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Building Sustainable Affordable Housing: A Review of Critical Risks, Barriers, and Success Drivers

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ABSTRACT

This review examines the critical risks, barriers, and success factors in achieving sustainable affordable housing (SAH) by addressing environmental, economic, social and technical dimensions of sustainability. The aim of this study is to identify different critical risks and barriers to the development of the Sustainable Affordable Housing (SAH) CSF framework. The objectives of this research are to define SAH (Sustainable Affordable Housing) and important factors for achieving SAH and to develop SAH Critical Success Factors (CSFs) frameworks. To achieve these objectives, there are two methods for reviewing and analyzing documents, i.e., systematic review and bibliographic review. The years of publication are limited to 2014 to 2023 in the English language and restricted to open access. A total of 63 articles were retrieved and screened for relevance identified as directly relevant to our topic using the PRISMA systematic review process. The growth pattern aligns strongly with an exponential growth model, as evidenced by a high R^2 value of 0.9133 indicating a robust correlation and demonstrating the accelerating interest in the field over the past decade. This comprehensive analysis led to the development of the sustainable affordable housing (SAH) critical success framework, providing a structured approach to understanding and implementing critical factors for sustainable and affordable housing initiatives. The findings emphasize the need for integrated policy reforms, innovative construction technologies, and collaborative stakeholder engagement to advance the SAH agenda. Future research directions include conducting longitudinal studies to assess the long-term impacts of SAH policies, comparative analyses of international best practices, and explorations into emerging construction technologies.

Keywords: Sustainable Affordable Housing (SAH); Housing Affordability; Critical Risks; Critical Barriers; VOSviewer

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1. Introduction

India is rapidly urbanizing; it is estimated that 416 million new urban dwellers will be added by 2050^[1]. The reason for this increase in population is the migration of people from rural areas to urban areas; as a result, essential services, living conditions and infrastructure have been negatively affected^[2, 3]. As per the report of the “Ministry of Housing and Urban Affairs (MoHUA)” at the end of the year, 2017 the total housing shortage was over 10 million, and 95% of this housing shortage was in Economically Weaker Sections (EWS) and Lower-Income Group (LIG). The Indian government plans to close this housing gap with its “Housing for All by 2022” mission, which focuses on building “12 million housing units” over the duration of the program’s period (2015–2022) through a combined effect of slum re-development and rehabilitation projects collaborating with the non-government sector, direct government-led housing delivery, government housing subsidies, and supporting the benefits from construction^[4–6]. However, such a focus has a number of consequences. Affordable housing development has long been a pressing challenge for policymakers, developers, and communities around the world^[7]. Providing decent, safe, and affordable shelter is crucial for ensuring equitable access to adequate living conditions, which are fundamental to individual and community health and well-being^[8]. However, the development of sustainable affordable housing faces a range of complex risks, barriers, and challenges that must be addressed to achieve long-term success and create housing that is truly accessible and beneficial for all^[9]. These challenges include financing and funding constraints, restrictive land use and zoning regulations, difficulties in tenant selection and property management, the ongoing need for maintenance and preservation, and the challenge of integrating affordable housing with access to essential social

services and community resources^[10]. Overcoming these barriers will require a comprehensive, multifaceted approach that brings together various stakeholders and aligns housing policy with broader efforts to promote health equity and community well-being^[11].

India’s global commitment to achieving the global “Sustainable Development Goals (SDGs)” recognizes that housing is an important factor in sustainable development across all of the SDGs, and it is clearly described in Target 11 of the SDGs^[12]. Access to essential services is facilitated by good housing, which also encourages equitable growth and the construction of a sustainable future, all of which have a direct impact on the variables that contribute to or reduce the consequences of climate change^[13]. As a result, investing in sustainable social housing will have a direct and significant impact on the achievement of several SDG targets. Although awareness of sustainable development is growing in India, it has yet to become an important factor to be considered in housing construction, which can be achieved by using alternative construction materials that are cost-effective and prevent the environment from harmful emissions^[14]. The legacy of structural racism, discriminatory housing policies, and socioeconomic inequities has led to significant disparities in access to affordable, high-quality housing, with marginalized communities bearing a disproportionate burden^[15, 16]. These disparities have profound implications for individual and community health, as housing is a key social determinant of health. Substandard housing conditions, such as exposure to environmental toxins, lack of safety and security, and limited access to essential services, can contribute to a range of negative health outcomes, including increased risk of chronic diseases, infectious diseases, and mental health issues^[17, 18]. The definition of affordable housing from different organizations are shown in **Table 1**.

