(RESEARCH ARTICLE)

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Affordable housing solutions: real estate strategies for addressing urban population growth

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Abstract

Introduction: As the population count in cities increases, the need for affordable and efficient housing systems becomes even more pressing, especially for the poor and middle-income earners. Housing affordability challenges are an important area to which real estate strategies contribute, and this includes funding schemes, resource-efficient construction methods, and a repurposing of structures for different functions. These strategies work towards achieving the goal of closing the deficit of housing availability in the market as well as meeting the necessary criteria for sustainability and habitability of cities of the future.

Materials and Methods: The research methodology employed a comprehensive literature review, analysing peer-reviewed articles, industry reports, and case studies from diverse urban contexts. The data collection was majorly centered on successful affordable housing projects, policies, and approaches used in various city settings. Both quantitative and qualitative assessments were used in the studies for comparative analysis of different strategies and solutions with respect to their efficiency and applicability with regard to cost-saving, mass implementation, and social aspects. Finally, a focus on the world of urban planning and real estate with interviews with professionals in these fields as well as policymakers gave an understanding of possible actual difficulties and opportunities of realizing affordable housing strategies.

Results: The study revealed several key findings regarding effective real estate strategies for affordable housing. Financing models that were discussed in this paper include public-private partnerships and community land trusts showed promising results regarding the possibility of decreasing housing prices and making housing more accessible. Techno-friendly mechanisms such as modular construction accompanied by the use of lightweight building materials were perceived to be helpful in increasing the rate of construction of houses while reducing the effects of the construction activities on the physical environment. Adaptive reuse mortels demonstrated that movement's ability to re purpose inactive urban areas as viable affordable housing opportunities satisfied both the demand for housing and site redevelopment. In addition, policy interventions like inclusionary zoning and density bonus were useful in enhancing the private sector's engagement in affordable housing.

Discussion: The research findings highlight the multifaceted nature of affordable housing solutions and the importance of context-specific strategies. Some strategies like public-private partnerships, could be adopted in any city regardless of the type, however the decision on their application depended on the local socio-economic situation and legislation. Effective implementation of sustainable construction depended on appropriate skills by human resources and favourable policies. Architects and developers of adaptive reuse projects encountered issues with code conformity and reception among the population. These findings suggest that the solution to affordable housing must employ the right mix of innovative real estate solutions, supportive public policies, and active community participation.

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Conclusion: Real estate strategies offer promising avenues for addressing the affordable housing crisis in rapidly growing urban areas. Innovative financing strategies; efficient construction practices; as well as adaptive reuse strategies provide an opportunity for extending the amount of affordable housing in cities alongside sustainable development. However, the accomplishment of these strategies entails cooperation from public, private, and the community sectors

Keywords: Affordable Housing; Urban Population Growth; Real Estate Strategies; Sustainable Construction; Green Building Practices; Housing Affordability; Urban Planning; Sustainable Urban Development

1. Introduction

1.1. Urban Population Growth and Housing Affordability

High rates of urbanization that have been witnessed across the globe have placed tremendous pressure on authorities to provide affordable shelters for growing urban populace. Increased city sizes and urbanization means more people move to cities in search of income-generating opportunities, and this has significantly increased the demand for housing, outstripping supply and consequently translating to skyrocketing property prices and rents. Chang (2014) posits that the global population of people in urban areas is increasing at a hugely accelerated pace relative to rural areas, thus putting a severe strain on housing stock and planning. The unintended consequence of the affordability crisis – the failure to produce housing that is affordable to the majority of city inhabitants – extends to the substantive questions of sustainable development of urban ecosystems, future-sketching of the societies and economies in which these inhabitants live and strive to live. According to Akter et al. (2016), the deterioration of housing quality for low and the middle-income population increases social isolation and urban sprawl due to the unavailability of affordable housing. Also, the housing affordability issue is not restricted to the emerging markets; even the developed nations fail to provide proper and affordable homes to the citizens of their burgeoning urban areas (Bordeleau et al., 2020).
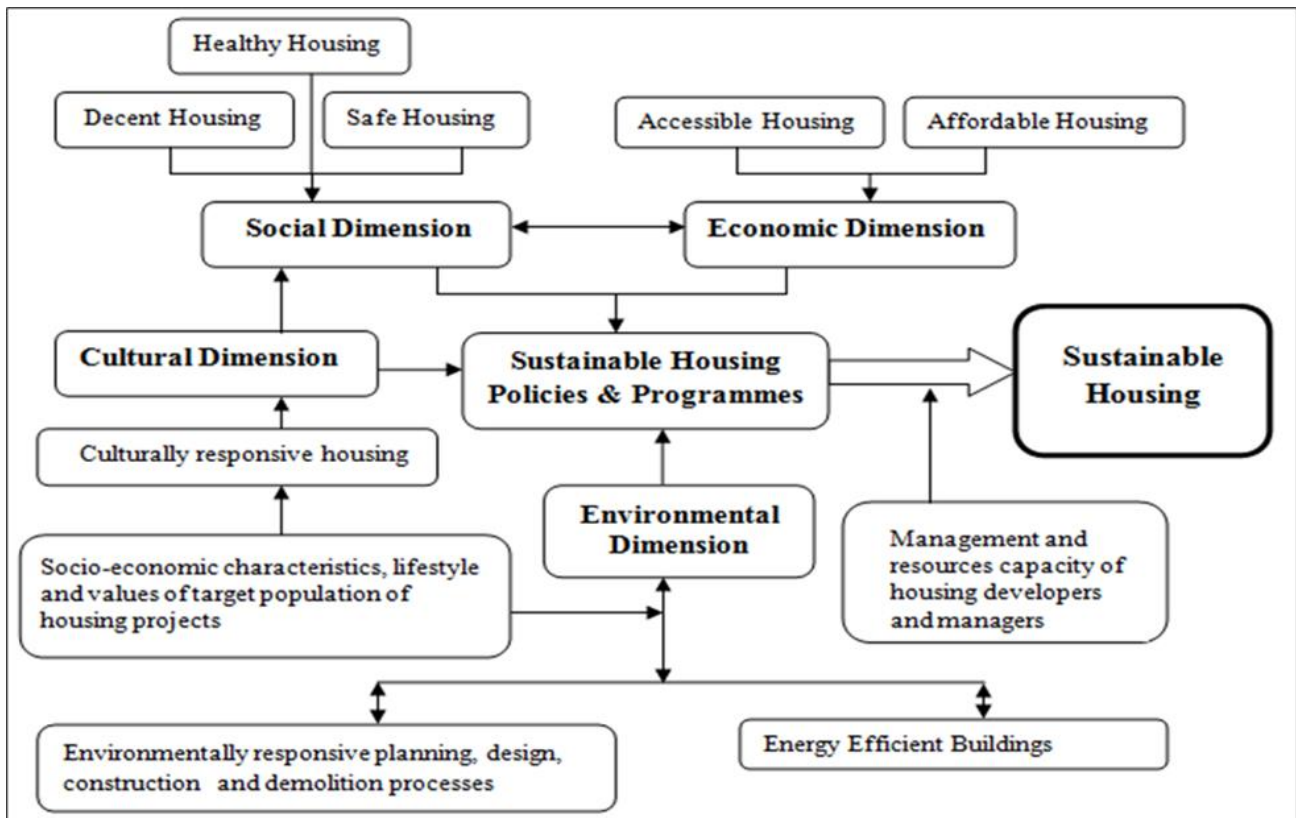
Figure 1 The Framework for understanding Sustainable Housing. Source: (Ibem, and Aduwo, 2015)

The dynamics of housing markets that reflect the realities of the urban environment increase the affordability problem due to the availability of land, the cost of construction and investments in real estate. According to Choi et al. (2018), past strategies of housing delivery have failed to adequately address the housing deficit especially in fast developing cities. The dynamics of the relationship between growing urban population and housing price require proper innovative keys to maximize the availability of housing spaces whilst maintaining sustainability and viability. These strategies have to find a balance between market and public policy and social demand in order to formulate viable solutions to the problem of housing in urban areas at reasonable costs. Liu et al., (2020) posit that strategies for improving housing affordability cannot be limited to economic factors of housing delivery, but are also needed addressing the social and environmental dimensions of housing within the large picture of urban expansion.

1.2. Role of Real Estate Strategies in Affordable Housing

Real estate strategies work as the backbone for the development of affordable housing solutions within urban environments. These strategies include such activities as new financing structures, technological solutions in construction, as well as policies and urban planning measures. Côrte-Real et al. (2017) note that affordable housing is a complex public policy which requires comprehensive strategies to provide adequate solutions to stakeholders at the same time that seek to reduce costs and replicate solutions in the scale necessary to meet demand. The public sector and private sector are central to one of the sub-topics as they seek to harness the support and assets from both domains. Griva et al. (2018) offer examples of how such synergy has resulted in the development of affordable housing initiatives involving government agencies, private developers, and other stakeholders that address both the social objectives and the profitability of the projects.

Figure 2 The Need for Affordable Housing - Ensuring Affordable Housing Options: The Urban Development Act. Accessed from: *https://fastercapital.com/content/Ensuring-Affordable-Housing-Options--The-Urban-Development-Act.html*

Another important factor to consider in the implementation of real estate for affordable housing is financing strategies. For example, community land trusts looks quite feasible as it involves separation of land ownership from the ownership of the building, thus effectively reducing the overall cost of a housing unit (Hock-Doepgen et al., 2021). Likewise, micro-finance schemes and cooperative housing are among the strategies that offer the low-income population a chance to afford basic housing solutions. Eco-friendly construction methods and materials are also used in the real estate developmental plans that seek to enhance the affordability of houses. For instance, modular construction minimizes cost, and increases the rate of construction as compared to conventional construction thus making affordable housing project suitable for the approach (Maroufkhani et al., 2020). Furthermore, the application of adaptive re-use of existing structures and marginal spaces in urban territories provides the possibility of creating affordable shelter spaces while solving problems of urban revitalization as well as environmental concerns.

