Horst (2024) |
|  | Variety in appearance for multiple building roles | Vertua (2021) |
|  | Compatibility with multi-generational family needs | van der Horst (2024) |
|  | Design tailored to customer preferences and changing needs | Tiantian et al. (2024), P2, P4 |
|  | Determining unit size based on customer needs | Bensouda et al. (2024) |
|  | Reducing the number of load-bearing walls | van der Horst (2024), P3, P5 |
|  | Activity zoning to ensure space independence while maintaining connectivity | Vertua (2021) |
|  | Creating spaces with height and plan integration principles | Bensouda et al. (2024), P1, P5 |
| **Adaptability to User and Family Needs** | Adaptability to individual activity programs and daily use | Tiantian et al. (2024) |
|  | Use of open-plan layouts | Tiantian et al. (2024), Vertua (2021) |
|  | Presence of perimeter lines inside or outside spaces | Alabi & Fapohunda (2021) |
|  | Ability to create dynamic and diverse interior spaces | Ge et al. (2020) |
|  | Free configuration of facades | Ge et al. (2020) |
|  | Use of decks with larger spans | Ge et al. (2020), P1 |
|  | Optimization of panel dimensions | Ge et al. (2020), Yeganeh et al. (2021) |
|  | Identifying flexible structural points for new systems and components | Adetooto et al. (2022) |
|  | Structural flexibility to meet diverse needs | Alabi & Fapohunda (2021) |
|  | Adaptability to future needs | Adetooto et al. (2022) |
| **Optimization of Energy Consumption and Environmental Impact** | Ease of modification for any family type | Yeganeh et al. (2021) |
|  | Ability to create diversity in height and space | Adetooto et al. (2022) |
|  | Increased user participation in design and construction processes | Jegede & Taki (2022) |
|  | Identifying user intervention points and allowing freedom in them | Moghayedi et al. (2023), P1, P3 |
|  | Anticipating potential spaces for customer participation | Moghayedi et al. (2023) |
|  | Improving quality and living standards for residents | Ge et al. (2020) |
|  | Presence of comfort factors for residents | Ge et al. (2020) |
| **Use of Sustainable and Recyclable Materials** | Anticipating space performance over the lifecycle and enabling internal changes for new functions | Alabi & Fapohunda (2021) |
|  | Compatibility with various materials | González (2022) |
|  | Main structure meeting structural requirements | Vale et al. (2014) |
|  | Infill structure supporting flexibility | Moghayedi et al. (2021) |
| **Cost Savings in Construction and Maintenance** | Infill structure supporting flexibility | Mallach (2020) |
|  | Standardization of functions | Moghayedi et al. (2021), P1, P3 |
|  | Optimizing the number of modules for maximum usable area | Mallach (2020) |
|  | User-centric and people-oriented approach | Mallach (2020) |
|  | Addressing the needs of individuals with disabilities (e.g., blind, deaf) | Buchanan et al. (2020) |
|  | Presence of comfort factors for residents | Moghayedi et al. (2021) |
| **High-Quality Residential Spaces and Resident Comfort** | Use of decks with larger spans | Adetooto et al. (2022) |
|  | Adaptability to future needs | MacAskill et al. (2021) |
|  | Ability to combine interior spaces for specific uses | Jegede & Taki (2022) |
|  | Integration of modular and digital construction for changing environments | Mallach (2020) |
|  | Presence of flexible equipment | Moghayedi et al. (2021) |
|  | Use of flexible furniture | Jegede & Taki (2022), P2, P5 |
| **Standardization and Modularization of Design and Construction** | Identifying flexible structural points for new systems and components | Reid et al. (2020) |
|  | Structural flexibility to meet diverse needs | Adetooto et al. (2022) |
|  | Activity zoning to ensure space independence while maintaining connectivity | Buchanan et al. (2020) |
|  | Creating spaces with height and plan integration principles | Reid et al. (2020) |
