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INTEGRATING LANDUSE PLANNING AND INFRASTRUCTURE PLANNING: OPPORTUNITIES AND CHALLENGES

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Abstract: Urbanization necessitates integrating land use and infrastructure planning for efficient, sustainable development. Traditionally approached separately, joint planning coordinates urban growth, promoting livability, resilience, and equity. Case studies showcase successful integration models facilitating economic and social benefits. However, fragmentation across agencies and governments with distinct objectives hinders progress. Further challenges include conflicting stakeholder interests, data limitations, and institutional constraints.

Nevertheless, opportunities exist to improve outcomes through cross-agency collaboration, participatory processes engaging communities in decisions, and shared data systems. With strategies addressing barriers and capitalizing on synergies, integrated planning optimizes land use and infrastructure. Though achieving coordination poses challenges, the rewards are more holistic, coherent planning benefiting all. This paper reviews the rationale, benefits, hurdles, and solutions for integrated land use and infrastructure planning essential for thriving, sustainable urban communities. It argues that while difficult, integrating these interlinked elements creates long-term value. By understanding impediments and adopting proven, context-sensitive strategies, practitioners can navigate complexities for the greater communal good

Index Terms **- Integrated planning, Holistic approach, Stakeholders, Participatory planning, Sustainability, Policy-making**

1 INTRODUCTION

Infrastructure planning and land-use planning are critical components of urban and regional planning that can significantly impact the development, functioning, and sustainability of communities. The integration of these two planning processes has the potential to enhance the efficiency, effectiveness, and equity of development while promoting sustainable outcomes. Infrastructure and land-use planning are interdependent and complementary processes that shape communities' physical and social fabric.

Infrastructure, such as transportation, water, energy, and communication networks, supports the movement of people, goods, and services, while land-use planning determines the location, intensity, and mix of activities that occur within a given area. The integration of these two planning processes can lead to more efficient, effective, and sustainable development outcomes. However, the integration of infrastructure planning and land-use planning is often challenging due to competing interests, complex governance arrangements, and technical and financial constraints.

The study draws on a review of the relevant literature, case studies, and data-based analysis to provide insights and recommendations for policymakers, planners, and stakeholders involved in infrastructure and land-use planning. This research paper aims to examine the opportunities and challenges of integrating infrastructure planning and land use planning, including the benefits, barriers, and strategies for successful integration.

1.1 LITERATURE REVIEW

Land use planning and infrastructure planning are two important components of urban planning that are often addressed separately. However, there is growing recognition that these two planning processes should be integrated to create more sustainable and efficient urban environments. This literature review examines the current research on the integration of land use planning and infrastructure planning and its potential benefits.
Integrating land use planning and physical infrastructure planning will enhance social equity. By placing affordable housing near public transit and other amenities, low-income residents can have better access to employment, education, and other opportunities. This can help to reduce the income and wealth disparities that are often associated with urban areas (Moretti, 2012).

Another potential advantage of integrating land use planning and physical infrastructure planning is improved transportation efficiency. By coordinating land use and transportation planning, cities can develop more efficient transportation networks that reduce congestion and travel times (Cervero R, 1997). This can be achieved through the use of transit-oriented development, which places housing and commercial development near public transit (Ewing R, 2008).

One of the primary benefits of integrating land use planning and physical infrastructure planning is the creation of more compact and walkable communities. These types of communities reduce the need for car travel, which can lower greenhouse gas emissions and improve air quality. This approach to planning is commonly referred to as "smart growth" (Burchell, 2000). Additionally, compact communities can also create more vibrant and liveable neighborhoods (Litman, 2018)

The integration of infrastructure planning and land-use planning can be achieved through various approaches, such as incorporating infrastructure considerations into land-use planning, incorporating land-use considerations into infrastructure planning, or developing joint infrastructure and land-use plans. One approach that has gained prominence is transit-oriented development (TOD), which involves locating high-density mixed-use development around transit stations to promote walking, cycling, and public transit use while reducing car dependency (Cervero R, 1997) (Moudon, 2003).