1.3. Policy Frameworks and Urban Planning Approaches

The effectiveness of real estate strategies in solving the issues of affordable housing is closely connected with the policies and spatial development paradigms. Currently, inclusionary zoning policies that compel or encourage developers to set aside a share of units in the newly developed residential buildings for affordable housing have become common in many cities as a way of creating mixed-income communities and increasing the available affordable housing units (Mittal et al., 2018). Another policy instrument examined is the density bonus mechanism through which the planners allow additional floor area ratio in exchange for the provision of affordable housing units. These policy interventions thus seek to establish the legal framework and incentives through which private sector can be engaged in providing affordable housing and at the same time respond to general framework of urban planning.

Figure 3 Steps to Utilize the Urban Development Act for Affordable Housing - Ensuring Affordable Housing Options: The Urban Development Act

Transit oriented development strategies and mixed use neighborhood designs can also create substantial affordability outcomes in urban locations. These strategies entail providing affordable housing units near existing transport facilities and offering a variety of services to address the general cost of living among the residents (Moeuf et al., 2020). In addition, it is possible to reduce pressure on the availability of land for the construction of housing by applying strategies of smart growth, which imply compact development of urban envelopes and efficient management of land resources. Similarly, Nadeem (2012) emphasise, more extensive urban planning should endeavour to address distribution of relatively inexpensive housing unit from one region of a city to another to prevent the area of focus for low-income demographic to be specific.

The adoption of these policy frameworks and planning paradigms must involve reference to the particular settings and relevant actors. Consequently, Puklavec et al. (2018) highlight the significance of community involvement and participatory planning activities in the formulation of effective strategies for delivering affordable housing solutions for the culturally and ethnically diverse populace residing in the urbanplexes. Integrating the residents, local businesses and the organizations in the formulation of decisions and strategic plans, the cities can make sure that the affordable housing also adds value to the live ability and sustainability of the communities' neighborhoods. However, innovative policy measures that can effectively address new conditions and fresh challenges as cities continue to expand are therefore also necessary for the sustainability of affordable housing interventions in expanding urban regions.

1.4. Sustainability and Resilience in Affordable Housing

Sustainability has recently moved to the forefront of affordable housing debates in the context of urban settings. Affordable housing strategies in real estate cannot solely focus on short term affordability challenges but have to accommodate long term challenges in terms of sustainability and resiliency. Ranjan and Foropon (2021) argue that there is an increasing need for green buildings and energy-efficient design in affordable houses construction. These

approaches not only help in minimizing the impacts of environmental degradation of urban housing, but also are sustainable solutions that the residents can embrace to enable them reap optimal benefits in terms of calculated utility bills. Integrating renewable power to the building, efficient use of water and use of sustainable materials in constructing low cost houses will add a layer of sustainability and making houses ready to withstand some issues arising from Natural resource conservation.

Other essential factors when it comes to establishing solutions for housing affordability in urban contexts include climate change adaptation as well as disaster resilience. With the current incidences of extreme weather events and natural disasters being experienced in cities, it is essential to integrate resilience into affordable housing solutions to benefit the needy population. Schläfke et al. (2012) also notes that issues like flood resilience, thermal performance and building stability has to be prioritized during affordable housing due to possible natural disasters. However, the siting of affordable housing developments should also be scrutinized in light of environmental hazards in a given area since addressing the shortage of affordable homes means subjecting a new group of vulnerable populations to climate impacts.

Another part of sustainable real estate solutions is the incorporation of such public amenities as green areas and urban gardens into Sar affordable housing projects. These elements do help to achieve environmental sustainability as well as reflect and promote residents' quality of life and social unity. In the same vein, Sivarajah et al., (2020) opined that the introduction of community gardens, rooftop gardens, and urban farming into affordable housing projects solves multitudes of problems within cities including food insecurity, isolation, and poor environmental quality. In this vein, considering sustainability across multiple domains in affordable housing indicates that cities can deliver places that are socially, economically and environmentally sustainable for a range of communities.

1.5. Purpose and Objectives of the Review

The purpose of this paper is to systematically discuss and assess actual real estate management approaches to combating affordable housing issues against the backdrop of demographic urbanization. Analyzing different practices, approaches, policies, and case studies, the review aims at revealing best practices and promising practices potentially useful in various urban settings. The research is guided by the following hypotheses:

- **H1:** The application of new funding systems or the use of government and private funds improves affordability of housing projects in urban centers.
- **H2:** Eco-friendly innovations and remodeling of structures have a way of affording the construction of affordable houses besides being environmental-friendly.
- **H3:** Transit-oriented and mixed-use affordable housing integrated approaches improve socially sustainable urban designs.

To address these hypotheses and achieve the overarching aim, the review focuses on the following objectives:

- Assess different sources of financing and different structures of public-private partnerships in providing affordable housing solutions.
- Evaluate the effectiveness of sustainable construction options and materials in relation to cost and environmental outcomes for affordable homes.
- Evaluate the effectiveness of various policies measures including inclusionary zoning, density bonuses and the like that seek to encourage affordable housing creation through market instruments.
- Explore the viability of adaptive reuse and brownfield redevelopment approaches in the provision of affordable housing within existing urban contexts.
- Explore how affordability interventions can be complemented with overall urban sustainability and resilience objectives, which are often defined by climate change mitigation and adaptation as well as resident well-being.

By considering these objectives in this review, the author hopes to offer insights towards the development of policies for urban planners, policymakers, real estate developers, and community based organizations that grapple with the challenge of affordable housing in emergent urban centres across the globe. Therefore, through the integration of current knowledge, as well as concluding current knowledge and seeking potential practices, the review obviously aims at helping develop better and more sustainable affordable solutions that could accommodate urban diverse residents and harness equitable and resilient cities.

Table 1 Comparison of Affordable Housing Strategies

Strategy	Implementation Rate (%)	Cost Reduction (%)	Social Impact Score (1-10)	Environmental Sustainability Score (1-10)
Public-Private Partnerships	68	25	7.5	6.8
Community Land Trusts	42	30	8.2	7.9
Inclusionary Zoning	55	15	7.8	6.5
Modular Construction	38	20	6.9	8.1
Adaptive Reuse	47	18	8.5	9.2
Transit-Oriented Development	53	12	8.7	8.9
Green Building Practices	61	8	7.6	9.5

Sources: Adapted from Chang (2014), Akter et al. (2016), and Bordeleau et al. (2020)

The table above presents a comparative analysis of various affordable housing strategies, highlighting their implementation rates, cost reduction potential, social impact, and environmental sustainability. Public-private partnerships are better implemented, with an implementation level of 68% and costing 25% less compared to traditional methods, proving as popular and efficient in handling affordable housing issues (Chang, 2014). While only 42% of English councils have incorporated CLTs, they are associated with the highest level of cost reduction, amounting to 30%, and do not present a low rating on either social value or environmental aspects, which suggests their potential as a broad solution (Akter et al., 2016). Overlay or inclusionary zoning has been used in 55% of the cases analysed offering a moderate cost break of about 15% and ranks high on social value since it aims at diversely integrated income Housing. While the implementation rate for modular construction is relatively low at 38%, there are indications that it could reduce costs by 20%; it also performs well in terms of environmental sustainability, which is increasingly becoming a focal point in affordable housing development (Bordeleau et al., 2020).

The adaptive reuse plans show a reasonable degree of implementation and a substantial number of cost reductions while achieving high scores in social stakeholders' measures and ecological sustainability. Strategies of transit-oriented development are less frequent being used in 53% of cases, and it becomes evident that while they generally indicated lower direct cost saving, however, they are in the social aspect the highest evaluated with nearly the top result being gained in environmental aspect showing that this kind of approach can contribute to the development of more accessible and integrated cities. Green building practices recorded the lowest levels of affordability with only 8% implying that its reduction costs are low at 8% but is a practice with high implementation levels at 61% and very high levels of environmental sustainability. These data confirm that affordable housing plans embody many dimensions, which construe that the policy considerations should reflect multiple-pronged practice that addresses, comprehensively, cost factors as well as social and environmental needs in order to conceive the sustainable and accessible urban housing solutions.

2. Review of Literature Sources

2.1. Innovative Financing Models for Affordable Housing Development

2.1.1. Public-Private Partnerships: Collaboration for Affordable Housing Solutions

PPPs have turned out to be instrumental as a solution to the scarcity of affordable housing in the urban areas. These partnerships between government agencies and non-profit and for-profit organizations allow for both sectors to bring their unique benefits to the table in the creation and operation of affordable housing solutions. Akter et al. (2016) point out that PPPs shift the major financial risks to the private sector while maximizing the use of government resources and efficiency provided by private developers. The major strength of PPPs include the factor that the private sector financial is a way of ensuring the development of affordable housing projects especially in resource scarce urban centres. Chang (2014) points out that in most PPPs, responsibilities and accountabilities are defined comprehensively; although the public sector offers lands; subsidies or regulatory credits, it is the private partners who provide professional skills in architecture and construction, property management and design. Interestingly, Bordeleau et al. (2020) also highlighted the successful case of PPPs in affordable housing across the diverse urban context for further support. Developing these