Table 1. Definition of affordable housing.

Organization	Definition of Affordable Housing
Government Organization Pradhan Mantri Awas Yojana (Ministry of Housing and Urban Poverty Alleviation, Government of India)	<ul style="list-style-type: none"> • Size of DU for EWS: <30 sqm (Super Built-up area), for LIG: 30–60 sqm. for MIG: 60–120 sqm • Repayment of home loans in monthly installments not exceeding 30% to 40% of the monthly income of the buyer
Research Institute Making Urban Housing Work in India (RICS, LEVVEL, CBRE)	<ul style="list-style-type: none"> • Provision of ‘adequate shelter’ on a sustained basis, ensuring security of tenure within the means of the common urban household • Affordable housing is that provided to those whose needs are not met by the open market

Table 1. Cont.

Organization	Definition of Affordable Housing
Private Sector Affordable Housing - A Key Growth Driver in the Real Estate Sector by KPMG	Defined in terms of three main parameters <ul style="list-style-type: none"> • income level (independent variable) • the size of dwelling unit (independent variable) • affordability (dependent variable)

Source: Ministry of Housing and Urban Poverty Alleviation^[19].

Affordable housing is a critical issue, encompassing a complex interplay of social, economic, and policy factors. It's generally defined as housing that doesn't cost more than 30% of a household's gross income^[20]. Several factors influence housing affordability. One key element is the availability of subsidies and financing options. Another is the cost of land, infrastructure, materials, and labor. Government regulations and policies also play a significant role, impacting both the supply and demand sides of the housing market. For example, zoning regulations can restrict the construction of new housing units, driving up prices^[21, 22].

For this study, the problem statement emphasizes the persistent shortage of affordable, sustainable housing due to financial, policy, and technological constraints^[23–29]. This shortage is driven by limited access to funding, high development costs, restrictive zoning regulations, and insufficient policy support for innovative construction methods^[30–34]. Moreover, the housing sector often struggles with balancing environmental sustainability with economic feasibility, creating a gap in practical, scalable housing solutions that address both affordability and sustainability^[35–38]. These intertwined challenges necessitate a comprehensive approach that incorporates policy reforms, technological innovation, and stakeholder collaboration. The primary research gap of the study is that limited studies integrate sustainability criteria with affordability considerations in SAH.

2. Literature Review

2.1. Sustainable Affordable Housing

Sustainable affordable housing has become an increasingly important topic in the construction industry due to the growing demand for housing and the persistent deficit in housing supply^[39, 40]. Achieving sustainability in affordable housing projects involves a multifaceted approach that considers various aspects, including design, construction, and operations^[41]. Sustainable affordable housing can be defined

as housing that is designed, constructed, and operated in a manner that minimizes its environmental impact, while also ensuring that it is financially accessible to low-income and moderate-income households. This concept encompasses various elements, such as energy-efficient design, the use of renewable materials, and the incorporation of renewable energy sources^[42, 43]. The concept of sustainable affordable housing has its roots in the broader movements towards sustainable development and environmental protection that gained momentum in the late 20th century^[44]. As concerns over the ecological impact of human activities grew, there was an increasing recognition of the need to address the environmental and social implications of housing construction and operations^[45]. In the 1970s and 1980s, the energy crisis and growing awareness of the environmental impact of buildings led to the development of early sustainable housing initiatives, focusing primarily on energy efficiency and renewable energy integration^[46, 47]. These early efforts paved the way for the more comprehensive approaches to sustainable affordable housing that emerged in the subsequent decades. The 1990s saw the rise of green building certification systems, such as LEED and BREEAM, which helped to establish standards and guidelines for sustainable construction practices^[48, 49]. These frameworks were increasingly applied to affordable housing projects, highlighting the importance of environmental performance alongside affordability. In the 2000s and 2010s, the concept of sustainable affordable housing expanded to encompass a broader range of considerations, including social equity, community engagement, and life-cycle cost analysis. Governments, non-profit organizations, and the private sector began to collaborate more closely to develop innovative approaches to delivering high-quality, environmentally responsible, and financially accessible housing^[50]. Today, sustainable affordable housing is recognized as a crucial strategy for addressing the intersecting challenges of housing affordability, environmental sustainability, and social inclusion^[51, 52]. The field continues to evolve, with ongoing research, policy developments, and technological

advancements driving the search for more effective and equitable solutions.