Infrastructure planning and land-use planning have traditionally been developed separately, with little consideration for the interactions between them. However, recent studies have highlighted the benefits of integrating these planning processes, such as reducing traffic congestion, enhancing access to services and amenities, promoting sustainable modes of transportation, and improving environmental quality; (Levinson D. M, 2018) (Mumford, 2018) (Zhu Y, 2017).

However, integrating land use and infrastructure planning is not without its challenges. One of the main obstacles is the need for coordination between multiple government agencies and departments (Gang, 2002). Additionally, there may be resistance from developers and property owners who are accustomed to a more traditional, segregated approach to urban planning (Litman, 2018).
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1.2 CASE STUDIES

Several case studies illustrate the opportunities and challenges of integrating infrastructure planning and land-use planning. Amongst those few have interpreted for a successful integration in their urban planning network where the results are greatly impressive. Some of the examples are summarized below:
Case Studies (International)
Portland, Oregon: In 1979, Portland established its Urban Growth Boundary to limit the expansion of the city's footprint and promote development within existing boundaries. Combined with a comprehensive

transportation plan that prioritizes public transit and non-motorized transportation, Portland has become a more sustainable and liveable city with a vibrant downtown and thriving neighborhoods.

In 2005, Robert Geller instituted that there is a requirement for non-motorized transportation for the city of Portland, Oregon where bicycle commuting has high potential if required infrastructure improvements and relevant programs address commuters' "interested but concerned" situation.

Curitiba, Brazil: Curitiba is recognized globally for its innovative land use and transportation planning. The city implemented a Bus Rapid Transit (BRT) system in the 1970s, which has become a model for other cities around the world. The city has also implemented a zoning code that encourages mixed-use development and pedestrian-friendly streets.

Vancouver, Canada: Vancouver's comprehensive land use and transportation plan focuses on creating complete neighborhoods with a mix of uses, a range of housing types, and access to public transit. The city has also implemented a Greenest City Action Plan, which aims to make Vancouver the greenest city in the world by 2020.

Freiburg, Germany: Freiburg has implemented policies that promote sustainable land use and transportation, prioritizing public transit, non-motorized transportation, and mixed-use development. The city has also implemented policies to promote renewable energy and energy efficiency. The result has been a more sustainable and liveable city with a high quality of life.

Case Study 1 (National): **Integration of Land Use Planning and Infrastructure Planning for Delhi Metro**

The Delhi Metro is an excellent example of how the integration of land use planning and infrastructure planning can result in sustainable and economically viable projects. The Delhi Metro was designed with the objective of promoting sustainable transport and reducing the city's carbon footprint.

The metro stations have been designed as transit-oriented developments, which means that they have been integrated with surrounding areas to create a mixed-use development. This has resulted in new economic opportunities in the form of affordable housing and employment opportunities for the people of Delhi. The integration of land use planning and infrastructure planning has also had a positive impact on the environment. By reducing the number of private vehicles on the road, the Delhi Metro has reduced air pollution and contributed to the improvement of air quality in Delhi.

Figure 1 Transported Oriented Metro Corridor (Source: TOI)

Case Study 2(National): **Integration of Land Use Planning and Infrastructure Planning for Gujarat Solar Park**

The Gujarat Solar Park is another example of how the integration of land use planning and infrastructure planning can result in sustainable and economically viable projects. The solar park was built on barren land that was previously of little economic value.

The solar park was designed to make use of the barren land in Gujarat and promote renewable energy. By generating renewable energy, the solar park has created new economic opportunities for the state. The solar park has also reduced the state's carbon footprint by decreasing the dependence on fossil fuels.

The GSP is home to 36 businesses that operate on 5,384 acres (2,178.82 hectares), generating 730 megawatts (MW) of solar energy. Additionally, 20 MW worth of projects are being implemented, including a 15 MW

project that the locals are opposed to. Launched on December 30, 2010, the solar park was put into operation on December 31, 2011.