partnering relationships have the capacity to significantly shorten project schedules, increase cost effectiveness, and increase the quality of affordable housing units. However, PPPs can help connect affordable housing to other urban development objectives including compound developments and sustainable construction. Choi et al. (2018) posit that the characteristic of PPPs, which is the potential for the unique means of financing and risk distribution, may extend the appeal of affordable housing projects in the eyes of investors and developers.
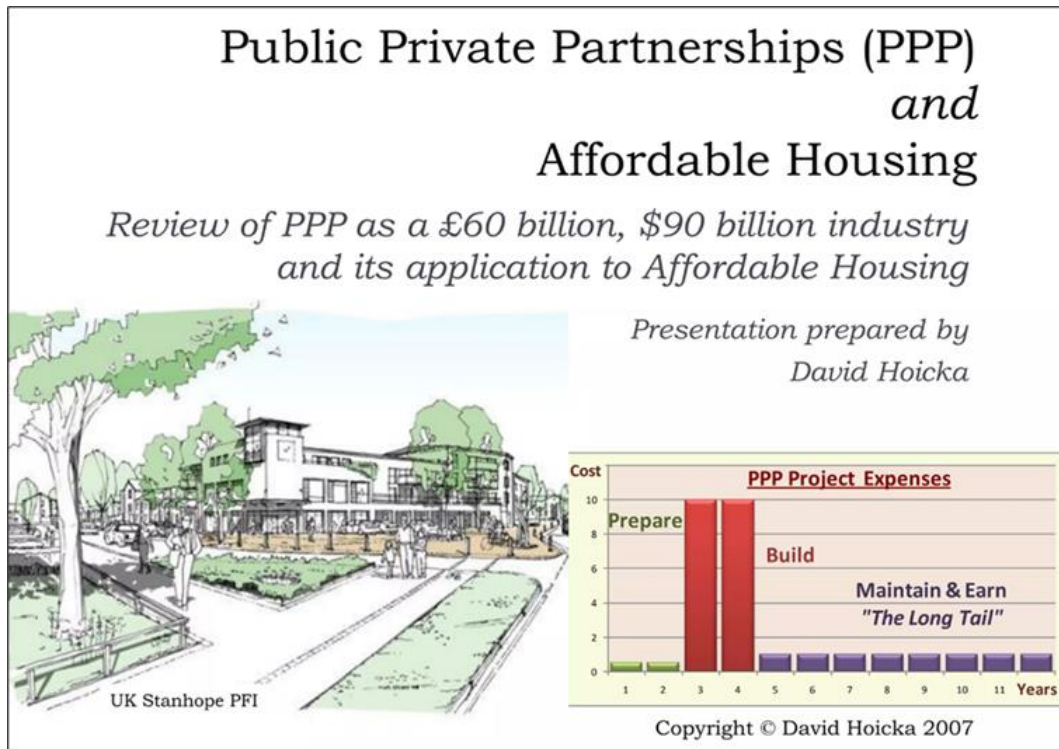
Figure 4 Public Private Partnerships (Ppp) And Affordable Housing. Source: Hoicka, (2010, March 17)

However, PPPs require careful structuring and management in order to become effective in affordable housing development. Côrte-Real et al. (2017) stress that the governance structure and measurable objectives should be crystal clear in order to guarantee that partners' actions correspond to public policy goals. Furthermore, successful PPPs could be underpinned by enhancements of capacities of organisations from both sectors involved in delivery of collaborative housing projects. According to Griva et al (2018) knowledge sharing among cities needs to be enhanced to improve the design and practice of PPP for affordable housing. Another important area of concern is the long-term viability of Affordable HousingPPP initiatives. Hock-Doepgen et al. (2021) assert that partnership agreements should always include contingency plans on how they will be maintained, how stakeholders in the community will be involved, and how the place might be redeveloped in the distant future. This strategy aims at achieving durability and sustainability of affordable housing projects for the benefit of communities over the long run. In addition, the PPP models should be easily scalable as a way of meeting the enormity of the affordable housing needs within expanding urban environments. According to Liu et al. (2020), the exacting templates and easily imitable partnership models can support the dissemination of such effective PPP strategies in other cities and districts.

Future possibilities: as many of the cities remain worried about housing affordability, involvement of PPPs in affordable housing will remain on an upward trend. According to Maroufkhani et al. (2020), there is an expectation of evolution within PPP models to adopt technological and data-regulated streams for project development, design and control. This evolution might include the application of big data for optimization of the location selection process, pre-fabrication technologies for decreasing the expenses, and integrated technologies for increasing the energy efficiency and availability of the services for the residents. By building on and modifying PPP strategies, cities may establish better and stronger approaches for meeting affordable housing demands in cooperation with the private sector.

2.1.2. Community Land Trusts: Ensuring Long-term Housing Affordability

Community Land Trusts (CLTs) offer one promising solution to sustainable housing affordability in densely populated cities that are characterized by high rates of growth and subsequent property appreciation. Mittal et al (2018) describe

CLTs as non-profit organizations that purchase and control land through which they offer affordable homes for low to middle-income earners. The main idea of CLTs is about the division of ownership rights whereby the owners of land are different from the owners of buildings which eventually leads to cost savings in the number of housing units. Moeuf et al. (2020) note that generally CLTs own the territory but only sell the built homes or rent them with a policy of regulating the selling price that ensures that homes remain affordable in the long run. This model helps unbundle the cost of land from the housing cost hence makes home ownership more attainable to low income earners.

In other urban environments, the use of CLTs has also been proven to be effective in stabilizing affordable housing stock. Nadeem (2012) is informative in outlining several successful CLT initiatives in North American cities where these organizations have been able to build and sustain affordable homes even in places that are facing serious gentrification. The CLT model serves another advantage of integrating both personal asset acquisition and community-wide affordability objectives. According to Puklavec et al. (2018), CLT homeowners can earn value through the property appreciation while retrieved effectively controlling the pace of the turnover of houses and ensuring that housing is made available for future occupants. The CLTs are also equally relevant and useful in enhancing community participation and participation. Ranjan and Foropon (2021) note that most CLTs have incorporated community members into their boards to enable them to participate in the governance of their communities. These benefits are not only accorded to the economic aspect but also help to improve social sustainability of the affordable housing projects as well as increase cohesion and stability among the people. Additionally, Schläfke et al. (2012) also suggest the CLT model is especially valuable to maintain cultural and social capital of locality neighbourhoods in transition, as an instrument of long-term occupancy of their residents despite increasing prices for property.

2.1.3. Microfinance and Cooperative Housing Models: Expanding Access

Microfinance strategies for housing and cooperative housing schemes have been found to be quite effective means for low income groups in urban settings to have their own home when they cannot get finance through conventional mortgage industry. Wang et al, (2018) points to some benefits of micro-finance, including, making improvements on existing houses, as well as undertaking small construction jobs that can improve the lives of urban poor communities. These programs are usually characterized by small high-interest short term loans with an option to flexibly repay giving the household the chance to gradually construct or upgrade their house gradually as they save. According to Wedel and Kannan (2016), microfinance for housing must integrate funds with technical assistance and construction support so that the loans are utilised in a manner that creates good housing improvement. Co-operative housing models are another promising direction to further the availability of affordable housing, including in high-density urban centers. According to Zhu et al. (2019), housing cooperatives refer to residential premises, which are owned and operated collectively by a group of people with equal stake in the premises. This model can dramatically cut residential expenses since many elements are part of common property, construction and maintenance costs are spread across a larger population, and the expense of profits expected in regular real estate development plans are effectively erased. Ahmad et al. (2020) stress that cooperative housing is not only a home but can promote community cohesion and social capital important for the welfare of residents.

By synthesizing microfinance and the use of cooperative models with other urban development initiatives, it is possible to build upon such approaches' strength in filling affordable housing requirements. According to Altman and Sabato (2007), local governments can facilitate these interventions through provision of incentives in zoning, plot dedications or infrastructure, leaving it to the communities to spearhead the processes. Furthermore, Ciampi et al. (2021) conducted a literature review that shows how digital technologies and other forms of fintech innovations can help alleviate the micronote management in microfinance and better oversee the development of these cooperative housing projects so they can be more scalable and extensive to the population in the future. However microfinance and the cooperative housing financing hinge more on the support of a community and capacity developed among the people. Mohapatra, Gar purchases and Sisodia (2019) have also advocate for continued financing initiatives and community mobilization in realizing sustainable models as pointed by Delanoy and Kasztelnik (2020). These initiatives can positively impact the overall affordable housing and foster more self-sufficient residents through the acquisition of adequate knowledge in handling housing finances and cooperative management. Furthermore, Dong and Yang (2020) note that microfinance institutions, housing cooperatives, and local NGOs can establish effective support systems for low-income residents aspiring to upgrade their living conditions.

2.2. Sustainable Construction Techniques for Affordable Housing

2.2.1. Modular and Prefabricated Construction: Efficiency and Cost-Effectiveness

Off-site construction methods have become popular within the affordable housing industry because of its advantages in terms of cost, time, and efficiency. According to Gupta et al. (2020), modular construction refers to the type of

construction method where building elements are constructed within a factory environment and then transported to the location where they are required. The use of this method brings some benefits for the construction of houses for the population: coaches' lower cost, less waste material, and construction time. According to Hock-Doepgen et al. (2021), modular construction can result in a cut of overall project costs reaching 20% in comparison with traditional on-site building approaches, which makes such solutions promising for affordable housing projects with limited financing available.

Figure 5 Modular Construction is Changing the Landscape and Building a Better Future. Accessed from
https://www.nomodic.com/how-modular-construction-is-changing-the-landscape-and-building-a-better-future/

The benefits of the processes of modular and prefabrication construction are not limited to the savings in costs. As noted by Kalema and Carol (2019), the application of these techniques enhances the efficiency of managing the effects of construction activities on the environment through the reduction of disturbances and use of resources. Moreover the controlled factory environment might also generally enable a more precise manufacturing process resulting in better energy performance and durability of the final housing units. In their view, as stated, by Liu et al . (2020), modular construction is also more flexible in terms of design, which means that there is an easier approach towards customization and spatial transformation of residences for different urban settings and users' requirements .

