Housing for urban poor, a smart city initiative in Bengaluru, Karnataka, India

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Abstract Housing for the urban poor is a critical social and economic issue many cities face worldwide. Adequate housing is a fundamental human right, and providing affordable and decent housing for low-income individuals and families is essential for ensuring social equity and sustainable urban development. Several approaches and strategies can be adopted to address this issue. It's important to note that addressing housing for the urban poor requires a multifaceted and holistic approach. Combining various strategies and collaborating with stakeholders can lead to more effective and sustainable solutions to this pressing issue. This paper discusses various affordable housing situations, policies, and schemes in the Global and Indian contexts and Bengaluru to determine what housing means for the urban-poor with reference to the smart and sustainable city concept.

Keywords —Housing, Urban-poor, sustainable, stakeholders, holistic approach

I. INTRODUCTION

A. Urban Poor

According to Oxford University, "Urban poverty is a term used to describe a range of economic and social problems that are present in industrialized cities and are brought on by a number of processes, including the development of high living standards, the rise of individualism, social fragmentation processes, and the dualization of the labor market, which results in social dualization."

B. Housing for Urban Poor?

Due to a general increase in residents brought on by net population growth and migration, housing affordability may be difficult for neighborhoods with rising housing demand.[21] The United Nations has referred to the right to a dignified place to live as an essential and unalienable human right. The internationally recognized development model for attaining sustainability is extensively featured especially in SDG 11.[22] While urban housing shortages have persisted for years, today's society must prioritize finding solutions because of how quickly the world is urbanizing. The absence of an actual strategy to address urban housing scarcities, particularly for low-income households, has led to a growth in slum area in urban settings in emerging countries.[23] Urban poor housing refers to the inadequate, substandard, or informal housing conditions experienced by low-income individuals and families in urban areas. It encompasses a range of challenges related to shelter, infrastructure, services, and living conditions typically associated with poverty and lack of access to basic resources.

C. Housing for Urban-poor around the world

Urban poor housing is a complex issue that affects millions of people in cities around the world. Although there is a significant gap between city and countryside poverty, urban poverty is still a problem that needs to be addressed nationally.[8] Urban slum areas are one of the world's most significant issues for emerging countries, especially in the last 30 years. They emerged due to rapid urbanization in various emerging nations of Africa, Asia, and Latin America.[9] For example, the amount of underprivileged folks living in slums or substandard housing in emerging nations is estimated at 828 million. Speculation indicates that this number will reach 1.4 billion by 2020.[48] The housing situation for the urban poor is a global problem. According to the World Bank, 1.6 billion society live in slum areas, and this is likely to grow to 2 billion by 2030. Slums are characterized by poor-quality housing, insufficient infrastructure, and lack of access to crucial amenities. However, these strategies can improve the lives of the urban poor and make cities more inclusive and sustainable. In Brazil, the Favela Bairro program has upgraded over 1,000 slums, providing better housing, infrastructure, and social services. The Pradhan Mantri Awas Yojana (PMAY) program has provided housing loans to over 10 million poor families in India. The Shelter Afrique program has provided loans to over 100,000 low-

income households to build or improve their homes in Kenya.

D. Housing for Urban-poor people in India

Affordable housing for the urban poor people in India has been a significant challenge due to rapid urbanization and population growth. Millions of people in Indian cities live in slum areas and casual clearances, facing insufficient housing, absence of elementary facilities, and poor living conditions. To address this pressing problem, the Indian government and various organizations have implemented several initiatives and policies. Despite these efforts, challenges persist, such as funding constraints, inefficient implementation, bureaucratic hurdles, and difficulties in identifying eligible beneficiaries: rapid urbanization and a growing urban population strain existing resources and infrastructure. A multi-faceted approach is needed to address these challenges comprehensively, including policy reforms, better urban planning, increased private sector participation, and a focus on sustainable and inclusive development. Local and state governments and civil society organizations must work collaboratively to offer adequate infrastructure solutions for the urban-poor people in India. The city's rapid slumification has resulted in widespread environmental damage.[18] Smart cities balance effectiveness and fairness by directing on building inhabitants' capacity to establish rivalry and cooperation.[37] Rapid urbanization has put considerable pressure on land and other natural resources. Housing shortages have contributed to the creation of slum areas and illegal clearances.[38] During the period of the unregulated real estate "boom," which was characterized by increasing prices, the notion that a home should be "affordable" was cherished by all. The massive housing scarcity in India, which primarily affects households in the Economically Weaker Section and Low-Income Groups, presents a significant challenge to the government.[19] According to a 2018 report by the National Housing Bank, about 60 million households in India need more adequate housing. This includes households living in slums, informal settlements, and other forms of inadequate housing. The causes of the housing problem for the urban poor are complex and interlinked. They include rapid urbanization, poverty, lack of affordable housing, and poor governance. Rapid urbanization is one of the main drivers of the housing problem. India's urban population is growing yearly at 2.1%, projected to reach 600 million by 2030. The rapid growth is straining the country's infrastructure and housing stock. Poverty is another major factor contributing to the housing problem. About 22% of Indians live below the national poverty line, even higher in urban areas. Low-income households need help to afford to pay for decent housing. Access to affordable housing is also a significant problem. The cost of housing in India has been rising faster than incomes, making it difficult for low-income