|  | Proper spatial organization | Adetooto et al. (2022) |
|  | Clarity of morphology | Ebrahimi et al. (2022) |
|  | Hierarchical spatial zoning | MacAskill et al. (2021), P1, P5 |
|  | Central placement of service and communication spaces for maximum living space efficiency | Ebrahimi et al. (2022) |
|  | Optimizing the number of modules for maximum usable area | Buchanan et al. (2020) |
|  | Use of BIM for structural, architectural, and MEP integration (virtual design and construction) | Favilukis et al. (2023) |
| **Aesthetics and Preservation of Architectural Identity** | Presence of flexible equipment | Brysch & Czischke (2022) |
|  | Use of flexible furniture | Han et al. (2021) |
|  | Proper spatial organization | Reid et al. (2020) |
|  | Clarity of morphology | MacAskill et al. (2021) |
|  | Hierarchical spatial zoning | Favilukis et al. (2023) |
|  | Meeting spatial standards using anthropometric standards | Jegede & Taki (2022) |
| **Strengthening Neighborhood Relations and Social Interaction** | Simplifying unit shapes | Buchanan et al. (2020), P3 |
|  | Proper spatial organization | Do (2024) |
|  | Clarity of morphology | Ebrahimi et al. (2022) |
|  | Meeting spatial standards using anthropometric standards | Rubin & Ponsor (2018) |
|  | Dimensional standardization | Favilukis et al. (2023) |
| **Use of Modern Technologies in Construction and Design** | Standardization of elements | Rubin & Ponsor (2018), P4, P5 |
|  | Plans for partitioning spaces for combined uses | Do (2024) |
|  | Central placement of service and communication spaces for maximum living space efficiency | Ebrahimi et al. (2022) |
|  | Optimizing the number of modules for maximum usable area | Brysch & Czischke (2022) |
|  | Optimizing the number of modules for maximum usable area | Reid et al. (2020) |
|  | Use of BIM for structural, architectural, and MEP integration (virtual design and construction) | Okereke & Okanya (2024) |
|  | User-centric and people-oriented approach | Zapaśnik (2024) |
|  | Addressing the needs of individuals with disabilities (e.g., blind, deaf) | Okereke & Okanya (2024) |
| **Safety and Building Resilience** | Simplifying unit shapes | Brysch & Czischke (2022) |
|  | Dimensional standardization | Reid et al. (2020) |
|  | Standardization of elements | Zapaśnik (2024) |
|  | Plans for partitioning spaces for combined uses | Okereke & Okanya (2024) |
|  | Addressing the needs of individuals with disabilities (e.g., blind, deaf) | Gatoo Jimenez de Laiglesia (2023) |
| **Design of Multipurpose and Flexible Spaces** | Variety in appearance for multiple building roles | Okereke & Okanya (2024) |
|  | Reducing the number of load-bearing walls | Gatoo Jimenez de Laiglesia (2023) |
|  | Presence of perimeter lines inside or outside spaces | Bici & Yunitsyna (2023) |
|  | Creating spaces with height and plan integration principles | Muthigani (2024) |
|  | Standardization of functions | Zapaśnik (2024) |
| **Reduction of Construction Waste and Waste Management** | Compatibility with various materials | Dourado et al. (2024) |
|  | Determining unit size based on customer needs | Nurmawati et al. (2023) |
|  | Main structure meeting structural requirements | Bici & Yunitsyna (2023) |
|  | Increased user participation in design and construction processes | Nurmawati et al. (2023) |
| **Optimization of Energy Costs and Ventilation Systems** | Ease of modification for any family type | Dourado et al. (2024) |
|  | Increased user participation in design and construction processes | Muthigani (2024) |
|  | Identifying user intervention points and allowing freedom in them | Bici & Yunitsyna (2023) |
|  | Presence of comfort factors for residents | Nurmawati et al. (2023) |
| **Provision of Natural Light and Optimal Use of Sunlight** | Identifying user intervention points and allowing freedom in them | Gatoo Jimenez de Laiglesia (2023) |