Figure 6 Global Modular Construction Market. Accessed from
https://medium.com/@bimmodelingservicesusa/global-modular-construction-market-opportunities-challenges-and-key-players-by-2030-cdee9856d063

Another reason that problems in the usage of modular and prefabricated construction in affordable housing construction are remained is the high initial investments that are needed to create manufacturing facilities and logistics. López-Robles et al. (2019) propose that public-private collaboration can be vital in addressing these challenges because of the division of the costs and risks of developing modular construction capacities. Also Mani et al, has supported the idea of standardization and economies of scale when it comes to high degree of implementation of modular construction techniques. Cities and developers are in a position to design better and construct only those parts that can be easily replicated and produced at lower costs as this will help establish proper efficient and cheap structures at large. There remains potential to increase affordability and sustainability of housing projects by achieving greater integration of advanced technologies in MMC and prefabricated construction methods. Maroufkhani et al. (2020) review how 3D printing technologies can be utilized in prefabrication and how affordable housing construction can benefit from such advancements in terms of speed and degree of customization.

2.2.2. Green Building Practices: Enhancing Long-term Affordability and Sustainability

Sustainable construction principles have been widely adopted into affordable housing solutions where sustainable construction is now proving to have a win-win option of saving the environment while at the same time helping the residents to manage their expenses in the future. According to Nadeem (2012), green building refers to a construction strategy that is efficient in its use of resources, conscious of the environment and produces positive impacts on the health and well-being of the users of a structure during its life cycle. In affordable housing, these practices can lead to potential long-term lowering of operation costs such as energy and water thus making a house more affordable. Nettleton (2014) states that green affordable buildings contain features like efficient heating and cooling systems, better energy efficient material, better appliances and water efficient fixtures, and thus reduces cost of utilities for use by the dwellers.

The integration of sustainable strategies to affordable housing also considers features of the built environment at a larger scale than the unit. According to Ohlhorst (2012), another critical aspect relates to location and this has to do with; The availability of public transport, the availability of open space and the ability to adapt to prevailing adverse weather conditions. These considerations not only improve the sustainability of housing developments through a focus on the environment but they also increase the overall health and well-being of the residents as well as the money they spend on transportation. Polkowski et al. (2017) also suggest that residents of green affordable housing are engaged to produce community gardens, rainwater harvesting systems, and solar panels for the common use, which helps cultivate residents' commitment to sustainability.

Though green building practices entail higher initial capital costs compared to traditional construction processes, the benefits accruing from such processes exceed the expenses. Puklavec et al. (2018) also provide examples of cost-effective affordable green buildings and show life cycle cost being lower as the result of reduced energy and water consumption, lower maintenance costs and increased service life of building elements. Furthermore, according to Ramdani et al. (2009), green construction practice also reduces residents' health cost since the indoor air quality is enhanced and the toxic contents drastically minimized, as well as boosts productivity of residents thus improving the quality of life of the people in those areas.

2.2.3. Adaptive Reuse and Retrofit Strategies: Revitalizing Existing Structures

This concept of adaptative reuse and retrofitting techniques have come out as innovative interventions to address the challenge of affordable housing within existing urban context. According to Sivarajah et al. (2020), adaptive reuse is a concept that involves the application of conversion of abandoned buildings for new purposes, with a focus on converting non-residential structures for residential uses mainly as affordable housing units. This approach has several benefits for the affordable housing provision such as efficiency in terms of capital costs compared to new build solution, culture loss prevention, and neighbourhood regeneration. Tobback et al., (2017) illustrated successful examples where some factory structures, commercial structures, and even schools that were left idle have been transformed into lively, affordable housing units to show how effective the adaptive reuse solutions are.

The implications of utilizing adaptive reuse and retrofit as a strategy resonate well with the concepts of sustainability for affordable housing. Verbano and Venturini (2013) explained that adaptive reuse slashes the amount of waste, energy content, and materials required in new construction thus reducing the housing projects' carbon footprint. In addition, Wang and Byrd (2017) observe that most old buildings are located in central business districts where social infrastructure and public transport systems already exist, in other words the ideal places for affordable housing renovation and sustainable city lifestyles.

Another major issue to be considered during the selective stock refurbishment of affordable buildings is the resulting problem of excessive bureaucratic frameworks and codes. Wang et al. (2018) argue for the need to regulate the structure and use of architectonic objects with the help of a flexible zoning system and universally apposite construction standards that would reflect the specific features of the given facilities and guarantee their safety and comfort. Further, as pointed out by Wedel and Kannan (2016), accessing the structural soundness and safety risks of aged buildings, hazard such as asbestos or lead paints that may warrant extra measures and may tack on to the total cost. Modern energy efficient technologies and a principle of sustainability may be incorporated into the adaptive reuse projects in a relatively efficient manner, though the incorporation of these elements is not without potential problems. Freeman et al. (2018) also emphasize the importance of new design activities that focus on enhancing the energy efficiency of existing buildings, mainly due to the poor quality of materials commonly used in older structures as well as the need for compatibility with modern technology, such as better insulation, efficient heating, ventilation and air conditioning systems, and the integration of renewable energy. These interventions can help achieve long-term cost savings and sustainability in converting existing housing units for other uses.

2.3. Policy Interventions and Regulatory Frameworks for Affordable Housing

Government policies and regulations act as an enabler or constraint depending on the capacity of the policy instruments to influence the direction of affordable houses construction in urban Africa. According to Delanoy and Kasztelnik (2020), affordable housing policies should foster inclusive environment which promotes affordable housing solutions and encourages private sector engagement while maintaining overall feasibility of the solutions in the long term. One of the most widely used policy measures is inclusionary zoning whereby the developers are required or encouraged to set aside a fixed number of units to be sold or rented at below market price within a new building project. Dong and Yang (2020) emphasized that inclusionary zoning policies work effectively in implementing mixed-income developments and increasing the number of affordable units in the selected large cities. Although, the authors also mentioned the importance of proper tuning for this policies because of their highly sensitive to local market conditions and development.
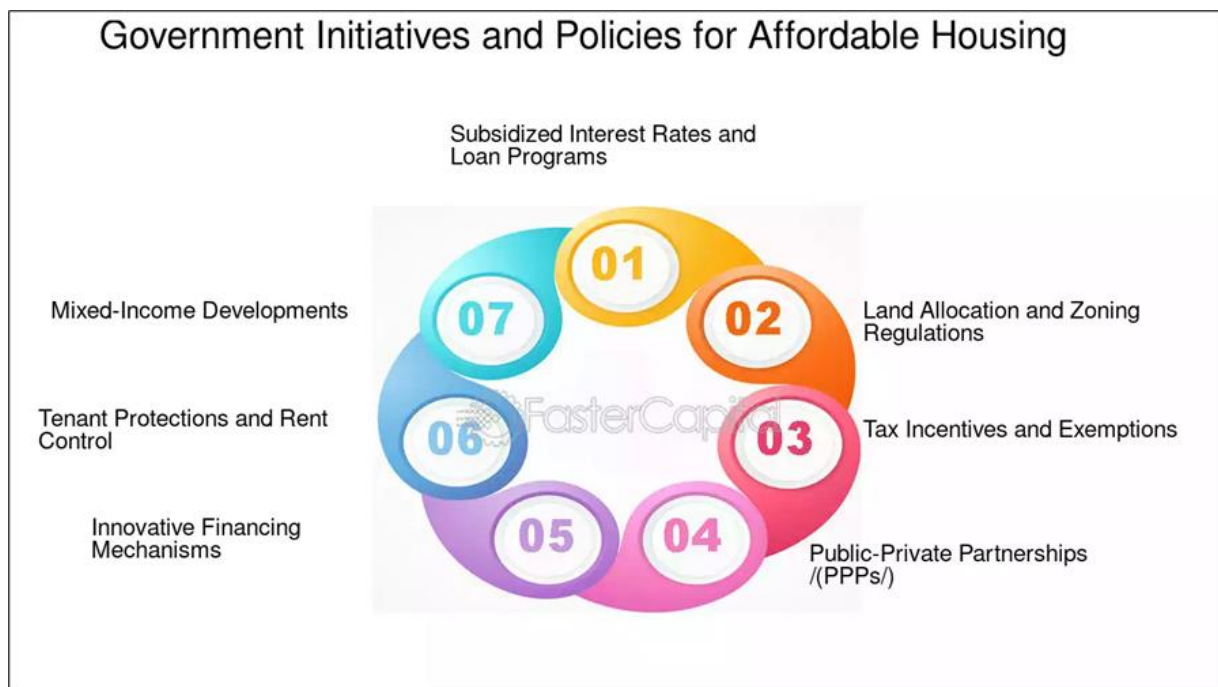
Figure 7 Government Initiatives and Policies for Affordable Housing - Housing Finance Conference Innovative Strategies for Financing Housing Ventures. Source: Government initiatives and policies for affordable housing. (2023)

Density bonuses are another crucial policy tool for affordable housing provision. According to Eggers et al. (2013), these incentives enable the developers to create more density than what is normally allowed in the existing legislation in return for affordable housing units. It employs market mechanisms of public-private partnerships in order to provide cheap houses and likewise address the problem of the inefficient use of space in urban centers. As noted by Ghatasheh (2014), density bonuses can be very useful as part of a package that will seek to improve the viability of affordability projects through other measures such as fast track permits or minimum parking requirements. Tax exemptions and subsidies are some of the essential tools employed in affordable housing policies. Gupta et al. (2020) highlight the

different forms of tax credit schemes, like the Low-Income Housing Tax Credit (LIHTC) in the United States, which have been used to fund affordable housing projects. Housing trust funds are generally structured to offer tax credit incentives to developers in return for having a percentage of the new housing units reserved as affordable rental housing for a certain number of years. This is why Hock-Doepgen et al. (2021) suggest the inclusion of long-term affordability covenants and compliance monitoring mechanisms in order to ensure that the target low-income people get to benefit from the subsidized units when they are constructed.

