Mobilize Technological breakthrough for Sustainable Urban Development: A Comprehensive evaluation

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Abstract:

This research aims to examine the role of new modern technological innovation in fostering sustainable development, most probably the key zone is urban areas. As the world is growing more into technological platform which urbanize rapidly, the requirement for renewable resources, solutions becomes crucial. This study will explore more advanced stage of technologies and their significance and applications to address environmental, social, and economic challenges in urban locality. The research will be able to frame practical and logical implementations in the society and to evaluate the impact of technological breakthrough on attaining sustainability goals. The findings will add to a better understanding of how technology can be advantageous to create smarter, more resilient, and environmentally friendly cities, fostering a sustainable future.

Keywords: *Sustainable, Implementation, Significance, Breakthrough*

Introduction

With the rapidly urbanization of the world. Today natural resources and sustainable resources is an essential pathway for urban development in the present era. The first and most critical step in promoting sustainable urban development is identifying models for sustainable urban development. This will be also called as economic growth model which is more useful for urban sustainable development focuses on long-term development, which measures the status of urban development based on the concept of sustainable development. It is of great theoretical and practical significance to promote the process of sustainable development, encourage sustained and rapid economic growth, achieve comprehensive, coordinated, and sustainable development, and achieve inclusive urban growth.

Starting with agenda for sustainable development, the United Nations Commission on Sustainable Development (CSD) published a list of 140 indicators covering the social, economic, environmental, and institutional dimensions of sustainable development (Commission on Sustainable Development, 2001). Sustainability examination mainly depends on a single indicator and a overall indicator system. In terms of a single index, traditional indices such as ecological footprint (EF) (Ahmed et al., 2021), ecological sustainability index (ESI), welfare index (WI), environmental vulnerability index (EVI), environmentally adjusted gross domestic product (EDP), sustainable economic welfare index (ISEW), human development index (HDI), urban development index .

(CDI) (Molinaro et al., 2020), green GDP, national happiness index and other classic indices (Wang and Chen, 2019; Yang et al., 2020) have been widely used.

Indicators For Measuring Sustainable Urban Development

1. **Ecological Metrics**: Environmental indicators are metrics or parameters used to

measure and assess various aspects of the environment. They provide valuable information to understand environmental conditions, track changes over time, and guide decision-making for sustainable practices. Here's an example of an environmental indicator: Air quality Index AQI, Green WORLD and biodiversity, Waste water management.

2. **Society Indicators:** Society indicators are metrics used to measure and assess various aspects of a society's well-being, progress, and quality of life. Human Development Index (HDI), basic services like clean water, sanitation facilities, healthcare, education, and affordable housing.

3. **Economic Indicators:** Economic indicators are statistical measures used to assess the performance and health of an economy. They provide insights into various aspects of economic activity, helping policymakers, businesses, and investors make informed decisions. Here's an example of an economic indicator.

4. **Gross Domestic Product (GDP):** Assessing economic growth, employment opportunities, and the contribution of urban areas to the national economy. Infrastructure development.

5. **Innovation and technology:** Innovation and technology is the development and widespread adoption of electric vehicles (EVs). Over the past decade, there has been a significant shift towards more sustainable and environmentally friendly transportation options. Electric vehicles represent a ground breaking innovation in the automotive industry, driven by advancements in battery technology and the push for cleaner energy alternatives.

Key Urban Development Missions In India

1. Atal Mission for Rejuvenation and Urban Transformation (AMRUT): AMRUT was introduced in 2015 to improve urban infrastructure and their requirements in cities with a population of over 1 lakh. Under AMRUT, over 5,000 projects have been approved for water supply, sewerage, drainage, urban transport, and green spaces across 500 cities in India. These projects aim to improve the quality of urban infrastructure and enhance the liveability of cities. The AMRUT mission is a better version of earlier Jawaharlal Nehru National Urban Renewal Mission (JNNURM) (2005-2014).

2. Pradhan Mantri Awas Yojana (PMAY): Housing for all (Urban)Although primarily focused on rural areas, PMGSY played a significant role in improving connectivity between rural and urban areas. The scheme aimed at providing all-weather road connectivity to unconnected villages, thus contributing to overall urban development.

3. Smart Cities Mission (SCM): The Smart Cities Mission was launched in 2015 to promote sustainable and citizen-friendly cities through the use of technology and innovative solutions. These cities are implementing various projects focused on infrastructure development, smart transportation, waste management, energy efficiency, and citizen engagement.

4. Swachh Bharat Mission (SBM): Swachh Bharat Mission (Urban) was launched in 2014 to achieve 100% sanitation and eliminate open defecation in urban areas. The mission has contributed to significant progress in sanitation coverage. As of May 2023, over 4,400 cities have become open defecation-free. The mission has also focused on solid waste management, with the construction of over 87,000 community and public toilets across urban areas.

5. Heritage City Development and Augmentation Yojana (HRIDAY): HRIDAY scheme called National Heritage City Development and Augmentation Yojana was launched by the Ministry of Housing and Urban Affairs on 21st January 2015. This scheme was introduced to preserve and revitalize the rich cultural heritage of the country.