households to find a place to live. Poor governance is also a factor contributing to the housing problem. The government needs to do more to provide for the shelter needs of the urban-poor people. There needs to be more coordination between diverse levels of management, and there needs to be more resources to implement housing programs. Several government programs are aimed at providing shelter for urban-poor people. These programs include the Pradhan Mantri Awas Yojana (PMAY), the Rajiv Awas Yojana (RAY), and the National Urban Housing and Habitat Policy (NUHHP). The PMAY is the government's flagship program to provide housing for 20 million households by 2022. The RAY program offers financial assistance to states and municipalities to improve their urban infrastructure, including housing.

While the 11th Five-Year Plan (2007-2012) set its main objective as 'Inclusive Growth,' this same goal has since been expanded and remains the focus of the 12th Five-Year Plan (2012-2017).[49] The NUHHP is a policy framework that guides the government's efforts to improve housing in urban areas. Despite these programs, the housing problem for the urban-poor people in India relics a significant task. More must be done to address the problem, including increasing affordable housing availability, improving housing quality, and strengthening governance.

The scope of this paper is to study the development of housing policies over 75 years and how the policies affect affordable housing in Bengaluru. The paper also defines the various terms related to urban poor, affordable housing, and smart cities. It will discuss the evolution of smart cities and how smart cities can affect affordable housing for urban poor with new technologies. It will help understand community participation and public-private partnership in improving the housing quality for the urban poor. The current housing situation in Bengaluru will be focused on understanding the current housing situation for low-income housing. This could include examining these initiatives' social, economic, and environmental impacts and the perspectives of low-income residents.

E. Urban Poor Housing schemes

There are several government housing schemes in India for the urban poor. Some of the most important ones include:

- Pradhan Mantri Awas Yojana (Urban) (PMAY-U) 2015: This is the foremost scheme of the Government of India for providing affordable housing solutions to the urban-poor people. It aims to provide two crore housing units to eligible beneficiaries by 2022. Under this scheme, beneficiaries can choose from three options:

  - Credit-linked Subsidy Scheme (CLSS): This scheme provides up to Rs. 2.67 lakh to

eligible beneficiaries to help them purchase a house in the open market.

o   In-situ Slum Redevelopment (ISR): This scheme offers economic assistance to states and ULBs to redevelop slums. The beneficiaries of ISR schemes are entitled to a free house in the redeveloped slum.

o   Pradhan Mantri Awas Yojana-Beneficiary-Led Construction (PMAY-BLC): The scheme provides a funding of Rs. 1.5 lakh to qualified recipients to help them construct their own houses.

- Deendayal Antyodaya Yojana-National Urban Livelihoods Mission (DAY-NULM) 2013: The scheme provides financial assistance to urban poor households to set up self-employment ventures. The scheme also provides training and skill development to beneficiaries.

- Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2015: This scheme provides financial assistance to cities to improve their infrastructure, including water supply, sanitation, and housing. AMRUT cities can use some of their funds to construct shelters for the urban-poor people.

- Jawaharlal Nehru National Urban Renewal Mission (JNNURM) 2005: This scheme was launched in 2005 to improve the infrastructure of 63 cities in India. JNNURM cities could use some of their funds to construct shelters for the urban-poor people.

F. Urban Poor Housing Policies

- **National Urban Housing & Habitat Policy (NUHHP) 2007:** This policy provides a framework for promoting affordable shelter for all, emphasizing the urban-poor people. It emphasizes the need for public-private partnerships, self-help housing, and slum improvement.

- **Basic Services for the Urban Poor (BSUP):** This program was launched in 2005 to provide safety of occupancy, housing demands, water, public health, well-being, education, and safety-security to the urban poor in 63 mission cities.

- **Slum Rehabilitation Scheme (SRS):** This scheme was launched in 1995 to rehabilitate slums in a planned and sustainable manner. It delivers economic assistance to slum area dwellers to construct new houses or expand their existing houses.

G. Critical appraisal of housing policies in the last 75 years

The critical analysis of housing policies for the past 5 years are as follows:

- 1947-1951: The first Five-Year Plan (1951-56) focused on providing necessities to the people, including housing. The government set up the Central Housing Board (CHB) to provide housing loans to middle-income families.

- 1951-1961: The 2nd Five-Year Plan (1956-61) emphasized the need for low-cost housing for the poor. The government launched the National Building Organization (NBO) to provide technical assistance to state governments in implementing housing schemes.

- 1961-1974: The 3rd Five-Year Plan (1961-66) and the fourth Five-Year Plan (1966-71) focused on low-cost housing. The government also launched the Indira Awas Yojana (IAY) in 1971 to provide housing to the rural poor.