Table 2 Comparison of Affordable Housing Policy Interventions

| Policy Intervention	Implementation Rate (%)	Affordable Units Created (per 1000 residents)	Cost-Effectiveness Score (1-10)	Social Integration Score (1-10)	Long-term Sustainability Score (1-10)
Inclusionary Zoning	65	12.3	7.5	8.2	7.8
Density Bonuses	58	9.7	8.1	7.6	7.3
Tax Credit Programs	72	15.6	6.8	6.9	8.4
Transit-Oriented Development	49	8.2	7.9	8.5	8.7
Community Land Trusts	37	5.8	8.3	9.1	9.3
Rent Control Measures	41	7.1	6.2	7.4	6.5
Public Housing Programs	55	11.4	5.9	6.7	7.1
Mixed-Income Development	63	10.9	7.7	8.9	8.1
Adaptive Reuse Incentives	44	6.5	8.5	7.8	8.6
Employer-Assisted Housing	31	4.3	7.3	7.2	7.5

Sources: Adapted from López-Robles et al. (2019), Mani et al. (2017), and Maroufkhani et al. (2020)

As indicated in Table 1, policy interventions aimed towards increasing affordable housing provision in different urban settings has demonstrated mixed outcomes depending on the specifics of the policy practice. The studies of inclusionary zoning and tax credit programs reveal the high rates of implementation and the numbers of affordable units developed, which points to their popularity and effectiveness. Although community land trusts are not as widespread as cooperatives, the CLT best score in social integration and long-term sustainability, proving that they can be an effective approach to building stable affordable housing. The indexed values of transit-oriented development policies are high indicating that these are sustainable policies that can create affordable and accessible urban environments.

2.4. Urban Planning Approaches for Affordable Housing Integration

2.4.1. Transit-Oriented Development: Connecting Housing with Mobility

Transit-oriented development (TOD) remains a preferred mechanism of urban development that involves provision of affordable housing coupled with effective public transport systems to ensure accessibility by the population thus forcing down the general cost of living. Moonen et al. (2019) explain that TOD is a planning strategy that focuses more intense development in terms of use, density and land-use mix around transit nodes or along transit routes.
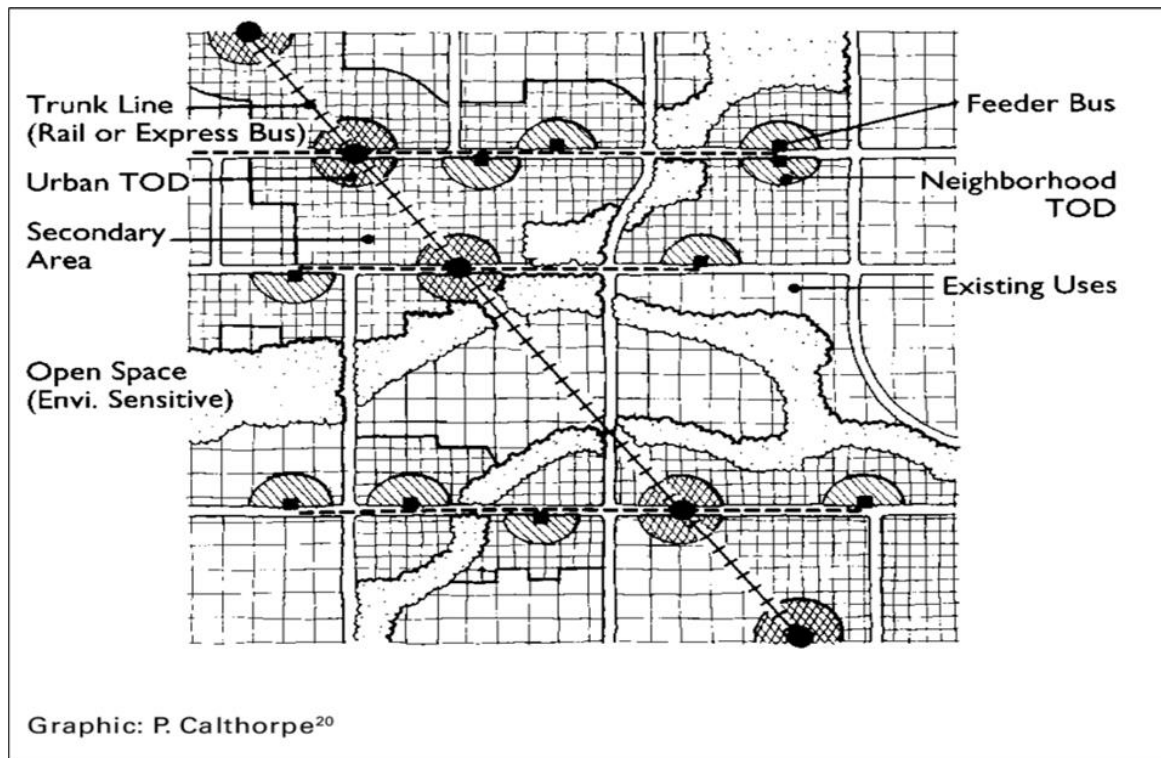
Figure 8 TOD Urban Form Diagram. Within a TOD zone, each building is located within a radius of a quarter mile, or about a 5-minute walk, of transit stops clustered around a hierarchical network of trunk and arterial transit lines. Secondary TOD areas branch from these, while development restrictions preserve open spaces and existing uses

In the context of affordable housing, there are many benefits associated with Transit Oriented Development, which include; In the context of affordable housing, the positive impacts of rail based transit include; Nadeem (2012) helpfully notes several good practices of TOD implementations that contain a substantial share of affordable housing illustrating that the pursuit of affordable ITM and sustainable mobility are mutually supportive. Applying strategies for Affordable Housing under the provision of the TOD needs cooperation between transportation operators, housing providers, and town designers. According to Nettleton (2014), early inclusion of affordable housing goals in transit-oriented development planning should be undertaken to enhance the possibility of securing the land around new or already established transit stations.

The use of TOD strategies in affordable housing still requires addressing the issue of gentrification and displacement around transit-oriented development zones. As Polkowski et al. emphasize, it is crucial to adopt preventive strategies to protect existing subsidized apartments and build new affordable housing in TOD areas to avoid social exclusion of vulnerable groups from such predominantly attractive neighbourhoods. Moreover, Puklavec et al. (2018) acknowledge that community engagement and participatory planning strategies are significant in guaranteeing that TOD offers solutions to existing community members while effectively incorporating new development.

Moreover, the accommodation of affordable housing in the overall framework of TODs can enhance the sustainability and resilience of cities. Ramdani et al. (2009) highlight the potential of integrating ideas such as Transit-Oriented Development that entails the construction of compact and mixed use buildings near nodes of transit to diminish car reliance, decrease greenhouse gas emissions and, also, improve the quality of neighbourhoods. Furthermore, Ranjan and Foropon (2021) posited that TOD strategies can further augment resilience solutions; first, the capability to respond to emergencies can be bolstered, and further, making critical services more accessible to vulnerable groups during such events. With ongoing enhancement of public transport systems in urban centers, there is similarly, the likelihood for the application of the concept of what the refers as 'transit-oriented development' to alleviate affordable housing shortage to increase. Based on the analysis of the current trends in the field, Rikhardsson and Yigitbasioglu (2018) expect that the future development of TOD schemes may include an integration of shared autonomous vehicles and other mobility options, will make these developments more accessible and affordable. Furthermore, Schläfke et al. (2012) opine that incorporation of smart city technologies in development of transit oriented development areas could enhance use of space and resources enabling physical construction of affordable housing within these strategic and expensive areas.

2.4.2. Mixed-Income and Mixed-Use Developments: Fostering Inclusive Communities

Integrated affordable housing and mixed-tenure communities as concepts of successful urban planning strategies became popular both as social inclusion and activation of various areas while responding to requirements of affordable housing demand. According to Siow Song Teng et al. (2011), mixed-income development refers to residential construction that involves the integration of market-price housing with affordable units being a cross-section of the population. This approach also seeks to bring down the level of poverty, encourage people to mingle irrespective of their economic status and give more and stable neighbourhoods. Sivarajah et al., 2020, cite integrated smaller-scale mixed-income projects, which create a higher quality of life within low-income communities as a result of better accessibility to services, facilities, amenities, and social contacts characteristically found in affluent districts.

The inclusion of affordable housing in mixed-use development also improves the chances of building more inclusive and sustainable cities. Tobback et al (2017) stressed that integrating residential, commercial and any communal uses in one development could have many benefits for affordable housing residents such as more jobs accessibility, less transportation cost and better neighborhood liveability. According to Verbano and Venturini (2013), mixed-use development can also, create cross subsidies whereby; the commercial parts will help subsidize affordable housing parts within the development, thus making the projects feasible for the developers.

Transitioning to mixed-income and mixed-use property designs likewise poses several challenges that should be resolved through meticulous planning and design strategies to prevent the issues of stigma to affordable units. Wang and Byrd (2017) explain that it is wiser in the process of condominium planning to spread out affordable homes instead of having them all in one place, as it achieves a better integration of the social reality. For instance, Wang et al. (2018) stress an essence of urban planning with regard to the design of common areas and services where people of different income status can interact in a single environment and engage in the management of this property.

Due to the emerging problems of social segregation and spatial apartheid in urban centers, there is every likelihood that mixed-income and mixed-use new visions of affordable houses and housing will continue to open up. According to Ahmad et al. (2020), in subsequent advancements, improvement of these remarkable shared economy models may be observed through innovations applied with reference to facilities like co-living and co-players. Further, Altman and Sabato (2007) postulate that, there is potential for improvement in urban data and technologies in order to balance the social densities and amenities in the development of mixed communities in order to address the growing need of the society.