These policies demonstrate the government's promise to sustainable urbanization in India. The impact of these policies in improving urban infrastructure, housing, sanitation, livelihoods, and overall quality of life in urban areas play a

major role. The Smart Cities Mission and AMRUT mission have become better in terms of project identification and implementation. However, there have been obstacles in implementation execution delays in project execution, adequate funding, and issues in private sector participation. PMAY-U has made progress in sanctioning and constructing cheap and affordable houses for the urban poor. DAY-NULM has made progress in providing skill training and employment opportunities for the urban poor. However, challenges exist in terms of skill quality, job placement, and sustainability of livelihoods created. The Swachh Bharat Mission (Urban) has witnessed significant progress in terms of constructing toilets and promoting cleanliness and hygiene. However, challenges remain in terms of waste management, behaviour change, and sustaining the cleanliness efforts.

Challenges Of Urbanization In India:
Urbanization in India presents a plethora of challenges, reflecting the rapid pace of urban growth and the strain it puts on infrastructure, resources, and socio-economic systems. Some key challenges include:

1. **Infrastructure Deficit**: Indian cities often struggle with inadequate infrastructure such as roads, public transportation, water supply, sanitation, and waste management. Rapid urbanization exacerbates these deficiencies, leading to congestion, pollution, and reduced quality of life.

2. **Housing Shortage and Slums**: The growing urban population has created a significant demand for housing, resulting in a shortage of affordable homes. As a result, many people end up living in informal settlements or slums, lacking basic amenities and vulnerable to natural disasters and social instability.

3. **Environmental Degradation**: Urbanization contributes to environmental degradation through increased pollution, deforestation, and depletion of natural resources. This poses significant health risks and threatens ecosystems, exacerbating issues such as air and water pollution, climate change, and loss of biodiversity.

4. **Water Scarcity and Quality**: Rapid urbanization strains water resources, leading to scarcity and deteriorating water quality. Many cities face challenges in supplying clean water to their residents, while unchecked industrial and domestic waste contaminate water bodies, further exacerbating the problem.

5. **Urban Governance and Planning**: Inadequate urban governance and planning processes hinder effective management of urbanization. Weak enforcement of regulations, corruption, and lack of coordination among government agencies often lead to inefficient resource allocation and unsustainable urban development.

6. **Traffic Congestion and Air Pollution**: The rise in vehicular traffic in urban areas has led to severe congestion and air pollution. Traffic congestion not only wastes time and energy but also increases greenhouse gas emissions and health risks associated with air pollution, such as respiratory diseases.

Opportunities For Sustainable Urbanization In India:

1. **Smart Cities Mission**: The Indian government's Smart Cities Mission aims to develop 100 smart cities across the country, leveraging technology and innovation to improve infrastructure, services, and quality of life. This initiative presents an opportunity to integrate sustainable practices such as efficient energy use, smart transportation systems, and waste management into urban development.

2. **Renewable Energy Integration**: India has significant potential for renewable energy sources such as solar and wind power. Integrating renewable energy into urban infrastructure, such as rooftop solar panels and wind turbines, can reduce dependence on fossil fuels and mitigate greenhouse gas emissions, contributing to sustainable urbanization.

3.   **Green Building Practices**: Promoting green building practices such as energy-efficient design, use of sustainable materials, and green spaces can enhance the environmental performance of urban infrastructure. Initiatives like Leadership in Energy and Environmental Design (LEED) certification encourage the adoption of sustainable building standards in Indian.

4.   **Public Transportation Expansion**: Investing in public transportation infrastructure, including metro rail, buses, and non-motorized transport options like cycling and walking paths, can reduce congestion, air pollution, and carbon emissions in urban areas. Expanding and improving public transportation networks presents a significant opportunity for sustainable urban mobility

5.   **Urban Green Spaces**: Creating and preserving green spaces such as parks, gardens, and urban forests not only enhances the aesthetic appeal of cities but also provides numerous environmental and social benefits. Urban green spaces help mitigate urban heat island effects, improve air quality, promote biodiversity, and enhance residents' health and well-being.

So, Capitalizing on these opportunities and adopting a holistic approach to urban planning and development, India can achieve sustainable, inclusive, and resilient cities that improve the quality of life for urban residents while safeguarding the environment for future generations.

Recommendations For Promoting Sustainable Urbanization:

Integrated Urban Planning: Develop comprehensive urban plans that consider social, economic, and environmental dimensions of sustainability. This involves coordinating land use, transportation, infrastructure, and housing policies to create cohesive and well-functioning cities.

Impact and Mixed-Use Development: Encourage compact, mixed-use development patterns that minimize sprawl, reduce reliance on private vehicles, and promote walkability and accessibility to amenities and service.

Transit-Oriented Development (TOD): Prioritize transit-oriented development around public transportation nodes to promote sustainable mobility, reduce traffic congestion, and create vibrant, livable communities.

Conclusion: In conclusion, sustainable urbanization in India is a complex and multifaceted challenge. Rapid urbanization, inadequate infrastructure, slums, environmental degradation, and social inequality pose significant challenges to achieving sustainable urban development. However, there are also opportunities for progress, including green infrastructure, technology and innovation, policy reforms, and a circular economy approach.

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