- 1974-1990: The 5th Five-Year Plan (1974-78) and the sixth Five-Year Plan (1980-85) saw a shift in focus from low-cost housing to middle-income housing. The government launched the Rajiv Gandhi Housing Scheme (RGHS) in 1985 to provide housing loans to middle-income families.

- 1990-2000: The 7th Five-Year Plan (1985-90) and the 8th Five-Year Plan (1992-97) saw a further shift in focus to the private sector. The government introduced several policies to encourage private investment in housing, such as the Housing for All by 2022 (HFA 2022) mission.

- 2000-present: The 9th Five-Year Plan (1997-2002) and the 10th Five-Year Plan (2002-07) continued to focus on the private sector. The government also launched the PMAY in 2015 to provide shelter to the urban-poor people.

Overall, the housing policies and schemes in India in the past 75 years have been characterized by several shifts in focus. The government has moved from focusing on low-cost housing to middle-income housing and the private sector. However, despite these shifts, the housing shortage in India remains a significant problem. Here are some of the key criticisms of housing policies in India:

- The policies have been fragmented and uncoordinated, leading to a lack of coherence and effectiveness.

- The policies have been biased towards the built-up areas, neglecting the countryside areas.

- The policies have been inadequate to cater the requirements of society's poor and marginalized sections.

- The policies have been implemented ineffectively, due to lack of resources, corruption, and bureaucratic delays.

Despite these criticisms, there have been some positive developments in the housing sector in India in recent years. The HFA 2022 mission has helped to raise awareness of the housing problem and has mobilized resources to address it. The PMAY has also been successful in providing housing to millions of people. The housing policies in India have evolved over the last 75 years, focusing on providing affordable housing to the masses. Here is a summary of the key policy shifts:

- 1950s: The focus was on providing basic housing to the poor through public housing schemes. The government also established the National Building Organisation (NBO) to promote modern building materials and techniques.

- 1960s: The focus shifted to slum improvement and rehabilitation. The government launched the Slum Improvement and Clearance Scheme (SISCS) and the Slum Rehabilitation Scheme (SRS).

- 1970s: The government introduced the concept of low-cost housing and set up the Housing and Urban Development Corporation (HUDCO) to provide economic assistance to state governments and private developers for low-cost housing projects.

- 1980s: The focus shifted to self-help housing, and the government launched the Indira Awas Yojana (IAY) to provide financial assistance to low-income households to build homes.

- 1990s: The government introduced the concept of public-private partnership (PPP) in housing and launched the National Housing Policy (NHP) in 1998. The NHP intended to offer housing for all by 2022.

- 2000s: The government initiated the PMAY in 2015 to accelerate the pace of infrastructure construction in India. The PMAY goal is to deliver housing for all by 2022.

- 2000 to 2023: The housing policies of 2000 to 2023 have been mixed. Some policies have successfully increased the housing supply and made it more affordable, while others have had less impact.

One of the most successful policies has been the Low-Income Housing Tax Credit (LIHTC). The LIHTC offers tax breaks to developers who build affordable housing. Since its inception in 1986, the LIHTC has helped to create over 3 million affordable housing units. Another successful policy has been the Home Affordable Modification Program (HAMP). HAMP was a government initiative that helped homeowners struggling to make their mortgage payments. The program helped to modify over 4 million mortgages. The government needs to address these challenges to make housing policies more effective. The government needs to increase its investment in housing, make it easier to acquire land for housing projects, reduce the cost of construction, and raise awareness of the government's housing schemes. The government also should take steps to address corruption in the housing sector.

H. Smart cities

Business Dictionary, 6 Nov 2011: " A developed metropolitan area that excels in several crucial categories, including economy, mobility, environment, people, living, and government, to promote sustained economic growth and good quality of life. Strong human capital, social capital, and/or ICT infrastructure will help you excel in these crucial areas."

Caragliu, Del Bo, & Nijkamp, 2011: "When investments are made in traditional transportation, social and human capital, as well as modern ICT infrastructure, they enable sustainable economic growth in a city and a high value of life, with a wise organization of natural possessions, through participatory authority."

I. Historical Evolution of Smart Cities

The idea has evolved, dating back to the 1970s. The first significant project considered smart city initiatives was the A Cluster Analysis of Los Angeles, conducted by the Los Angeles County Department of Public Works in 1974. This project used data analysis to identify areas of the city that most needed improvement.

In the 1990s, the development of the Internet and other information technologies led to a renewed interest in smart cities. One of the utmost notable examples from this period is Amsterdam, which created a virtual digital city in 1994. This city model was used to plan and manage the city's structure, and it helped to improve efficiency and sustainability.

The 2000s saw a further acceleration in the growth of smart cities as the cost of expertise decreased and the capabilities of these technologies increased. In 2008, IBM launched its Smarter Cities Challenge, which provided funding and support to cities developing innovative city initiatives.