2.2. Critical Success Criteria for SAH

The existing literature highlights several critical success criteria for sustainable affordable housing projects. These criteria can be categorized into various domains, such as environmental, social, technical and economic factors^[53]. One comprehensive study identified 21 critical success criteria for sustainable affordable housing, including energy efficiency, water conservation, waste management, affordability, accessibility, and community engagement. Another study used the Analytic Hierarchy Process to evaluate the critical success factors for sustainable housing delivery in Nigeria, identifying key factors such as government support, stakeholder collaboration, and life-cycle considerations^[12]. These criteria encompass a range of important considerations, from the environmental performance of the housing to the social and economic factors that influence its accessibility and long-term sustainability. The various aspects of sustainability in housing are classified into four broad categories as shown in **Figure 1**.

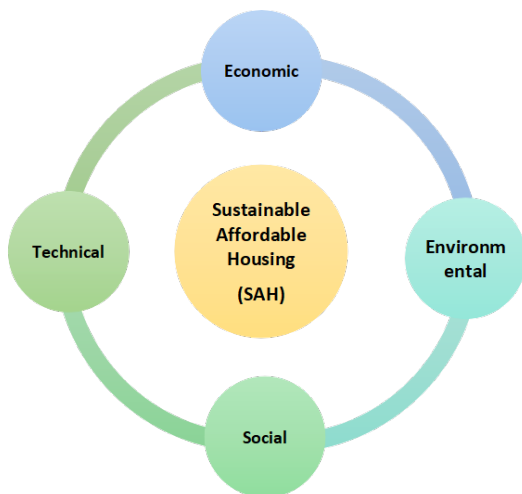


Figure 1. Different factors associated with achieving sustainable affordable housing.

Source: ^[54].

2.3. Sustainability in the Housing Context

Guidelines are provided by the National Building Code (NBC) 2016 for the construction of residential and commercial buildings. It defines sustainable buildings as those that meet performance requirements while causing the least

amount of disruption to the environment, thereby helping to improve the functioning of “local, regional, and global ecosystems” during the construction and life cycle of the building. The concept of sustainability has also evolved to broaden its scope. Sustainable development is defined as the principle of meeting today’s needs without risking tomorrow’s needs^[55]. It broadly includes three aspects: social, economic, technical and environmental, but the importance of each varies depending on the context^[56]. The four broad categories of sustainability in the context of housing is further elaborated in next section.

2.3.1. Economic Sustainability

Housing is related to economic sustainability both as a commodity and as a habitat. Housing must be affordable to the urban poor as a commodity^[57]. The cost of the dwelling unit, as well as the cost of utilities, operation, and maintenance, are important components in determining whether the poor can afford to stay in their home. In this regard, the procedures for allocating social housing units to the urban poor are critical^[58]. To avoid leaking out of the unit or a lessened sense of ownership on the one hand, and low pay-back rates on the other, a careful balance between providing free accommodation and overburdening low-income citizens must be found^[59]. As a habitat, affordable housing should make it easier for residents to find work and earn a living in the city. In this sense, factors such as location and land use are important^[36].

2.3.2. Social Sustainability

Residents’ needs must be met when it comes to social housing. Security of tenure is the first and most basic step toward achieving long-term social housing sustainability, as it allows the urban poor to gain access to short- and medium-term personal development opportunities, as well as infrastructure, services, and finance^[60]. The majority of the urban poor live in squatter settlements with little or no tenure security. The persistent threat of displacement restricts economic progress and asset buildup^[61]. Residents should be able to obtain a basket of essential commodities and services from their dwelling unit, such as freshwater, sanitation, waste disposal, education, and health facilities^[62]. The living unit itself should be able to accommodate all of the family’s essential activities^[63]. Buildings that do not meet the basic needs of communities’ risk being

abandoned by their intended users, resulting in a wasteful depletion of material resources and the emergence of slum settlements^[64].