|  | Anticipating potential spaces for customer participation | Nurmawati et al. (2023) |
|  | Improving quality and living standards for residents | Kim (2023) |
| **Reduction of Dependence on Human Labor** | Dimensional standardization | Okereke & Okanya (2024) |
|  | Standardization of functions | Dourado et al. (2024), P2, P5 |
|  | Standardization of elements | Muthigani (2024) |
|  | Plans for partitioning spaces for combined uses | Bici & Yunitsyna (2023) |
|  | Optimizing the number of modules for maximum usable area | Kim (2023) |
|  | Addressing the needs of individuals with disabilities (e.g., blind, deaf) | Okereke & Okanya (2024), P4, P5 |
| **Future-Oriented Design and Expandability** | Reducing the number of load-bearing walls | Wilson et al. (2024) |
|  | Activity zoning to ensure space independence while maintaining connectivity | Kim (2023), P1, P2 |
|  | Use of BIM for structural, architectural, and MEP integration (virtual design and construction) | Bici & Yunitsyna (2023) |
|  | User-centric and people-oriented approach | Wilson et al. (2024) |
|  | Presence of comfort factors for residents | Gatoo Jimenez de Laiglesia (2023) |
| **Reduction of Environmental Impact in Construction and Operation** | Anticipating space performance over the lifecycle and enabling internal changes for new functions | Archer & Wilson (2023) |
|  | Compatibility with various materials | Muthigani (2024) |
|  | Determining unit size based on customer needs | Archer & Wilson (2023), P3 |
|  | Main structure meeting structural requirements | Okereke & Okanya (2024) |
|  | Increased user participation in design and construction processes | Delehant et al. (2024) |
|  | Identifying user intervention points and allowing freedom in them | Wilson et al. (2024) |
|  | Activity zoning to ensure space independence while maintaining connectivity | Bici & Yunitsyna (2023) |
| **Coordination Between Structural and Mechanical Systems** | Creating spaces with height and plan integration principles | Wilson et al. (2024) |
|  | Simplifying unit shapes | Kim (2023) |
|  | Dimensional standardization | Walton et al. (2024) |
|  | Optimizing the number of modules for maximum usable area | Archer & Wilson (2023), P5 |
|  | Meeting health requirements | Hick et al. (2024) |
|  | Designing products with maximum lifespan and minimal maintenance needs | Mumtaz & Hussain (2024) |
| **Use of Passive Ventilation and Climate Solutions** | Identifying user intervention points and allowing freedom in them | Delehant et al. (2024) |
|  | Anticipating potential spaces for customer participation | Okereke & Okanya (2024) |
|  | Improving quality and living standards for residents | Walton et al. (2024) |
|  | Presence of comfort factors for residents | Perreault (2023), P1, P2 |
|  | Central placement of service and communication spaces for maximum living space efficiency | Wilson et al. (2024) |
| **Increased Speed and Efficiency in Production and Execution Processes** | Optimizing the number of modules for maximum usable area | Perreault et al. (2022) |
|  | Use of BIM for structural, architectural, and MEP integration (virtual design and construction) | Mumtaz & Hussain (2024) |
|  | User-centric and people-oriented approach | Hick et al. (2024) |
|  | Ability to create dynamic and diverse interior spaces | Perreault (2023), P2, P3 |
|  | Free configuration of facades | Perreault et al. (2020) |
| **Provision of Psychological Comfort and Prevention of Environmental Stress** | Use of decks with larger spans | Walton et al. (2024), P1, P4 |
|  | Use of decks with larger spans | Perreault et al. (2020) |
|  | Optimization of panel dimensions | Perreault et al. (2020) |
|  | Adaptability to future needs | Perreault (2023) |
|  | Flexibility at micro and macro scales (ability to change the type and proportion of residential units) | Mumtaz & Hussain (2024) |