The 2010s saw the actual appearance of smart cities as a global phenomenon. 2011 the first Smart City Expo World

Congress was held in Spain. This event has since become an annual gathering for smart city experts worldwide.

Today, there are hundreds of smart city projects underway around the world. These projects use various technologies to improve cities' efficiency, sustainability, and value of life. Some of the maximum shared smart cities technologies include:

- Internet of Things (IoT) devices
- Artificial intelligence (AI)
- Renewable energy
- Sustainable Transportation
- Big data analytics
- Cloud computing

The development of smart cities is still in its initial stages, but it can transform how we live, work, and play in cities. By using technology to solve some of the most pressing challenges facing cities, such as traffic congestion, pollution, and poverty, smart cities can generate more functional, sustainable, and equitable urban surroundings. Here are some of the critical milestones in the evolution of smart cities:

- 1974: Los Angeles County Department of Public Works conducts the A Cluster Analysis of Los Angeles, the first significant project considered a smart city initiative.
- 1994: Amsterdam creates a virtual digital city, one of this period's most notable examples of an intelligent city.
- 2008: IBM launches its Smarter Cities Challenge, which provides funding and support to cities developing innovative city initiatives.
- 2011: The first Smart City Expo World Congress was held in Spain.
- 2015: India's Prime Minister Narendra Modi initiated the Smart Cities Mission, a program to grow 100 smart cities in India.
- 2020: The COVID-19 epidemic accelerates the adoption of smart city technologies, as cities use these technologies to track the spread of the virus, manage public health resources, and provide essential services to residents.

The future of smart cities is bright. As technology advances, we can expect to see even more innovative and influential smart city solutions being developed. These solutions can make our cities more livable, sustainable, and equitable.

J.   Concept of smart cities around the world

The term "smart cities" has been popular for some time, and its proponents claim that it offers limitless prospects for development and well-being.[10] New techniques and approaches for increasing training and learning in a networked atmosphere are being familiarized by the globalization of smart cities. For schools and other educational institutions adopting the next-generation learning environment, smart cities, which rely on analytics and digital competences to connect people and daily activities to improve quality of life, can present new hurdles. [11] Globally, the availability of essential infrastructure for a high standard of living and a healthy environment is the main topic of discussion regarding intelligent cities. Big Data, digital flow, and networked technology are frequently characteristics of the smart city [6]. The idea of smart cities is gaining traction worldwide as governments and businesses look for ways to improve city areas' efficiency and sustainability. A smart city cannot be well-defined in a way that applies to all situations. Nevertheless, it is generally acknowledged that this city uses ICT to improve the value of life for its inhabitants, better use resources, and create a more sustainable environment. Some of the most well-known include:

- Barcelona, Spain: Barcelona is a pioneer in developing smart cities, as seen in Figure 1. The city has implemented many innovative technologies, including an intelligent transportation system, an intelligent waste management system, and an innovative lighting system. In particular, the best practices for data-oriented competencies can be found in Barcelona: horizontal data stages, action centers, dashes, agendas and educational institutions, laboratories, study centers, and planned development offices.[12]

Figure 1 Barcelona smart city

Source:
https://hbarchitects.co.uk/about/journal/my-kind-town/

- **Singapore:** Singapore has a long history of using ICT in a big way. The "Intelligent Nation 2015" strategy opened the way for the development of the following-generation wired and wireless infrastructure and provided numerous chances for ICT workers as shown in Figure 2. The "Infocomm Media 2025" plan, built on this basis, aims to harness media and support the smart nation project.[35] Singapore is another city at the forefront of the intelligent city movement. The city has invested heavily in ICT and has developed several innovative solutions, such as an intelligent water management system and a smart grid.

Figure 2 Singapore smart city

Source : https://www.thalesgroup.com/en/worldwide-digital-identity-and-security/iot/magazine/singapore-worlds-smartest-city

- **New York City, USA:** As part of a project to transform New York City into a smart city, numerous technologies have already been put in place there. To make people's lives better, a number of pilot initiatives have been started. There are numerous events where local businesses, startups, and residents can share their opinions, suggestions, or solutions for making NYC a smart and healthier place to live.[34] The city is using ICT to improve its efficiency and sustainability. Some smart initiatives in New York City include an intelligent parking system, a smart street lighting system, and a smart water management system.

- **Seoul, South Korea:** Seoul has taken on ICTs and shrewd innovations throughout the long term. Seoul's e-government drive started during the 1990s, and in 2003, Smart City Seoul was launched to update the e-government foundation fundamentally.[13]

- **Copenhagen:** Copenhagen is one of the world's important cities for smart mobility results. The city has a longstanding constancy to sustainable transportation. It has implemented a series of innovative initiatives to upgrade cycling, walking, and public transport while reducing reliance on cars and enhancing the air quality of public transport. One of Copenhagen's leading innovative mobility solutions is the development of bicycle infrastructure.[14]