2.3.3. Environmental Sustainability

The development of social housing should not threaten the ability of younger generations to survive in urban surroundings or threaten ecosystems by depleting natural resources^[65, 66]. The development of an affordable housing supply and urban growth should be done while keeping the natural environment in mind^[67]. Environmental sustainability has a cultural as well as a planning component. On the supply side, architects and planners will define the building's embodied energy through material and design selections^[68]. On the demand side, the end-user will play a critical role in significantly reducing energy through lifestyle choices^[69]. Choices like how they are operating and maintaining buildings, including water management and solid waste collection, will be important components of long-term sustainability^[70]. As a result, if we want to achieve long-term housing, both supply and demand side components are important in social housing programs.

2.3.4. Technical Sustainability

Sustainable affordable housing aims to provide environmentally responsible and financially accessible homes. Key principles include energy efficiency, water conservation, and sustainable materials^[71]. Energy efficiency involves minimizing energy use through strategies like better insulation and efficient appliances. Water conservation focuses on reducing water usage through low-flow fixtures and rainwater harvesting. Sustainable materials minimize environmental impact through recycled content and responsible sourcing. Affordable housing projects can integrate renewable energy sources like solar power. Careful urban planning is crucial, considering site selection and access to services. Community development is enhanced through shared spaces and economic opportunities.

2.4. Sustainable Affordable Housing is Core of SDGs

Sustainable buildings can contribute to dealing with climate change, reducing carbon emissions and pollution, managing global resources, and improving energy performance^[72, 73]. "How we fulfill the Paris climate objectives

will be determined by the infrastructure created in the next five years," Ms. Marchal said. "It's a threat, but it's also a big opportunity for countries to jump to climate-ready infrastructure^[74]." The building is sustainable when it plays a role in all three aspects related to sustainable development: economic sector, the environment, and benefits to society^[75]. Now, as the world strives to accomplish determined goals like the "Sustainable Development Goals (as outlined in the global Agenda 2030) shown in **Figure 2** and the Paris Climate Agreement", infrastructure is becoming more recognized by different stakeholders and agencies. When it comes to the economy, housing provides us with various benefits like job creation during the construction and maintenance phases^[32, 35].



Figure 2. Housing in the context of the SDGs.

Source: Author.

Sustainable housing plays a key role in conserving natural resources and reducing the impact of climate change by connecting communities to cities, providing education and job training, and providing transportation and telecommunication services^[76, 77]. All of this helps to achieve national economic goals while also protecting the environment.

3. Research Methods

The objectives of this research are to define SAH (Sustainable Affordable Housing) and identify important factors for achieving SAH, as well as to develop SAH Critical Success Factors (CSFs) frameworks. To achieve these objectives, there are two methods for reviewing and analyzing documents, namely systematic review and bibliographic review. A systematic literature review was conducted to identify critical success factors (CSFs) by drawing insights from various disciplines, particularly within construction through

PRISMA. These factors were refined through synthesis and organized into clusters using content analysis. One of the key advantages of a systematic narrative review lies in its detailed content analysis, which helps in developing explanatory theoretical frameworks. Following this, a bibliometric analysis was employed to validate and visually map the clustered CSFs obtained from the literature review. Firstly, the research protocol was developed for the study as shown in **Figure 3**. In the second step of the study, relevant keywords and a reliable database for document searches were identified using VOSviewer software (version 1.6.19). This software employs network visualization techniques to analyze keyword occurrences and their link strengths. The top three keywords, namely (“AFFORDABLE” AND “SUSTAINABLE” AND “HOUSING”) were selected for querying the Web of Science (WoS) Core Collection database on November 11, 2024.

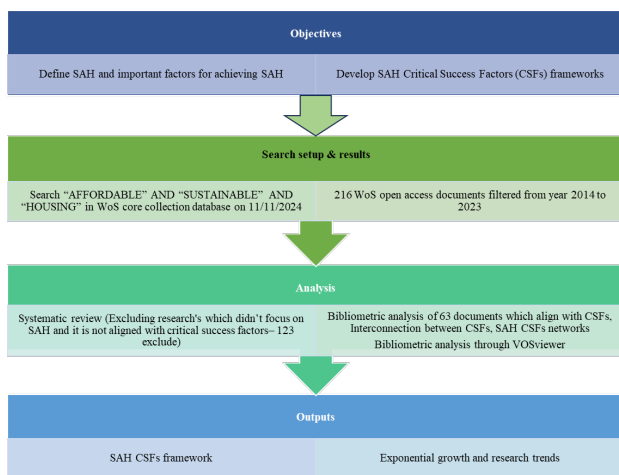


Figure 3. Research protocol for the study.