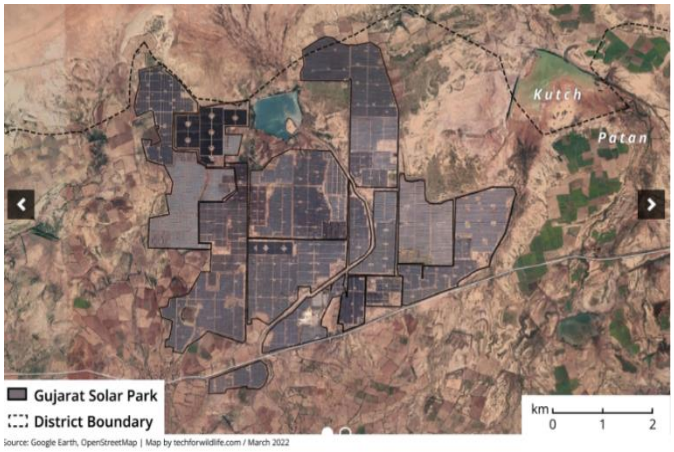

Figure 2: 5,384-acre Gujarat Solar Park in Patan (Source: Technology for Wildlife)

1.3 INFERENCES FROM CASE STUDIES

Urban Growth Boundary and prioritizing public transit and non-motorized transportation as seen in Portland city has been the triumph for creating a sustainable and liveable city with a vibrant downtown and thriving neighborhoods. Through proper implementation of public transit integrated with non-motorized transportation paves the way for renewable energy usage in transport and other sectors of development. We are evident of this in the case of Freiburg where it has led to many benefits of integrated land use and infrastructure planning.

With interlinked prospects of complete neighborhoods, diverse housing, and public transit accessibility, Vancouver has become a highly liveable and sustainable city, leading the way in environmental initiatives and quality of life. In Curitiba we experienced through the implementation of a Bus Rapid Transit (BRT) system and zoning codes that encourage mixed-use development, it has achieved an equitable and sustainable city, setting an example for other cities worldwide.

In India, we saw enhanced accessibility to public transportation, and an emphasis on TOD-based development has been fruitful for residents of Delhi which has effectively reduced the city's carbon footprint, improved air quality, and created economic opportunities. Additionally, it has enhanced accessibility to public transportation, resulting in a more sustainable and liveable city environment. We saw a situation where barren land conversion for renewable energy generation and economic development through it in the case of Gujarat Solar Park which has contributed to the reduction of reliance on fossil fuels, aligning with the state's efforts in addressing climate change and promoting sustainability.

2 A PERSPECTIVE ON EASTERN REGION OF INDIA

Integrated infrastructure and land use planning is a crucial aspect of urban development in Eastern India. This approach emphasizes the need for coordinated planning between infrastructure development and land use planning to create liveable and sustainable cities. The goal is to ensure that the physical and social infrastructure required to support urban development is well-coordinated with the way land is used in a city.

Bhubaneswar Smart City Project

The Bhubaneswar Smart City project is a great example of how integrated planning can be used to create a smart and sustainable city. The city has integrated various infrastructure projects, such as the BRT and cycle tracks, with land use planning to improve connectivity and reduce traffic congestion. The BRT corridor connects the residential areas to the commercial areas, and the cycle tracks provide a safe and eco-friendly alternative for short commutes. The city has also implemented smart parking solutions, such as multi-level parking, to reduce parking congestion on the streets. Additionally, the city has prioritized the development of pedestrian infrastructure, such as footpaths, to encourage more people to walk and cycle.