- **Oslo, Norway:** In terms of environmental sustainability and energy efficiency, Oslo, which has 680,000 residents and a population density of 15 persons per ha, has made great strides. This is one of the few cities in 2016 that have published a brief energy policy paper. In Oslo, there are now more than 400 roadside charging stations (100 per year). [15]

- **Zurich, Switzerland:** Numerous scholarly journals and essays about Zurich have existed. Zurich has garnered attention from a transportation standpoint due to its innovative methods. Numerous studies underline the great service quality, integrated network, high priority of public transportation, and straightforward and dependable timetable structure from the public transportation perspective. [16]

- **Amsterdam:** The "Amsterdam Smart City Programme" is the name of Amsterdam's smart city initiative. The goal of Amsterdam Smart City, as shown in Figure 3, is clean: optimizing the value of contemporary ICTs to assist city institutions and citizens in handling their social, economic, and environmental challenges and creating a long-lasting, irreplaceable society.[36]

Figure 3 Amsterdam Smart city

Source : https://www.smartcitiesworld.net/news/news/us-mayors-launch-smart-cities-institute-3640

K. Indian smart cities

India's cities are growing in population due to rising public interest and the availability of modern amenities. Cities need to be built since they are generally too crowded. Cities in India are being updated and redeveloped as smart or intelligent cities to give modern amenities and to improve the value of natural life.[4] Indian cities can become more sustainable and resistant to the risk of urban scarcity by implementing the goals of smart cities in India.[3] By utilizing a "Sustainable Smart" strategy and strengthening its infrastructure, services, and management methods, India may be able to accelerate economic growth.[5] 100 Smart Cities will quickly bring millions of Indian citizens into

innovative and transparent electronic management and easily improve their lifestyles.[7] Including sustainable cities and communities in the 2030 Agenda is one of the Sustainable Development Goals (SDGs). Cities can, therefore, make a significant contribution to the future. assist in the Sustainable Development Goals' accomplishment.[17] The Indian government's nationwide city revitalization initiative is named the Smart Cities Mission. 100 cities are to be transformed into "smart cities by 2022. Information and communication technology are used in smart cities. This includes transportation, energy, water, waste management, and public safety. The Smart Cities Mission is constructed on the following principles:

- citizen participation

- holistic approach

- sustainability

- innovation

- technology adoption

The mission has four pillars:

- Smart Governance includes e-governance, citizen engagement, and public-private partnerships.

- Smart Mobility includes intelligent transportation systems, public bike sharing, and last-mile connectivity.

- Smart Environment: Water conservation, waste management, and renewable energy.

- Smart People: This includes education, healthcare, and skill development.

The Smart Cities Mission has been praised for its ambitious goals and innovative approach. However, it has also been criticized for its lack of clarity and transparency. Some of the challenges faced by the Smart Cities Mission include:

- Lack of coordination between different levels of government

- High implementation cost

- Absence of skilled manpower

- Resistance to alteration from citizens and businesses

Despite of the challenges, India's urban landscape can be transformed by the Smart Cities Mission. In India, it can improve human quality of life for millions and make the nation more liveable and sustainable.

L. Smart cities in Karnataka

According to the Ministry of Housing and Urban Affairs, Karnataka has seven cities selected below for the Smart Cities Mission. These cities are:

1. Bengaluru 2. Hubli-Dharwad 3. Belagavi 4. Mangaluru 5. Shivamogga 6. Tumakuru 7. Davanagere

Davanagere received 59.93% of the vote during the "Smart City Competition Challenge assessment," while Belagavi finished 15th with 57.99%. The State will have to rely on Joint Undertakings, Subsidiaries, Public Private Partnership and turnkey contracts to complete the remaining parts of the project. [39] Karnataka State has also launched an official AMRUT program in 27 cities announced by the Government of Karnataka.[40] Under this mission, these cities are expected to implement various projects to improve infrastructure, transport, and utilities, among other things, using technology and innovation. Creating intelligent traffic management systems, smart energy grids, and waste management systems are some of the suggested projects in these cities. In addition to the Smart Cities Mission, Karnataka has also launched the Karnataka Digital Economy Mission (KDEM) to leverage technology to promote economic growth and development in the state. The mission aims to make Karnataka a hub for technology and innovation by creating a favorable business environment and supporting the development of emerging technologies such as AI, blockchain, and 5G. Karnataka is working towards creating a more sustainable, efficient, and connected urban environment by adopting innovative city technologies and initiatives.

M. Bengaluru as a smart city

India's "Smart City Mission" (SCM) incorporates Bengaluru's avant-garde city projects. The SCM, which was unveiled in 2015, aims to use "smart technology" to upgrade the infrastructure of 100 cities across India. The cities were chosen through a modest procedure in which the urban plans were assessed based on a number of standards, including how comprehensive and involved they were. The city has proposed initiatives, including those that would enhance specific neighborhoods and those that would enhance the entire city. [2] The Karnataka Government has signed an accord with network solutions provider Cisco for a pilot program to elaborate a blueprint for a smart, intelligent, sustainable Bengaluru.[47] Bengaluru was chosen in 2015 as one of India's 100 smart cities as part of the Smart City Mission. Through of technology, the mission seeks to improve the sustainability, livability, and efficiency of Indian cities. The organization responsible for carrying out Bengaluru's smart city projects is called Bengaluru Smart City Limited (BSCL). The BSCL has identified six focus areas for its smart city projects:

- Efficient mobility: This includes improving public transportation, developing last-mile connectivity, and promoting non-motorized transport.