Source: Author.

The search yielded 611 documents from the Web of Science database. Then, results werw refined for the years of publication 2014 to 2023 in the English language limited to open access. A total of 186 articles were initially retrieved and screened for relevance, with 63 articles identified as directly relevant to our topic. Many of the initially identified publications didn't focus on SAH and were not aligned with critical success factors; therefore, they were excluded from further consideration. Alongside the initial database searches, extensive manual searches took place on the reference lists of significant articles. This approach ensured a comprehensive review that encompassed not only SAH studies but also research on topics such as critical risks, critical

barriers and critical success factors. A detailed methodology for the selection of 63 articles is shown in **Figure 4**. This analysis focused on exploring the interconnections among CSFs and the SAH CSF networks. The final list comprised 63 CSFs specific to SAH research, which were categorized into two major databases: the first is the possible risks associated with SAH, and the second is the various barriers that create problems in achieving SAH.

In the fourth step, the frequency of the 63 identified CSFs and their co-occurrence within the same documents was calculated. This data was used to create a node table and an interconnection matrix, both developed through VOSviewer. This software, known for its open-access bibliometric analysis capabilities, facilitated the visualization of relationships among the CSFs. Finally, in the fifth step, the findings from the bibliometric and content analyses were synthesized. This comprehensive analysis led to the development of the Sustainable Affordable Housing (SAH) CSF framework, providing a structured approach to understanding and implementing critical factors for sustainable and affordable housing initiatives.

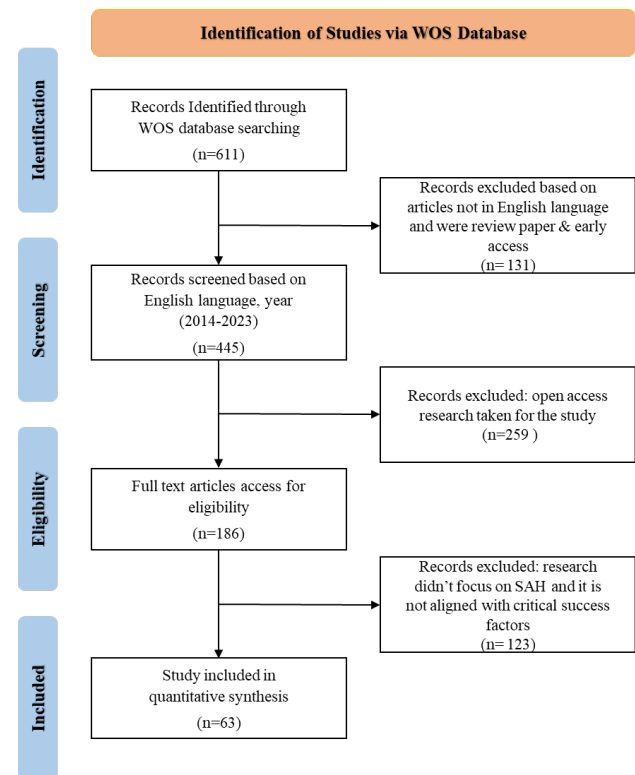


Figure 4. PRISMA framework for identified research for systematic review.

Source: Author.

4.3. Sustainable Affordable Housing (SAH) Facets

The performance of affordable housing projects can be assessed at three levels: housing conditions, neighborhood characteristics, and location. This paper focuses specifically on housing, emphasizing the subcategories of design, construction, and operation of affordable housing types. By incorporating aspects of affordability, sustainability, and innovation, the study identified various risks and barriers for SAH. Previous studies have highlighted various risk factors commonly associated with construction projects^[83]. Many of these risks

are general and can be observed across different countries and project types. Key risk factors identified in the literature include fluctuations in foreign exchange rates, corruption, political interference, high operational costs, and volatility in inflation and interest rates^[84, 85]. Additionally, risks such as construction time and cost overruns, poorly designed contracts, inadequate supporting utilities or infrastructure, design and construction deficiencies, and land expropriation pose significant challenges in the construction industry. Possible risks associated with SAH are shown in **Table 2**.