Figure 3- (i) Janpath Street Development (ii) Smart Parks along streets (Source: Bhubaneswar Smart City Limited)

New Town, Kolkata

The New Town area in Kolkata is another excellent example of integrated infrastructure and land use planning. The development of green spaces and pedestrian infrastructure has been given priority in the area, which has helped to create walkable neighborhoods. The city has also implemented a decentralized solid waste management system that uses composting and recycling techniques to reduce the amount of waste sent to landfills. Additionally, the area has implemented an intelligent transportation system that helps to reduce traffic congestion, by using real-time data and analytics to manage traffic flow (Mukherjee, 2020)

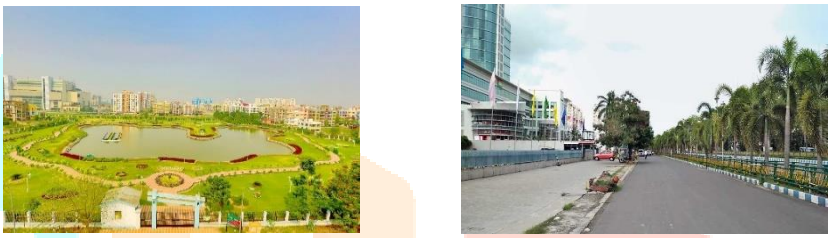

Figure 4-(i, ii) Building up Green infrastructure and Complete streets as part of the post-integration process (Source: The Telegraph online and Facebook)

Cuttack Municipal Corporation

Cuttack has developed a comprehensive land use plan that integrates transportation, housing, and environmental sustainability. The plan includes provisions for public transportation, bicycle infrastructure, green spaces, and mixed-use development. The city has implemented a network of cycle tracks and pedestrian paths that encourage residents to walk and cycle instead of using cars. The network connects different parts of the city, making it easier for residents to get around without relying on private cars. Cuttack has also developed an underground rainwater harvesting system that helps to conserve water and prevent flooding. The system has been successful in reducing the city's dependence on groundwater and preventing flooding during heavy rains. The city has implemented a solid waste management system that helps to reduce pollution and improve public health.

Figure 5 - Odisha's Largest canal in Cuttack being redesigned and revitalized with landuse planning (Source- Youtube)

Ranchi

Ranchi, the capital city of Jharkhand state, has developed a comprehensive land use plan that integrates transportation, housing, and environmental sustainability. The plan includes provisions for public transportation, pedestrian infrastructure, green spaces, and mixed-use development. The city has implemented

a network of pedestrian paths and sidewalks that encourage residents to walk instead of using cars. The network connects different parts of the city, making it easier for residents to get around on foot. Ranchi has also developed an extensive network of public parks and green spaces, which helps to improve air quality and provides recreational space for residents. The city has implemented a solid waste management system that helps to reduce pollution and improve public health

These examples demonstrate the importance of integrated infrastructure and land use planning in Eastern India. The approach is crucial to ensuring that the development of infrastructure and land use planning is well-coordinated to create liveable, sustainable, and resilient cities. Through this approach, cities can develop in a way that supports economic growth, improves social equity, and reduces environmental impacts.

Figure 6 - Ranchi Smart City project integration process (Source - L&T Construction, Indiatimes.com)

2.1 LINKAGE BETWEEN LANDUSE AND DEVELOPMENT CONTROL PLAN WITH INFRASTRUCTURE PLANNING

The linkage between Land Use and Development Control Plan (LUDCP) and infrastructure planning in eastern India, particularly in cities like Bhubaneswar, Cuttack, and Ranchi, is crucial for ensuring coordinated and sustainable urban development. LUDCP serves as a regulatory framework that guides land use decisions and development control measures, while infrastructure planning focuses on the provision of physical infrastructure such as transportation networks, utilities, and public facilities. The integration of these two planning processes is essential to achieve optimal utilization of land, efficient provision of infrastructure, and the creation of liveable urban environments.

Both infrastructure planning and land use development control plan are important because they help to create liveable, sustainable, and resilient cities. In India, where rapid urbanization is occurring, these plans are especially critical to ensure that cities can cope with the influx of people and can provide basic services to all residents. The government and local authorities are responsible for creating and implementing these plans. They must work with stakeholders, such as citizens, developers, and environmentalists, to ensure that the plans are equitable, transparent, and effective.