- Sustainable environment: This includes reducing pollution, improving waste management, and promoting renewable energy.

- Safe and secure city: This includes improving crime prevention and detection, and providing better disaster management.

- E-governance: This includes improving citizen services, making government more transparent and accountable, and promoting citizen participation.

- Quality education: This includes improving access to quality education, and promoting lifelong learning.

- Healthcare: This includes improving access to quality healthcare, and promoting preventive healthcare.

Following are a few of the major initiatives approved as part of the Bengaluru Smart City Mission:

- Chunavana: This mobile app provides information on public transportation, traffic, and other city services.

- Integrated Command and Control Centre (ICCC): This centralized system monitors and controls traffic, public transportation, and other city services.

- Smart street lighting: This project involves replacing old street lights with energy-efficient LED lights.

- Smart parking: This project involves installing sensors in parking spaces to help drivers find available parking spots.

- Rainwater harvesting: This project involves constructing rainwater harvesting structures to collect and store rainwater.

- Solar power plants: This project involves setting up solar power plants to generate electricity from solar energy.

The Bengaluru Smart City Mission has significantly improved the city's infrastructure and services. However, there is still a lot of work to be done. The BSCL is committed to making Bengaluru a truly smart city by 2023. Here are some of the challenges that Bengaluru faces in becoming a smart city:

- Lack of funding: The Smart Cities Mission is a central government-funded system, but the funding is insufficient to implement all the planned projects.

- Bureaucracy: Implementing smart city projects is often hampered by bureaucracy and red tape.

- Public participation: Public involvement in the planning and implementing of smart city schemes is lacking.

- Technology adoption: To make Bengaluru a smart city, there is a need to enhance the usage of new skill.

Despite these challenges, Bengaluru is well on becoming a smart city. With continued investment and public participation, Bengaluru can become a model for other cities in India.

N. Housing for Urban-poor in Smart cities

In the Southern Hemisphere, the reality of urban informality is changing, with suggestions for how we interpret this phenomenon in and across remunerative, spatial, and political action committee domains.[46] Utilizing technology and data, smart cities improve efficiency, economic growth, sustainability, and the quality of life for urban residents.[51] The population pressures many cities in emerging nations experience have been attributed to them. Smart cities that use digital skill extensively may also help achieve the increased demand for facilities and infrastructure.[52] Urban informality is frequently associated with unchecked illicit activity, poverty, and marginalization and is typically associated with displacement brought on by urbanization. In addition to some falling outside the more comprehensive metropolitan statutory plans and objectives, the actual smart city projects should be specifically listed in the CDPs. This oversight prevented many city, state, and local government organizations from thoroughly understanding how the (smart) city functions and how these particular initiatives interact with one another. These organizations functioned on various smart city domains (land use, transportation, housing, water, and sanitation). [20] Smart cities are increasingly being seen as a way to address the challenges of urbanization, including the need for affordable housing for the urban poor. Smart city technologies can increase housing delivery efficiency, lower housing costs, and enhance residents' quality of life. Smart city technologies can be applied in a variety of ways to enhance urban poor people's access to housing, including:

- Using data to identify and target areas with a need for affordable housing. Smart city data can be used to identify areas with a high concentration of poverty, overcrowding, and substandard housing. This information can then target resources and interventions in these areas.

- Using technology to improve the efficiency of housing delivery. Land acquisition, financing, and home construction can all be streamlined with the help of technology. This can help reduce the

housing cost and make it more affordable for low-income households.

- Using technology to make housing more sustainable and resilient. Smart city technologies can make housing more energy-efficient, water-efficient, and disaster-resilient. This can lower the cost of living for low-income households while also enhancing their standard of living.

- Utilizing technology to raise inhabitants' quality of life. Residents may have access to necessary services like healthcare, education, and transportation. This can assist low-income households to live better quality lives and have more productive members.

Technology implementations in cities over the previous two decades have been driven by the rapid advancements in ICT, solid-state sensors, and exponential development in processing capacity in the setting of the twenty-first century.[41] Smart city technologies are being used in governance in a way that helps the state government make its cities more livable and demonstrates its commitment to strengthening its resilience and urban services.[42] Smart City technologies offer effective city amenities, serving as a hub for citizens to access a variety of amenities.[43] Although numerous promising initiatives are in the works, the application of smart city technologies to better urban poor housing is still in its infancy. For example, Singapore is using smart city technologies to develop a new generation of public housing that is more affordable, sustainable, and resilient. The energy efficiency of Barcelona's social housing stock is being improved through innovative city technologies. Cape Town employs smart city technology to make critical services accessible to people living in unofficial colonies. Smart city technologies have the potential to significantly contribute to solving the delinquent of providing cheap housing as they advance. Smart city technology can contribute to creating more egalitarian and livable cities by increasing the efficiency with which housing is delivered, making housing more sustainable and resilient, and enhancing the quality of life for occupants. Here are some specific instances of smart city initiatives tackling the issue of affordable housing for urban poor people:

- The Singapore Land Authority's (SLA) Smart HDB Town Pilot uses sensors and data analytics to improve the management of public housing estates in Singapore. The project aims to reduce energy consumption, improve water efficiency, and enhance security.