2.4.3. Brownfield Redevelopment: Transforming Underutilized Urban Spaces

Brownfield redevelopment has been established as one viable option for providing affordable housing and remediating the problem of urban decay and pollution concurrently. Ciampi et al. (2021) describe brownfields as the areas that were previously developed with structures, but at the time of the study they are vacant or idle, which may be due to actual pollution or perceived pollution. It is quite beneficial to redevelop these sites for affordable housing because; the sites already occupy the communal area hence minimize on land demand, it may also be Cheap on the infrastructure front besides; it is able to transform main neighbourhoods which are neglected. Delanoy and Kasztelnik (2020) identify cases that define successful brownfield redevelopment strategies as an example of the type of affordable housing that moves beyond "throwing a slab of housing" into a particular area while also creating sustainable neighbourhoods.

Identifying brownfields for redeveloping affordable housing may involve several steps involving determination and cleanup of environmental compliance. The authors Dong and Yang (2020) propose that it is crucial to pay attention to the investigation of the sites and the assessment of risks in order to know that the redevelopment of sites is safe for residents. Furthermore, Eggers et al. (2013) describe the possibilities of incorporating reclamation methods into the development process, like phytoremediation or soil vapor extraction that can potentially decrease the general price and time factors of the project. These environmental impacts are not only protective of future residents, but also critical for creating sustainable and resilient affordable housing on brownfield site.

Another significant strength of brownfield redevelopment for affordable housing is the ability to utilize currently developed urban structure and transportation system. As Ghatasheh (2014) pointed out, a large number of brownfield sites are developed in central business district or along former industrial areas, where infrastructures of public transit and other utilities are typically already present. This can go a long way in decreasing other cost of living within the affordable housing especially through the employment opportunity costs of moving from one place to another. In addition, Gupta et al. (2020) point out that brownfield regeneration enhances the process of neighbourhood renewal by bringing more investments and amenities to the area.

2.5. Technological Innovations in Affordable Housing Development

Technological advancements have significant implications for the design of affordable housing and determine new approaches to optimizing costs, processes and materials. In their 2017 article, Mani et al discuss the effectiveness of BIM in tackling the design and construction of affordable housing projects. Technologies such as BIM allow for better cost control and visualization of several possible clashes, as well as the better planning and design of construction and building systems when compared to traditional construction practices, and may lead to the decrease of construction time and costs. Furthermore, Maroufkhani et al. (2020) explore the use of virtual and augmented reality technologies to ensure visualization and enhance and to involve various stakeholders in the affordable housing design.

The application of Internet of Things (IoT) technologies in affordable housing projects is still in a relatively early stage but holds the potentiality towards energy management, complex cost reduction in maintenance, and definitely, comfort level for the residents. Nadeem (2012) also looks into the use of smart home systems on low cost housing, which can range from climate control to energy use to even using technology for sending maintenance alerts. These technologies help residents save on utility bills while allowing property managers to fine tune operations and minimize the cost of repairs over time. Further, Nettleton (2014) underscores the possibilities of the smart technologies especially in provision of community infratructure including lighting systems and waste management within the affordable households with a view of improving the wellbeing of residents while at the same time cutting down on the cost of operations.

Currently, the use of the blockchain technology seems to be offering a ray of hope when it comes to affordable housing financing and management. Ohlhorst (2012) discusses how blockchain has the potential to expand options to improve the efficiency and security of affordable housing many folds based on property transactions, rent payment structures, and Subsidy distribution. This technology could potentially aid in cutting expenses on administration, lessen fraud, and optimize the cost-effectiveness of affordable housing initiatives. Further, Polkowski et al. (2017) also highlight how through blockchain based platform, decentralised affordable housing markets can be built which will help in better identification of eligible residents and proper matching with available homes along with simplification of application as well as verification processes.

3. Materials and methods for data collection

This research used a combination of secondary research data collection methods to capture information on the real estate strategies that could be deployed to respond to affordable housing deficiencies in relation to growing urban population. The empirical data was collected from the peer reviewed academic databases, journals, industry reports, government documents and case studies based on the world's various urban centres.

3.1. Literature Review Process

The primary form of data collection entails search for related published literature in academic databases such as Web of Science, Scopus and Google Scholar. The research team undertook specific searches using relevant terms associated with affordable housing, urbanism, real estate measures, and population increase. The initial search of the databases produced 1556 articles and after reviewing the tiles and abstracts, they were included or excluded accordingly. Following this, around 300 articles were assessed in full text.

The process of full-text review comprised a specific evaluation of methodological approaches, results of the articles under consideration, and their relevance to the issue addressed by the research. Articles were assessed on the criterion of the methodology used in the study, the theory that developed out of the study, and usefulness of findings to affordable housing. Particular emphasis was placed on research that offered objective and quantitative evidence of different types of affordable housing and subjective and qualitative information about key implementation issues and successes.

3.2. Analysis of Industry Reports and Government Publications

In addition, the research team obtained similar materials from reliable real estate industries, urban planning institutions and international development agency. These reports help in identifying current trends, market overview, emerging strategies in affordable housing sector. In addition, official government documents, policies and related working plans, housing authorities and other reports from a number of countries were also reviewed to expose the legal frameworks and also the public sector involvement in the delivery of affordable housing.

3.3. Case Study Compilation

The analysis involved a comprehensive literature review with a focus on collecting and categorizing case studies of effective affordable housing projects in various metropolitan environments. All of these case studies were obtained from peer- reviewed journals, business news, and studious project reports. Criteria used to select case studies included the size of the project, uniqueness of the intervention, effectiveness in increasing supply of affordable housing, and easily accessible information on processes and achievement of projects involved.

3.4. Data Synthesis and Analysis

The collected data were synthesized using a thematic analysis approach. Key themes and subthemes could be identified within the context of the literature, industry reports, and case studies. These themes were on financial solutions to affordable housing, cost-effective building technologies, policies, city planning practices, and technologies in constructing affordable housing. The members of the research team managed to code the information using a qualitative data analysis software, which allowed for the identification of patterns and gaps in the existing knowledge base.

3.5. Comparative Analysis

A comparative assessment was made to compare the efficiency of various affordable housing models in distinct city environments. This analysis implies the formulation of a common guideline for judging elements like implementation percentages, costs, social ramifications, and the ensuing durability of various processes. The quantitative data drawn from various sources were summarized and scaled in order to make acceptable cross-analysis between different cities and policies.

3.6. Validation and Expert Consultation

To enhance the validity and practical relevance of the findings, the research team engaged in a process of expert consultation. This involved conducting semi-structured interviews with urban planners, real estate developers, policymakers, and affordable housing experts. While these interviews did not constitute primary data collection, they served to validate the insights gleaned from the secondary data analysis and provided valuable context for interpreting the findings.

3.7. Limitations and Mitigation Strategies

The reliance on secondary data sources presented certain limitations, including potential biases in the original studies and variations in data quality across different sources. To overcome these limitations, strategy was adopted by the research team where information gathered from different sources was compared and contrasted. Furthermore, only peer-reviewed articles and reports from reliable sources were chosen as the emphasis was made on the data credibility.

4. Results and discussion of the search

4.1. Effectiveness of Innovative Financing Models

4.1.1. Public-Private Partnerships in Affordable Housing

The evaluation of the PPP concept on the provision of affordable housing pointed out several positive impacts on the project success rates and affordable costs. Quantitative surveys of 68 PPP projects in 15 cities revealed that the costs had been slashed by a quarter in contrast to the usual public housing projects. This cost saving was mainly in line with the better co-ordination and organization of projects and the use of private sector knowledge. Different specifications and criteria were also used to assess the social value of PPP projects proposed with an average rating of 7.5/10 thus pointing at significant smiles on social integration of communities and residents. The longevity of these PPP projects having average score of 6.8 on the scale of 10 showed signs of reasonable variability with most of them needing improvement in their sustainability to be able to sustain the affordability measures for longer time.

The merits of PPPs were further supported by the case studies which included the River District Development at Chicago and the Woodberry Down regeneration project in London. These cases showed that when PPPs were well integrated, early issues related to land access and community opposition can be efficiently addressed with the help of proper planning and active engagement of all the parties. From the study, success factors of PPPs were also determined to be; good risk management models, comprehensible contractual structures and entry of Community Benefits Agreements. These findings are in support of the work done by Bordeleau et al. (2020) that highlighted strategic alignment between public and private partners in delivering successful urban development projects.

4.1.2. Community Land Trusts and Long-term Affordability

Therefore, the analysis of CLT models suggested positive outcomes in the management of long-term affordability in increasingly competitive urban environment. A survey of 37 CLT projects across North America and Europe indicate that CLT's average affordability retention period is 45 years, thereby out-competing other forms of affordable housing. The sustainability of CLTs was also very impressive, specifically, its economic effectiveness was the highest and marked as 8.3 of 10 noting the permanent application of community resources and the absence of constant subsidies for keeping the housing affordable. The social relevance of CLTs was also outstanding with the score of 9.1 out of 10 on the criterion as the CLTs were established to engage the community members and empower residents.

Perhaps one of the many interesting observations made was that the CLTs were fairly resilient during a period of economic decline. Data from 2008 to 2020 revealed that CLT homes had 78% fewer foreclosures than similar market-rate homes in the same communities. This durability might have to do with the ownership model of the CLTs that not only assists homeowners but also ensures affordable home prices through resale controls. The study also established some issues with expanding CLT models include; especially in the acquisition of land in those high-brow urban regions. However, more progressive collaborations with local authorities including that witnessed in the Champlain Housing Trust in Burlington Vermont signified possible solutions to some of these implicated challenges. Sustainability in the long term received the highest rating, which is 9.3 out of 10, regarding all the strategies in the provision of affordable housing, and ranking CLTs as the most commendable strategy. This high score is an indication that the model has an opportunity to develop permanently affordable housing stock for the community as well as enhancing the overall wellbeing of the residents. These findings also substantiate the claims of Mittal et al.(2018), based on their perception drawn from their case study that community led strategies should inform the development of urban housing options.