In the case of Bhubaneswar, the capital city of Odisha, the Bhubaneswar Development Authority (BDA) plays a central role in coordinating LUDCP and infrastructure planning. The BDA prepares the Master Plan and Development Control Regulations, which define land use patterns and development guidelines. These plans are closely aligned with infrastructure requirements, such as road networks, public transportation systems, water supply, and drainage. The integration ensures that land uses are appropriately located in relation to infrastructure, minimizing travel distances and promoting efficient resource utilization.

Similarly, in Cuttack, the Cuttack Development Authority (CDA) is responsible for integrating LUDCP and infrastructure planning. The CDA prepares the Comprehensive Development Plan (CDP) and Zonal Development Plans (ZDPs) to regulate land use and development activities. These plans consider infrastructure requirements, including transportation networks, water supply, sewerage systems, and public amenities. By aligning land use with infrastructure provisions, Cuttack aims to create sustainable neighborhoods, improve connectivity, and enhance the overall quality of life for its residents.

The development control plan determines how land within a city is used, while the infrastructure planning identifies the necessary physical and social infrastructure required to support the development. For example, if a city decides to allow the construction of a new commercial area, the development control plan will specify the size and height of buildings, as well as the number of parking spaces required. This, in turn, will determine the type and size of infrastructure needed to support the development, such as roads, electricity, and water supply

Figure 7 Interlinkage between Landuse Development process and Infra planning (Source: Author)

In Ranchi, the capital city of Jharkhand, the Ranchi Municipal Corporation (RMC) and the Ranchi Regional Development Authority (RRDA) are involved in coordinating LUDCP and infrastructure planning. The LUDCP for Ranchi outlines land use regulations and development guidelines, while infrastructure planning focuses on providing efficient transportation systems, water supply, sanitation, and other essential services. The integration of these plans ensures that land use decisions consider the availability and adequacy of infrastructure, promoting sustainable growth and balanced development.

Similarly, infrastructure planning can also influence land use development control plans. For instance, if a city plans to build a new transportation system, such as a metro line, this can lead to the development of new residential and commercial areas around the stations. This, in turn, may require changes to the development control plan to accommodate the new development. The interdependence between infrastructure planning and land use development control plan highlights the need for integrated and coordinated planning which is constantly crucial in terms of sustainable growth for the region and its stakeholders.

2.2 MECHANISMS FOR INTEGRATION DURING THE PLANNING PROCESS

Integrating infrastructure planning and land use planning can help to create more sustainable and efficient urban environments. Here are some ways in which this integration can be achieved:

Figure 8 - Steps for Integration during the planning process (Source: Author)

1. **Coordination:** The first step is to ensure that there is effective coordination and communication between the infrastructure planning and land use planning teams. This can be achieved through regular meetings, joint planning sessions, and the use of shared data and mapping tools.
2. **Data integration:** Infrastructure planning and land use planning require different types of data, but there is often significant overlap. By integrating data from both processes, planners can make more informed decisions about where to locate infrastructure and how to design it to meet the needs of the surrounding community.
3. **Comprehensive planning:** Land use planning and infrastructure planning should be considered as part of a comprehensive planning process. This means that the planning team should consider all aspects of a community, including transportation, housing, and economic development when making decisions about infrastructure and land use.
4. **Future-proofing:** Infrastructure and land use planning should be designed with the future in mind. This means considering factors such as climate change, technological advances, and population growth when making decisions about infrastructure and land use.
5. **Community engagement:** Finally, it's important to engage the community in the planning process. By involving residents in decisions about infrastructure and land use, planners can ensure that their plans are responsive to the needs and desires of the community, and are more likely to be successful in the long term.