- The Barcelona City Council's "Smart City for All" initiative uses smart city technologies to advance the quality of life for inhabitants of informal settlements. The project includes the installation of solar panels, rainwater harvesting systems, and LED lighting.

- The Cape Town Water and Sanitation Department's "WaterWISE" program uses smart metering and data analytics to improve water efficiency in informal settlements. The program has helped to reduce water consumption by up to 30%.

These are just a few examples of how smart city technologies can improve housing for the urban poor. As these technologies continue to develop, they have the potential to play a important part in addressing this global challenge.

O. Integrating SDGs in smart cities

Urban planners, politicians, and decision-makers face environmental severe difficulties due to the increased pressures that urban growth places on non-renewable energy causes and the numerous production circumstances. Reducing our dependence on fossil fuels helps lessen environmental change's effects, which are dangerous for all metropolitan areas and are felt globally. The wicked problems that define cities are worsened by urbanization and urban growth, whether branding and renewing as sustainable/innovative or those striving to become smart and sustainable. They could threaten efforts to achieve long-term climatic sustainability objectives since they put an important claim on the planet's reserves and ecosystem.[24] The population pressures many cities in emerging nations experience have been attributed to them. Smart cities that use digital technology extensively may also help fulfill the increased demand for services and infrastructure.[53] Air pollution is a major cause of environmental issues in many cities. An acceptable urban development policy must include strategies to reduce exposure to pollutants in light of the rise of the smart city idea.[54] Despite taking up just under five percent of the planet's surface, these urban centers absorb over 75 percent of the resources that are consumed by humans and produce 60-80% of the worldwide emissions of greenhouse gases (GHGs).[55] Because smart cities are committed to the SDGs and the tendency of their rules has changed from purely ICT-driven proposals to the promotion of overall urban structure in the aforementioned 6 dimensions, smart city valuations should use thorough standards and consider connections between various indicators. Urban planning must prioritize residents' happiness as a top priority since it represents cities' viability and current and future lifestyles to ensure that smart policies follow the SDGs' path. Urban happiness can be measured using livability and subjective well-being (SWB). Citizens' SWB clearly illustrates how satisfied they feel with various elements of life.[25] There

are several ways by which SDGs can be integrated into thoughtful city planning and implementation:

1. Goal Identification and Prioritization: Smart city planners should prioritize specific SDGs most relevant to their city's context. Each city has unique challenges and opportunities, so the choice of SDGs will depend on factors such as the local economy, environment, social dynamics, and infrastructure.

2. Data-Driven Decision-Making: Smart cities rely on data from various sources, including sensors, IoT devices, and citizen engagement platforms. This data can be used to monitor progress toward SDGs, measure the impact of interventions, and make informed decisions. For instance, air quality sensors can help track progress toward Goal 3 (Good Health and Well-being) and Goal 13 (Climate Action).

3. Inclusive Citizen Engagement: The absence of perilous citizenship towards developing city services is challenging because it could obstruct public participation in self-governing decision-making regarding the smart city. This is because the benefits of citizens are likely to be obstructed by the development of smart city facilities [1] Smart cities should involve citizens in decision-making processes. Participatory platforms can help gather insights from residents and stakeholders, aligning with Goal 16. This can lead to more inclusive urban planning and policies.

4. Sustainable Infrastructure: Smart cities can focus on Goal 9 (Industry, Innovation, and Infrastructure) by developing and implementing sustainable infrastructure projects. This can include efficient public transportation systems, renewable energy installations, and smart waste management systems.

5. Efficient Resource Management: Using technology to manage resources efficiently aligns with several SDGs, such as Goal 6 and Goal 12. Smart water management systems, waste recycling initiatives, and energy-efficient buildings contribute to these goals.

6. Climate Resilience: Smart cities can integrate climate resilience strategies aligning with Goals 11 and 13. This involves incorporating green spaces, flood mitigation measures, and climate-sensitive urban planning.

7. Digital Inclusion: To achieve Goal 10 (Reduced Inequality), smart cities should ensure digital inclusion for all citizens. This means providing access to technology and digital services to underserved communities, bridging the digital divide.

8. Economic Growth and Innovation: Smart city initiatives can drive economic growth and innovation, supporting Goal 8. Cities can create job opportunities and attract investment by fostering a conducive environment for startups and tech companies.