Critical Risk Factors (CRFs) & Critical Barriers to SAH

Table 2. Possible risks associated with SAH.

S. No.	Risk Categories	Risk Factors
1	Financing-related risk	Fluctuations in exchange rate Inflation rate volatility (price fluctuation of materials & labour & sustainable technologies) Changes in government financing strategies or project financing Delays in payments by governments/clients Litigations over claims payment
2	Political-related risk	Risk due to delays in project permit approval/delays in obtaining construction permits or issuance of documents Risk associated with opposition to large public-private housing projects Risk associated with land acquisition/land expropriations for housing Risk due to policy instability/political opposition to public housing projects
3	Procurement risk factors	Inadequate competition during project tendering Corruption in project procurement Errors and omissions in tender documents (i.e., inaccurate cost estimation)
4	Design & construction-related risk factors	Construction time overruns Construction cost overruns Construction deficiencies/defects Construction accidents and injuries

Source: ^[86-94].

Despite the many benefits of sustainable affordable housing, there are several risks and barriers that must be addressed to ensure its widespread adoption and success. One of the primary challenges is the higher upfront costs associated with sustainable design and construction, which can make these projects less financially viable for developers and less accessible for low-income households. Additionally, there may be a lack of awareness or understanding among policymakers, developers, and the general public about the long-term benefits of sustainable affordable housing, such as reduced energy and water costs, improved health outcomes, and enhanced community resilience.

The development of sustainable affordable housing (SAH) faces several critical challenges stemming from financial, policy-related, and technical issues. The implementation of energy-efficient designs, sustainable materials, and green technologies often results in elevated initial project costs, making investments less attractive to developers and financiers^[95-97]. Existing policy frameworks frequently lack adequate support mechanisms, such as housing subsidies, streamlined permitting processes, and regulatory incentives. Restrictive zoning laws and inconsistent government policies further hinder large-scale SAH development^[23, 45, 98].

Limited access to low-interest loans, reliance on tra-

ditional project financing models, and the absence of tailored financial instruments exacerbate the financial burden on developers^[99, 100]. A shortage of skilled professionals in sustainable construction practices, coupled with outdated building codes and insufficient technological integration, complicates project execution and reduces operational efficiency^[22, 101–104]. Addressing these barriers requires a multi-faceted strategy that includes policy reforms to enhance subsidy frameworks, development of innovative financing models, and fostering technical expertise through specialized training programs.

- High upfront costs due to innovative materials.
- Policy limitations related to funding and incentives.

Suggested actionable strategies, including: policy reforms for subsidy enhancements and strengthening public-

private partnerships. Governments should increase subsidies for sustainable housing projects by streamlining funding approval processes and offering tax incentives to developers who adopt green building technologies. Implementing tiered subsidies based on sustainability performance can further encourage environmentally responsible practices^[105, 106]. Establishing collaborative frameworks between public authorities and private developers can mobilize resources, share risks, and expedite project implementation. Various critical barriers associated with sustainable affordable housing are shown in **Table 3**. Successful models include joint ventures and concession agreements that align public welfare goals with private sector profitability^[8].

- Policy reforms for subsidy enhancements.
- Strengthening public-private partnerships.

Table 3. Various critical barriers associated with sustainable affordable housing (SAH).

S. No.	Barrier Categories	Barrier Factors
1	Cost-related barriers	High interest rates High cost of serviced land Changes in government financing strategies or project financing High upfront cost of materials and technologies for sustainable housing (both new construction and retrofitting) High inflation rate
2	Incentive-related barriers	Lack of planning control on land development Inadequate subsidies/public funding for sustainable technologies High cost of sustainable building materials/technologies Limited private partnership
3	Retrofitting-related barriers	Inadequate policies or sustainability assessment tools (standards or guidelines) for retrofitting housing facilities Lack of routine maintenance/poor maintenance culture of public housing facilities Limited access to sustainable technologies and materials for retrofitting

Source: ^[107–126].