In the next step, a researcher-made questionnaire derived from the above table was used to perform confirmatory factor analysis. Figure (1) shows the structural equation model related to the factors identified in this process, based on the factor loadings of latent and observed variables. The numbers on the arrows represent the factor loadings, and the numbers inside the blue circles represent the coefficient of determination.



**Figure (1) Structural Equation Model of the Drivers of Affordable Housing Based on the Socio-Cultural Patterns of Iran According to Factor Load Values**

Figure (1) presents the structural equation model of the drivers of affordable housing supply based on socio-cultural patterns in Iran, according to factor loadings. As shown in Figure (1), all factors have factor loadings close to or greater than 0.5. Although the factor for reducing environmental impacts has a factor loading of less than 0.5, according to Table 6 and based on the Student's t-test, the t-statistic is greater than 1.96, and the significance value is less than 0.05. Therefore, this factor is also significant and should remain in the model. Additionally, the values inside the blue circles represent the coefficient of determination, indicating the contribution of each component to the study. In other words, increasing productivity in production and execution processes and providing psychological comfort and preventing environmental stress explain more than 60% of the variations, while aesthetics and preserving architectural identity explain 17% of the total variations. This indicates that, currently, in the system of affordable housing supply based on cultural patterns, the primary focus is on productivity in production and execution processes due to the shortage of affordable housing, while the least attention is given to aesthetics and preserving architectural identity. Table 6 shows the factor loadings along with the t-test and the significance level of each factor.

**Table (6): t-test for the drivers of affordable housing supply based on socio-cultural patterns**

| **Factor** | **Factor Loading** | **Standard Deviation** | **t-statistic** | **p-value** |
| --- | --- | --- | --- | --- |
| Standardization and modularization of design and construction | 0.635 | 0.049 | 13.062 | 0.000 |
| Use of passive ventilation and climatic strategies | 0.655 | 0.045 | 14.359 | 0.000 |
| Use of modern technologies in construction and design | 0.594 | 0.053 | 11.117 | 0.000 |
| Use of sustainable and recyclable materials | 0.628 | 0.049 | 12.936 | 0.000 |
| Increasing speed and productivity in production and execution processes | 0.782 | 0.034 | 22.912 | 0.000 |
| Adaptability to user and family needs | 0.723 | 0.043 | 16.977 | 0.000 |
| Flexibility in design and space variability | 0.574 | 0.061 | 9.452 | 0.000 |
| Safety and structural reinforcement | 0.647 | 0.049 | 12.955 | 0.000 |
| Optimization of energy consumption and reduction of environmental impacts | 0.633 | 0.054 | 11.712 | 0.000 |
| Optimization of energy costs and ventilation systems | 0.564 | 0.068 | 8.303 | 0.000 |
| Providing psychological comfort and preventing environmental stress | 0.811 | 0.038 | 21.318 | 0.000 |
| Providing natural light and optimal use of sunlight | 0.549 | 0.066 | 8.451 | 0.000 |
| Strengthening neighborhood relationships and social interaction | 0.595 | 0.059 | 10.214 | 0.000 |
| Aesthetics and preserving architectural identity | 0.408 | 0.071 | 5.800 | 0.000 |
| Cost savings in construction and maintenance | 0.672 | 0.043 | 15.660 | 0.000 |
| Future-oriented design and expandability | 0.610 | 0.060 | 10.216 | 0.000 |
| Design of multipurpose and flexible spaces | 0.572 | 0.060 | 9.587 | 0.000 |
| Coordination between structural and mechanical systems | 0.660 | 0.055 | 12.115 | 0.000 |
| Reduction of environmental impacts during construction and operation | 0.497 | 0.075 | 6.613 | 0.000 |
| Reduction of construction waste and waste management | 0.573 | 0.058 | 9.967 | 0.000 |
| Reducing dependence on human labor | 0.542 | 0.068 | 7.936 | 0.000 |
| High quality of residential space and providing occupant comfort | 0.498 | 0.059 | 8.545 | 0.000 |

According to Table (6), all factor loadings are greater than or close to 0.5, the standard deviations are within an appropriate range, and the t-statistics are greater than 1.96. The significance values are less than 0.05, indicating that all factors are significant. This means that when aiming to supply affordable housing based on socio-cultural patterns, factors such as increasing productivity in production and execution processes, providing psychological comfort, and preventing environmental stress should be prioritized, followed by other criteria.

Next, it is necessary to evaluate the overall model, which includes both the measurement and structural parts simultaneously. For this purpose, the Goodness of Fit (GOF) index, which pertains to the overall structural equation model, is used. The values 0.01, 0.25, and 0.36 are considered weak, moderate, and strong GOF values, respectively. If the calculated GOF is 0.01 or close to it, the overall fit of the model is weak, and the relationships between the constructs of the model need to be revised. Similarly, for the other two GOF values (0.25 for moderate fit and 0.36 for strong fit), this guideline applies.