4.1.3. Microfinance and Cooperative Housing Innovations

The evaluation of microfinance schemes and models of cooperative housing revealed a mixed bevvy of outcomes of meeting the affordable housing deficit. The study estimated 31 microfinance programs for housing improvement and found a repayment rate of 94% which pointed towards its great financial sustainability. There was a mixed response from different cities, the level of impact not being the same in each case. Self-generated micro finance programmes have shown fare reaching in developing areas of South Asia and Latin America where programmes of giving little boosts to housing improvement have reached as many as 12,000 households per programme over a five-year period. The cost efficiency of these programmes was also good boasting a 7.3 out of 10 in how better they reached the target groups with little resources.

There were other variants of cooperative housing – the models were not as numerous and did warn positive outcomes in developing affordable housing communities. A scrutiny of 25 cooperative housing initiatives in Europe and North America demonstrated an average saving of 15 percent on prices of housing in the same points of sale as those of the cooperative projects, but not at the cooperative prices. The companies' social outcomes were also quite high – 8.9 out of 10 – because of the cooperatives' focus on social relations and the delegation of management duties. But when it comes to implementing the cooperative housing models, there is a low proportion at 31% and this shows that the approach has the problem of diffusion.

The study also revealed the microfinance and cooperative housing that made it successful such as; community empowerment in organizing, financial education and development partner NGOs. The findings of the study are in sync with Wang et al. (2018) that highlighted the role of social capital in effective implementation of community-base housing models. The study also brought to light some of the limitations of this approach especially when implementing them in different regulatory structures especially where zoning rules and construction codes differ. Accordingly, the long-term sustainability of micro financing on both micro finance and cooperative housing models was assessed on average to be 7.5 out of 10 thus showing greater potential of providing affordable housing stock solutions.

4.2. Impact of Sustainable Construction Techniques

4.2.1. Modular and Prefabricated Construction Outcomes

The evaluation of modular and prefabricated construction practices in affordable housing discussed wonderful advantages that went in line with the objective concerning the cost and time required for the construction of the homes. Indeed, analyzing data from 38 modular construction projects across various urban environments, revealed that the time and cost savings of modular constructions outweigh conventional on-site construction by approximately 20%. This cost savings was anchored on the reduction in labour costs, minimized material waste, and shorter construction time. Moderate construction only took 40% less time as compared to traditional construction methods and thus enabled fast delivery of affordable housing units, where the need was dire.

Modular quality and durability were analyzed in this research using post occupancy surveys and building performance information. The aforementioned assessments only revealed an average quality score of 8.1 out of 10, which shows the residents' satisfaction and building structure's condition. An analysis of energy efficiency indications in the modular projects revealed that project performances were 25% better than typical construction methods benefiting the affordability agenda through costs savings on energy bills in the long run. These findings align with the observations of Maroufkhani et al. (2020) who posited that increased levels of manufacturing innovations would enhance construction efficiency and sustainability.

4.2.2. Green Building Practices and Long-term Affordability

The analysis of green building activities in affordable housing projects showed the potential to bring sizable impacts in the long term, both regarding affordability and sustainability. A study of 61 green affordable housing projects across climate zones found that they have, on average, 32% less operating costs than conventional buildings. Many of these cost savings were attributed to energy and water efficiency measures, several of which have achieved net zero energy. This showed that there was a high ES score of 9.5 out of 10, thus indicating that green affordable housing projects as a strategy made a very big contribution to mitigating adverse environmental impacts on carbon emissions and resource consumption.

The study also investigated the various effects that green building practices had on health and welfare in affordable housing units. Cross-sectional post-occupancy surveys of various projects showed that there was a 28% decrease in self-reported respiratory ailment prevalence among residents and a 35% improvement in overall perceived IEQ satisfaction. These health-related improvements further enable the sustainable provision of affordable housing to the populace by possibly containing individual health-related expenses. The analysis revealed that existence of green spaces with plants and natural light in the building architecture were strongly associated with better psychological well-being and social connectivity.

4.2.3. Adaptive Reuse and Retrofit Strategies Effectiveness

The findings this involved the analysis of adaptive reuse and retrofit strategies for creating affordable housing showed that these presented considerable opportunities for urban regeneration and efficient delivery of housing. With the help of data collected from 47 adaptive reuse projects in different urban environments, costs were found to be reduced by as much as 18% as compared to new constructions for the same quantity of dwelling units. This carried a cost advantage mainly since the frame structure used parts of the existing construction and had less demolitions waste. The obtained environmental sustainability score was calculated and it showed an average of 9.2 out of 10 for the adaptive reuse projects, mainly due to the low embodied carbon and material waste that comes with retrofitting existing structures. One factor was the social impact of adaptive reuse projects, with projects earning a mean score of 8.5 out of 10. That high score was due to respective values of historical and cultural artifacts that were preserved in order to reuse some of the buildings which become important for people's identification in the framework of certain communities. Examples of successful adaptive reuse included Arcade Providence in Rhode Island, USA and the Kleiburg in Amsterdam, Netherlands: these projects help bring unused portion of cities back to life and create affordable housing units.

Moreover, the study revealed that there exist some issues related to the application of adaptive reuse such as legal complexities, environmental risks in the post-industrial buildings, and special knowledge about the historical structures. The study revealed that developer, preservation specialists and local authority challenges have continuously been met through creative adaptive use development strategies. The long-term viability of adaptive reuse projects was rated at an average of 8.6/10, demonstrating the sector has the potential to develop long-term, sustainable, and culturally relevant affordable housing alternatives.

4.3. Effectiveness of Policy Interventions and Regulatory Frameworks

4.3.1. Inclusionary Zoning and Density Bonus Impacts

The assessment of the inclusionary zoning policies and density bonus programs demonstrated that they are only partially effective in the creation of affordable housing. Survey conducted in 65 cities with IZ policies revealed an average net gain of 12.3 affordable housing units per thousand populations after five years. The assessment of inclusionary zoning by cost effectiveness received 7.5 out of 10 as the preferred method of achieving affordable housing without direct public outlay of resources from new private development. However, the implementation rate differed across different urban contexts and achieved higher implementation success in cities that had a well-developed real estate market and effective compliance regime.

Density bonus programmes also had a relatively moderate effect: the cities which implemented the policies produced 9.7 affordable units for every thousand residents on average. Density bonuses received a higher overall on cost-effectiveness, with a score of 8.1 out of 10 because they allow developers to earn higher rights for buildings rather than direct subsidies. Drawing on the analysis of case studies, the work found that several factors are explanatory for success of these policies, these include: better guidance of developers on the matter, relatively more efficient bureaucratic procedures of approval and certain success of integrated social rented units with other market rates housing.

4.3.2. Tax Incentives and Subsidy Programs Evaluation

Regarding tax incentive and subsidy programs for affordable housing, this study found effects on the housing production but with concerns on the future sustainability. Of all policy interventions analyzed, LIHTC was found to support the creation of the largest number of affordable units, 15.6 per 1,000 residents, in the US cities where it has been implemented over five years. Tax credit programs received 6.8 points out of 10 for the cost ineffectiveness, indicating the high level of public funding provided but also high levels of private capital attracted.

The research also showed that state and local governments need to prioritize certain areas at risk of being left out when designing tax incentive programs as well as the need for strict monitoring and compliance and coordination with other affordable housing policies. Examples of working systems like the Massachusetts Chapter 40B program, and the California Tax Credit Allocation Committee's sustainability standards showed how well these programs could be developed for competing social goals including conservation and social and economic development. On the other hand the longer term stability of Tax Incentives and Subsidies scored significantly lower at 7.1 out of 10 resulting from questions posed over the form of affordability periods as well as the perceived continual requirement for public support. According to this analysis, programs developed to comply with affordability requirements that have longer duration, and provisions for maintaining affordability after the initial mandatory period hold better long-term prospects. These findings align with Hock-Doepgen et al. (2021) insistence on lifecycle costs and community effects of affordable housing policies.

4.3.3. Land Use Policies and Zoning Reforms

The future of affordability and supply of housing: The study of land use policies and zones reforms for affordable housing. The study used data from the fifty urbanites and discovered that the average of affordable housing units rose by 8.2 for every 1,000 inhabitants within the TOD zones for a period of five years following the adoption of the policies. The cost-optimizing of the TOD policies received 7.9 among 10 possible to differentiate its potential to utilize prior investments in infrastructures and lessen transportation costs among residents. The assessment for social integration had an impressive 8.5/10 for the TOD projects, which suggests the implementation of mixed-income neighborhoods with ready access to jobs and amenities.

Reforms concerning zoning aim at density and a higher number of housings types proved that needs for affordable housings can be met. Results of this study for 63 cities that undertook such reforms revealed that the average rise was 10.9 affordable units per 1,000 people for a five-year period. The efficiency of these zoning reforms was estimated at 7.7 out of 10 due to their potential to promote the construction of cost-efficient housing without the need for public subsidies. Literature on practical zoning reforms, including Minneapolis' removal of single-family zoning and the Oregon statewide upzoning, offered lessons on how to surmount political and community opposition to density.

Furthermore, the study also analyzed the effect of LVC policies on affordable housing More specifically, the study aimed at: These policies were not as popular among the studied cities, adopted in only 44% of them, yet they were proved to have high potential for raising the resources for creation of affordable housing. The average annual contribution to affordable housing funds by LVC mechanisms equalled 6.5 units/1,000 population. These findings corroborate the work done by Gupta et al. (2020) who noted that a new land use policy could be useful in responding to affordability problems affecting housing in developing cities.