4.4. Critical Success Factors (CSFs) for Achieving SAH

The success of sustainable affordable housing (SAH) depends on several critical factors. These include strong political commitment and the formulation of effective housing policies. Access to low-interest loans for developers and government provision of low-cost land play a crucial role. Incorporating environmentally friendly materials, ensuring good project locations, and providing access to social amenities are essential. Stable political and economic conditions, private sector involvement, and incentives for sustainable designs further enhance success. Additionally, adaptability in hous-

ing design, transparent allocation, proper maintenance, and adherence to budgets and schedules contribute significantly. Effective coordination among stakeholders and promoting high-density development also support SAH goals.

The framework identifies three primary categories of critical risks: design and construction-related risks, financing-related risks, and political-related risks, alongside procurement risk factors, as shown in **Figure 7**. These risks converge to form critical barriers, further categorized into cost-related barriers, retrofitting-related barriers, and incentive-related barriers. To overcome these challenges, the framework outlines three enabling CSF domains:

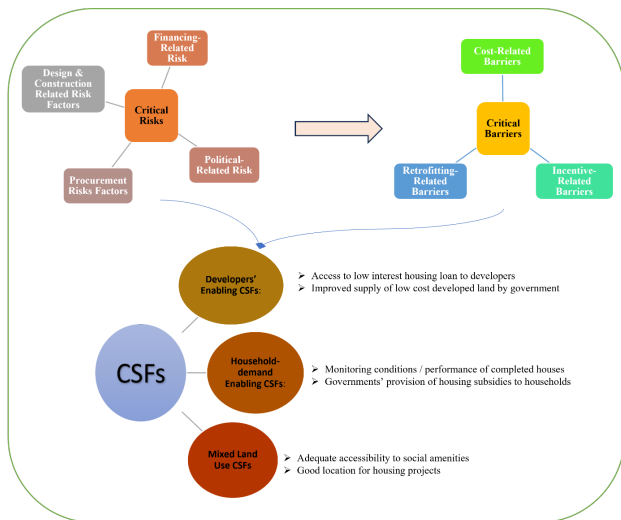


Figure 7. Critical success factors framework.

Source: Author.

- **Developers’ Enabling CSFs:** These focus on improving access to low-interest housing loans for developers and ensuring the government supplies low-cost, developed land, which facilitates cost-effective project execution.
- **Household-Demand Enabling CSFs:** This area emphasizes monitoring the conditions and performance of completed houses while encouraging governments to provide housing subsidies, enhancing affordability for households.
- **Mixed Land Use CSFs:** These highlight the importance of adequate accessibility to social amenities and selecting optimal locations for housing projects to ensure the functionality and sustainability of developments.

5. Conclusions

In conclusion, this research emphasizes the crucial role of identifying and implementing Critical Success Factors (CSFs) for Sustainable Affordable Housing (SAH). The study highlights three primary CSFs: Developers’ Enabling Factors, Household-Demand Enabling Factors, and Mixed Land Use Factors. Together, these elements create a comprehensive framework for fostering sustainable housing initiatives. Developers benefit from policies such as the mandatory inclusion of affordable units, access to low-interest loans, and government incentives, which help them incorporate sustainable designs. Meanwhile, households gain through government-provided subsidies and the assurance of quality housing via consistent monitoring. Lastly, mixed land use ensures opti-

mal locations and accessibility to essential social amenities, enhancing the livability and functionality of these housing projects.

The conclusion emphasizes the need for future research and policy development in sustainable affordable housing (SAH). Key research directions include conducting longitudinal studies to assess the long-term impacts of SAH policies on housing affordability, sustainability, and community well-being. Comparative studies are recommended to evaluate regional and international implementations, offering insights into best practices and scalable models. Policy recommendations include introducing dynamic subsidy models that adjust based on project sustainability performance, ensuring that environmentally conscious projects receive prioritized support. Zoning regulation reforms should encourage mixed-use developments and higher housing density in urban areas, optimizing land use and reducing sprawl. Additionally, innovation incentives such as tax credits for developers adopting eco-friendly technologies and grants for research in sustainable construction materials and methods are proposed to stimulate industry growth and technological advancement.

Author Contributions

The paper is equally prepared by all the authors. N.B. contributes under the guidance and supervision of S.K.M.

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Not applicable.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest

The authors declare no conflict of interest.

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