9. Education and Skill Development: Smart cities can promote Goal 4 (Quality Education) by leveraging technology for online education platforms, and skill development programs and enhancing access to education resources.

10. Partnerships and Collaboration: The SDGs can only be achieved via cooperation between the community and isolated sectors, academics, civic society, and business. Smart cities can facilitate partnerships contributing to multiple goals, such as Goal 17 (Partnerships).

P. Sustainable Smart Cities and Biophilic Architecture

Smart cities are developed to effectively manage and sustain expanding urbanization, lower carbon emissions, enhance livability, and raise citizens' ability to comprehend and benefit from emerging trends in contemporary communication technology.[26] Smart city development and rapid urbanization use an enormous amount of energy. Therefore, it is crucial to acquire technology that can detect energy prices at a city scale, expand energy infrastructures, and also reduce energy usage. Gas and electrical consumption are the two types of energy consumption found in metropolitan areas.[27] The world has lately seen exceptional encounters and augmented uncertainty, making it additionally inspiring for smart cities to expand their environmental competence and to aid the world in genuinely moving closer to reaching the environmental goals of SDG 11. Several urbanism models with a primary emphasis on the ecological aspect of sustainability have become recognized as "environmentally sustainable smart cities" due to this and other technological and global concerns.[24] Additionally, IoT technology is useful for tracking energy use, detecting $CO2$ and N_2 levels, gauging pH levels and SO, properly tracking transportation activities, and improving igniting schedules to reduce energy loss. Along with managing aeration, lighting, and shifting loads around smart cities, traffic management also aids in improving security and regularity. [28] Due to the greater urban energy demand, smart energy is the focus inside a smart, sustainable city [29]. Energy storage technologies provide the grid with flexibility and stability, enabling the well-organized use of renewable energy foundations and playing a crucial part in smart energy organization in smart cities [30] To satisfy today's basic human needs without jeopardizing the capacity of future generations to satisfy their particular, sustainable development is the ultimate goal. For humankind to co-evolve with other species, fully efficient systems must be developed again.[45] The ultimate objective of regenerative development is to create fully functional systems that enable the co-evolution of humans and other animals.

Urban designers, planners, and architects are increasingly interested in biophilic design. According to biophilic design, excellent design must consider nature and natural elements at the structure, site, city, and local scales. The idea of biophilia, promoted by Harvard myrmecologist and sociobiologist E.O. Wilson, largely forms its foundation. [31] Although the term "biophilia" was coined by psychologists in the 1960s, the accompanying movement didn't take off until naturalist Edward Wilson popularized it in the 1980s. Biophilia, or a love of nature, acknowledges that humans have an innate need to interact with it.[32] Given that people spend 90% of their time in buildings and that mental illness is the main cause of disability worldwide, environmental design brings both opportunities and challenges.[33] Regarding developing environmental movements and environmental catastrophes brought on by humans, it is significant to consider the fascination with and interest in "nature."[44] A generalizable model for other business sections may be a biophilic (environmentally friendly) building with the obvious objective of being self-sufficient in energy, recycling, and running a renewable energy model.[50]

II. UNIQUENESS OF THE PAPER

The paper discusses and critically analyses the policies in India over the past 75 years, focusing on affordable housing. Also, a review of cities around the world has been discussed in this paper. Smart city technologies have been identified for housing of urban poor. Smart cities are created to efficiently manage and sustain growing urbanization, reduce carbon emissions, improve livability, and improve inhabitants' understanding of and ability to take advantage of new trends in modern communication technology.

III. CONCLUSION

This paper thus reviews the housing conditions around the world and in India. Providing housing for the urban poor is critical to any smart city initiative. Housing for the urban poor can be made more accessible, inexpensive, and sustainable using clever solutions. Cities may increase housing affordability, sustainability, and accessibility for the urban poor by implementing clever solutions. This will contribute to making cities more inclusive and egalitarian while also improving the quality of life for the urban poor. In addition, sustainable buildings can be equipped with smart sensors and systems that can collect data on their energy use and performance. As technology develops, we expect to see even more innovative ways to use sustainable design to create more livable and sustainable cities. Combining sustainable architecture and smart city principles is a promising approach to creating more livable, sustainable, and resilient cities. As these technologies continue to develop, we can expect to see even more

innovative ways to use them to create a better future for our cities.

Findings suggest that the early years of independence were marked by a severe housing shortage, exacerbated by the influx of refugees from Pakistan, and the government responded with many policies aimed at increasing the supply of housing, including the provision of subsidized land and loans. However, these policies were largely unsuccessful in meeting the needs of the poor. There were achievements like a significant increase in the housing supply, particularly in urban areas, and a reduction in the housing shortage, although it remains significant. There was an improvement in the quality of housing, particularly for the poor. A more significant role for the private sector is the provision of housing. However, the challenge remains the high cost of housing, which makes it unaffordable for many people, and the lack of access to affordable finance for housing. The regulatory constraints on new housing development and the persistence of slums and informal settlements are some more.

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