2.3 MODUS OPERANDI FOR INTEGRATION

Infrastructure planning and land use planning for the above cities can be integrated through a variety of methods. Here are some examples:

1) **Transit-oriented development:** Transit-oriented development (TOD) is a land use planning strategy that focuses on creating compact, walkable communities around transit stations. By integrating infrastructure planning and land use planning, TOD can help to reduce reliance on cars, promote sustainable transportation, and increase access to amenities (Cervero, 1998).
2) **Green infrastructure:** Green infrastructure is a planning approach that seeks to integrate natural systems into urban environments. By using natural systems to manage stormwater, reduce heat island effects, and improve air quality, green infrastructure can help to create more sustainable and resilient communities (McMahon, 2006)
3) **Smart growth:** Smart growth is a land-use planning strategy that focuses on creating more compact, mixed-use communities. By reducing sprawl, promoting infill development, and creating more walkable neighborhoods, smart growth can help to reduce the need for car-based infrastructure and increase access to amenities (Ewing R, 2008)
4) **Complete streets:** Complete streets is a transportation planning strategy that seeks to design streets to accommodate all users, including pedestrians, cyclists, and transit riders. By integrating land use planning and transportation planning, complete streets can help to create more liveable communities and reduce reliance on cars (Smart Growth America, 2014)

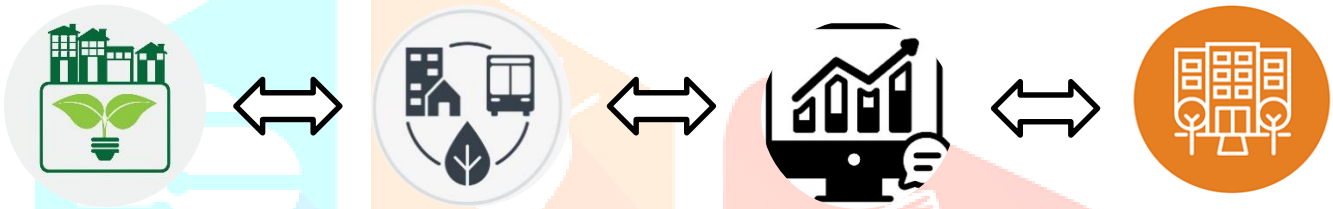

Figure 9 - Process for Integration from the bottom-top approach with the objective of sustainability (Source: Quikpik)

5) **Mixed-use development:** Mixed-use development is a land use planning strategy that combines different types of land uses, such as residential, commercial, and office, within a single development. By integrating infrastructure planning and land use planning, mixed-use developments can reduce the need for car-based transportation and promote walkability (Gehl, 2010)
6) **Sustainable urban drainage systems:** Sustainable urban drainage systems (SUDS) are a type of green infrastructure that manages stormwater runoff in urban areas. By integrating SUDS into land use planning and infrastructure planning, communities can reduce the risk of flooding, improve water quality, and create more sustainable environments (CIRIA, 2015)
7) **Compact development:** Compact development is a land use planning strategy that emphasizes the use of land in a more efficient manner, reducing the overall footprint of urban areas. By integrating infrastructure planning and land use planning, compact development can reduce the need for car-based transportation, improve access to amenities, and promote sustainable urban growth (Breheny, 1997)

2.4 OPPORTUNITIES FOR INTEGRATION

There are several opportunities for the integration of infrastructure and land use planning among which:

1) One opportunity for the integration of land use planning and infrastructure planning in India is the development of transit-oriented developments. They can provide affordable housing, employment opportunities, and access to public transportation, which can reduce the need for private vehicles and reduce traffic congestion.
2) Another opportunity is the use of renewable energy. By integrating land use planning and infrastructure planning, renewable energy projects can be developed on land that is currently of little economic value, such as barren land or landfills. This can create new economic opportunities while also reducing the dependence on fossil fuels and reducing the carbon footprint.
3) The integration of land use planning and infrastructure planning can also provide opportunities for the preservation of green spaces and natural resources. By considering land use needs together with infrastructure needs, planners can ensure that new infrastructure projects are developed in a way that minimizes the impact on the environment and preserves green spaces and natural resources.