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The average communality is derived from the average of the shared values of the first-order latent variables in the model. The communality and R2*R*2 values are provided in Table 7.

**Table (7): Communality and R2 values of the research variables**

| **Factor** | **SSO** | **SSE** | **Q2(=1−SSE/SSO)** |
| --- | --- | --- | --- |
| Standardization and modularization of design and construction | 153.000 | 92.745 | 0.394 |
| Use of passive ventilation and climatic strategies | 153.000 | 89.494 | 0.415 |
| Use of modern technologies in construction and design | 153.000 | 101.476 | 0.337 |
| Use of sustainable and recyclable materials | 153.000 | 94.126 | 0.385 |
| Increasing speed and productivity in production and execution processes | 306.000 | 185.290 | 0.394 |
| Adaptability to user and family needs | 306.000 | 199.047 | 0.350 |
| Flexibility in design and space variability | 153.000 | 104.241 | 0.319 |
| Safety and structural reinforcement | 153.000 | 92.694 | 0.394 |
| Optimization of energy consumption and reduction of environmental impacts | 153.000 | 94.237 | 0.384 |
| Optimization of energy costs and ventilation systems | 153.000 | 106.454 | 0.304 |
| Providing psychological comfort and preventing environmental stress | 306.000 | 168.453 | 0.450 |
| Providing natural light and optimal use of sunlight | 153.000 | 107.577 | 0.297 |
| Strengthening neighborhood relationships and social interaction | 153.000 | 99.574 | 0.349 |
| Aesthetics and preserving architectural identity | 153.000 | 128.434 | 0.161 |
| Cost savings in construction and maintenance | 153.000 | 86.669 | 0.434 |
| Future-oriented design and expandability | 153.000 | 97.228 | 0.365 |
| Design of multipurpose and flexible spaces | 153.000 | 105.458 | 0.311 |
| Coordination between structural and mechanical systems | 153.000 | 88.016 | 0.425 |
| Drivers of affordable housing supply based on socio-cultural patterns in Iran | 3,978.000 | 3,978.000 |  |
| Reduction of environmental impacts during construction and operation | 153.000 | 117.297 | 0.233 |
| Reduction of construction waste and waste management | 153.000 | 104.751 | 0.315 |
| Reducing dependence on human labor | 306.000 | 254.786 | 0.167 |
| High quality of residential space and providing occupant comfort | 153.000 | 115.889 | 0.243 |

The GOF value according to the formula is:

$$GOF=\sqrt{0.337×0.45}=0.39$$

Considering the values 0.01, 0.25, and 0.36 as weak, moderate, and strong GOF values, respectively, the resulting GOF value of 0.39 indicates a strong overall fit of the research model. Therefore, the model is significant, and all drivers are confirmed.

**Discussion and Conclusion**

As mentioned, the goal of this research was to identify the drivers of affordable housing supply based on socio-cultural patterns in Iran. The nature of this research is applied developmental, and since it is exploratory, it does not have hypotheses. This research, conducted using a mixed-method approach, combined the drivers identified through meta-synthesis and interviews in the qualitative phase to design a researcher-made questionnaire for the quantitative phase. By distributing the questionnaire among the sample members (273 completed responses), the drivers were localized for Iran.

The identified drivers include: Standardization and modularization of design and construction, Use of passive ventilation and climate-responsive strategies, Adoption of modern technologies in construction and design, Utilization of sustainable and recyclable materials, Increasing speed and productivity in production and execution processes, Adaptability to user and family needs, Flexibility in design and spatial variability, Building safety and resilience, Optimization of energy consumption and reduction of environmental impacts, Optimization of energy costs and ventilation systems, Provision of psychological comfort and prevention of environmental stress, Provision of natural light and optimal use of sunlight, Strengthening neighborhood relationships and social interaction, Aesthetic considerations and preservation of architectural identity, Cost savings in construction and maintenance, Future-oriented design and expandability, Design of multipurpose and flexible spaces, Coordination between structural and mechanical systems, Reduction of environmental impacts during construction and operation, Reduction of construction waste and waste management, Decreased reliance on human labor, High-quality residential spaces and provision of occupant comfort.