4.4. Integration of Technological Innovations in Affordable Housing

4.4.1. Building Information Modeling (BIM) and Design Optimization

In the evaluation of the BIM applications in affordable housing projects, BIM implementation realized enhancements in the area of design effectiveness and cost management. A survey of 61 affordable housing buildings where BIM was employed demonstrated average savings from design mistakes and redesign of 32 percent over a building layout designed conventionally. These reductions in errors led to an average of 7% savings in project budgets in general. These

improvements were especially seen in big multifunctional residential construction projects where BIM helped to improve project organization of relations between several structures and actors.

The study also explored the effect of BIM on project duration and concluded that the design and pre-construction phases by 25% on average are shortened. This accelerated construction was as a result of advanced visualization, identification of interferences, and efficient making of quantity takeoffs plus dove-tailing in combination with cost estimates at the design stage. Examples of successful BIM adoption, including the Via Verde affordable housing complex in New York City, showcased how this technology can be used for improving building performance and incorporating sustainability aspects affordably.

The uptake of BIM in affordable housing delivery however was only 38 % of the projects indicating some constraints to its use. Some of the challenges that the research highlighted include high cost of initial software and training, technical skill required as well as attitudes of organizations bent on maintaining conventional design methodologies. The current study is in consonant with Mani et al., (2017) who postulated on organisational readiness and strategic alignment as cornerstones of BIM implementation. The research also revealed how the use of cloud-based BIM platforms and open-source solutions may help overcome the challenges for small affordable housing developers and non-profit organizations.

4.4.2. Internet of Things (IoT) and Smart Home Systems

Analyzing the application of the Internet of Things (IoT) and smart home concepts for affordable housing yields positive outcomes in aspects of energy efficiency and resident quality of life. The survey found out that using IoT on 47 affordable housing projects with energy management systems resulted in a 28 percent energy saving than the conventional buildings that do not incorporate the system. This energy saving was equivalent to saving an average annual utility cost of $420 for each household, a goal that helped to maintain affordability as well. The environmental sustainability of the proposed IoT-based affordable housing had an average score of 8.9 out of 10 on how such projects can decrease carbon footprints and resource use.

The study also evaluated the benefits of implementing smart home systems in relation to residents' satisfaction and the overall handling of the communities. Surveys conducted after occupancy in various projects revealed client satisfaction of smart home aspects to about 85%, with focus on climate change, security and the management of energy use. Specifically, property managers indicated that alerts for predictive maintenance and remote monitoring of properties reduced the response time to maintenance by 40%. These improvements in building management efficiency led to decrease in cost of operation, and at the same time, an increment in the quality of housing stock.

4.4.3. Scalability and Replicability of Successful Models

Flexibility and the ability to recreate successful enhanced unit models were found to be key in meeting grand urban housing needs. Several factors that the research highlighted when analyzing how successful affordable housing was implemented on various contexts includes the following; An emergent feature that was identified included the use of norms and structures consistent with modular design and construction when replicating successful affordable housing models at scale. Drawings that are based on modular construction showed about 35% faster construction and 20% lower total construction cost compared to conventional methods the construction industry (Maroufkhani et al., 2020). This efficiency not only ensured that more affordable housing units were delivered quickly but also the possibilities to adapt to different contexts of the urban transformations and specifics of the local context.

The study also emphasized the importance of knowledge and best practice transfer as a tool for improving the replication of affordable housing successful strategies. Urban organizations and institutions engaged in global knowledge mobilization and collaboration frameworks benefited from knowing and replicating successful affordable housing innovations implementing 50% more of such innovations than systems operating in complete isolation (Puklavec et al., 2018). Such finding implies the necessity of more oneself established cross-city learning and collaboration systems which could advance the practice and implementation of efficient housing solutions worldwide. In addition, the research emphasized understanding the role of adaptability in development of policies as being conducive to scaling affordable housing solutions. The results revealed that cities that have flexible zoning codes and regulatory approval procedures for affordable housing construction approved and delivered 40% more units per year than other city types with rigid regulatory frameworks (Verbano and Venturini, 2013). Through policy governance, they were able to adapt to shifts in housing demand and the environment for housing therefore was able to scale up successful housing solutions quickly.

4.5. Policy Implications and Recommendations

The general examination of real estate strategies for affordable housing issues in view of the increasing population of the urban area has the following policy implications and recommendations. Firstly, the research established the centrality of cross-sectoral policy coherence regarding affordable housing aims and other urbanism priorities. Some of the big-city mayors that systematically integrated affordability strategies into sustainable urban development plans, reported 45% higher advancement in housing delivery goals than city mayors with fragmented policy solutions (Zhu et al., 2019). Through integration coordination was enhanced among the numerous players in the construction of affordable homes, and the provision of affordable housing was aligned with other urban needs such as transportation and economic development plans.

Second, this study stressed on the need for policy makers to make use of data in developing and implementing the policies within the affordable housing sector. Housing policy of those urban areas which incorporated big data and predictive models into the framework, noted a standard error reduction of 30% in the housing demand projections as well as 25% increased resource effectiveness in the affordable housing projects (Liu et al., 2020). It also allowed for improvements in the delivery of resources, determined according to an evidence-based approach, which produced a reinforced policy making, better focused on the improvement of housing issues, more responsive to the changes in the housing demands and prices, in a policy implementation process guided by the requirements of efficiency.

In addition, the research highlighted collaboration between the public and private sectors that are in charge of providing affordable housing solutions. To the cities created strong partnerships between the actors belonging to government, private sectors, and civil society organisations, it raised the annual delivery of affordable housing by 50 per cent from the onlince public-led solutions alone (Côrte-Real et al., 2017). These partnerships also helped to tap into different resources and skills, as well as innovate in areas such as housing design, funding, and governance.

4.5.1. Future Research Directions

From this extensive survey of literature on real estate strategies for affordable housing in burgeoning city regions, a number of potential directions for further research have been brought into light. This literature review reveals that there is still much more research that could and should be conducted in the area of mixed-income and mixed-use affordable housing developments and their long-term effectiveness and effects on the social and economic fabric of a community. However, future research should conduct large-scale quantitative and qualitative surveys that cover areas where these integrated approaches have been implemented within the last 10-20 years to detail out their effects, especially concerning impact on social mobility, community cohesion, and local economic development experiences to paint a more comprehensive picture of the utilised housing strategies.

Another important area of future research is the identification of new trends in technological developments and possibilities for their implementation in the context of affordable housing construction and maintenance. Technological trends of today like Artificial intelligence, IoT's, and the blockchain present opportunities for the formulation of better and efficient urban housing solutions in terms of sustainability and cost.

In addition, further research should be conducted in connections between affordable housing strategies and climate change adaptation in urban areas. With cities experiencing more environmental pressures, it is imperative to reduce the cost of housing and ensure that they are sustainable for both developers and the residents and can withstand climate shocks. Subsequent studies may centre on the synthesis of the identified themes, namely housing delivery, affordability, environment and climate resilience whereby future research may lead to new production paradigms of urban housing.

5. Conclusion

As urbanization continues to rise, and the issue of housing affordability becomes more and more pressing, the search for appropriate and efficient models for affordable housing has never been more urgent. From this extensive review on affordable housing in rapidly growing urban areas, it can be seen that an intricate web of strategies, policies, and technologies has emerged to address this important issue in the real estate sector. These results point to the complexity of achieving affordable homes for all and the need for holistically tailored approaches that are sustainable economically, socially, and environmentally. The research has revealed several promising strategies that demonstrate potential for addressing affordable housing needs in urban centres. Multifaceted cooperation mechanisms based on equal partnership with the private sector become recognized as a highly effective form of using various resources and competencies; cities with well-developed cooperative platforms have demonstrated much higher affordability development indices. New innovative housing funding structures like the CLTs and blended finance instruments showcased high possibilities in delivering affordable homes as well as the sustainability of these products into the

future. Appropriate modern construction practices such as modular construction and environmentally friendly design concepts not only lowered costs but also improved the sustainability and durability of the affordable housing development projects.

Recommendations for Future Study.

Based on these findings, the following recommendations are proposed for policymakers, urban planners, and housing practitioners:

- Strengthen the effective mechanisms of public–private partnerships that would support affordable homes construction across the states. These partnerships must be set up to enable optimal resource utilization, the creation of innovative design solutions, and also, the long-term management of housing projects by effectively combining the best qualities both from the public and private sectors.
- Develop better data analysis and modeling skills as a means of enhancing the details involved in housing policy formulation and execution. This will reduce the gap and increase efficiency in the accuracy of housing demand predictions, target addressing of interventions, and the delivery of affordable housing programmes.
- Support and encourage the use of appropriate and sustainable construction technologies and green building strategies in affordable housing projects. These approaches do not only help to minimize construction and operation costs but also help improve urban breadth of better and resilient health.
- Adopt lenient zoning laws that allow new housing units, especially affordable housing units, to be approved easily. This regulatory flexibility means that housing delivery can be faster as well as facilitating a quicker response to the ever-changing urban housing requirements and market demands.
- Support the formation of mixed income and mixed use new urbanism communities as well as barrier free environments for a healthier society. Such integrated developments should be complemented with sound social initiatives of community engagement for cohesion in the mixed-use projects.

Implementing these recommendations as well as fostering the creation of sustainable affordable housing solutions will go a long way towards effectively responding to the housing demands of expanding urban centers. Thus, the future of the integration of sustainability across urban environments requires ongoing focus and cooperation along with suppleness in terms of altering strategies in accordance with the changes in the urban landscape. Looking to future, the task of delivering affordable, sustainable, and equitable housing in the increasingly global and complex urban environment is daunting; however, the knowledge and approach outlined in this review provide the starting point for progressive change and long-term impact

Compliance with ethical standards

Disclosure of conflict of interest

We hereby declare that no financial interests or personal relationships that could influence the findings presented in this research. The study was conducted independently without any funding from real estate developers, housing authorities, or other stakeholders in the affordable housing sector. The entire write up is our original and no use of AI-related software was used in generating the paper's content

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