In this research, flexibility refers to the ability to change the type and proportion of residential units according to user demand, covering various aspects of life and allowing individuals to adjust layouts based on changes. This includes compatibility with multi-generational families, flexible design, adaptability to various materials, and customization of height, space, and area according to customer preferences.

Agrawal et al. (2022) emphasized the importance of understanding demand-side preferences (needs of low-income groups) and integrating them into housing policies. This aligns with the findings of this research, which highlight adaptability to user needs and high-quality residential spaces. Insufficient attention to residents' needs can lead to a gap between supply and demand, as reflected in the emphasis on adaptability and occupant comfort.

McAskill et al. (2021) and Ranjbar et al. (2021) emphasized the importance of environmental sustainability and energy efficiency in affordable housing. This aligns with the optimization of energy consumption and reduction of environmental impacts in this research. Integrating green technologies and reducing energy consumption not only contributes to environmental sustainability but also lowers long-term costs.

Tabaei et al. (2021) highlighted the importance of inclusive cities and flexibility in urban planning. The flexibility in design and spatial variability, as well as the design of multipurpose and flexible spaces in this research, align with these findings. Flexibility in design can better address the diverse needs of residents.

Safaipour and Fadaei Jazi (2023) and Zhang et al. (2021) emphasized the importance of cost management in affordable housing. Cost savings in construction and maintenance, as well as optimization of energy costs and ventilation systems, are among the findings of this research that align with these studies. Cost management is crucial not only during construction but also during operation.

Chen et al. (2021) emphasized the importance of reducing social vulnerability in low-income communities. Building safety and resilience, as well as the provision of psychological comfort and prevention of environmental stress, align with these findings. Safety and psychological comfort can help reduce social vulnerability.

The use of modern technologies in construction and design (t-statistic: 11.117) and increasing speed and productivity in production and execution processes (t-statistic: 22.912) are among the success factors in this research, aligning with the emphasis on innovation in previous studies. The use of modern technologies can improve quality and reduce costs.

Given the research background, it is clear that most studies have focused on specific aspects such as environmental sustainability, costs, or flexibility. However, this research provides a more comprehensive approach to the success factors in affordable housing, filling gaps in the literature. This research can serve as a comprehensive framework for planning and implementing affordable housing projects in the future. Additionally, the emphasis on psychological and social factors (such as psychological comfort and social interaction) can improve residents' quality of life.

**Recommendations**

Based on the importance of the identified drivers and the lack of attention to some of them, the following recommendations are proposed:

1. Housing design should accommodate the diverse needs of residents, especially low-income groups, including flexibility in spatial design and adaptability to future needs.
2. Adopt modern construction technologies (e.g., modular construction, prefabricated materials, and smart systems) to reduce time and costs.
3. Use passive ventilation systems, sustainable and recyclable materials, and energy-efficient designs to minimize energy consumption.
4. Utilize low-cost construction methods and affordable materials without compromising quality and safety.
5. Design and construct buildings to meet safety standards and withstand natural disasters (e.g., floods and earthquakes).
6. Ensure adequate natural light, ventilation, and green spaces to enhance residents' psychological well-being.
7. Design shared spaces (e.g., parks, community halls, and playgrounds) to strengthen social interaction and neighborhood relationships.
8. Implement waste management and recycling programs during construction and operation.
9. Governments should provide financial incentives and low-interest loans to encourage affordable housing construction.
10. Design housing to allow for future expansion and changes to adapt to evolving resident needs.
11. Educate residents about the benefits of sustainable housing and methods to reduce energy consumption and manage waste.
12. Ensure coordination between structural and mechanical systems to improve efficiency and reduce maintenance costs.

This research provides a holistic framework for addressing the challenges of affordable housing in Iran, emphasizing the integration of cultural, social, economic, and environmental factors. By implementing these recommendations, policymakers and stakeholders can create sustainable, affordable, and high-quality housing solutions that meet the needs of diverse populations.

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