4) Finally, the integration of land use planning and infrastructure planning can create opportunities for economic development. By considering land use needs together with infrastructure needs, planners can create projects that promote economic development and provide new employment opportunities.

Bhubaneswar:

Potential opportunity: Transit-Oriented Development - Bhubaneswar has the opportunity to implement transit-oriented development (TOD) principles, where land use planning and infrastructure development are integrated around transit nodes. This approach can promote mixed-use developments near major bus stops, railway stations, and future metro stations, reducing the reliance on private vehicles and improving accessibility for residents and businesses.

By developing vibrant commercial centers, recreational areas, and affordable housing options in close proximity to the Baramunda Bus Terminal, Bhubaneswar can create a walkable and transit-friendly neighborhood that encourages public transportation usage and reduces traffic congestion.

Cuttack:

Potential opportunity: Revitalization of Historic Areas - Cuttack has the opportunity to revitalize its historic areas through the integration of land use and infrastructure planning. Preserving and enhancing cultural and architectural heritage can attract tourism, boost economic activity, and improve the overall liveability of the city.

By promoting the adaptive reuse of heritage buildings, developing pedestrian-friendly streetscapes, and providing adequate parking and public facilities in the vicinity, Cuttack can transform areas like Choudhury Bazar and Nuapatna into vibrant heritage districts, attracting visitors and fostering economic growth.

New Town Kolkata:

Potential opportunity: Green Spaces and Ecological Connectivity - New Town Kolkata has the opportunity to create green spaces and enhance ecological connectivity through integrated planning. By preserving and integrating natural features, such as wetlands and urban forests, the city can provide recreational spaces, improve air quality, and promote biodiversity.

By developing a network of interconnected parks, waterfront promenades, and green corridors along ecologically sensitive areas, such as the East Kolkata Wetlands, New Town Kolkata can create a sustainable and resilient urban environment that offers recreational opportunities and protects the natural ecosystem.

Ranchi:

Potential opportunity: Integrated neighborhood Development - Ranchi has the opportunity to focus on integrated neighborhood development, where land use and infrastructure planning are combined to create self-sufficient and inclusive communities. This approach can provide mixed-income housing, educational and healthcare facilities, and local employment opportunities within walkable distances.

By integrating affordable housing, schools, healthcare centers, and commercial establishments in planned neighborhoods like Hinoo, Ranchi can ensure that residents have access to essential amenities and employment opportunities without the need for long commutes, thereby fostering social cohesion and sustainable community development.

5) Enhancing access to services, amenities, and employment opportunities.
6) Promoting sustainable transportation modes, such as walking, cycling, and public transit.
7) Reducing traffic congestion, air pollution, and greenhouse gas emissions.
8) Improving social equity, affordability, and liveability.
9) Fostering economic development, innovation, and resilience.

2.5 CHALLENGES FOR THE INTEGRATION MECHANISM

There are many major challenges faced by the eastern zone cities of India which face lateral and fractional challenges which does hamper the process of integration. Some of the challenges are explained below:

Bhubaneswar:

Major Challenge: Rapid Urbanization - Bhubaneswar has witnessed significant population growth and urban expansion, leading to challenges in managing land use and infrastructure. The integration process must address the demand for housing, transportation, and basic services while ensuring sustainable development.

The increasing number of residential developments and commercial centers in the city outskirts pose challenges in providing efficient infrastructure, such as transportation networks and utility services, to support these areas. The redevelopment of the Ekamra Kshetra area, which encompasses the historic Old Town, presents challenges in balancing the preservation of cultural heritage with the need for modern amenities, such as wider roads, drainage systems, and improved utilities.

Cuttack:

Major Challenge: Inadequate Infrastructure - Cuttack faces challenges related to outdated infrastructure, including road networks, public transportation, and water supply systems. The integration process must focus on improving existing infrastructure and developing new facilities to cater to the city's needs.

The inadequate road network in the core and outskirts of Cuttack causes congestion and limits connectivity. Coordinating land use planning with the expansion and improvement of road infrastructure is crucial to alleviating traffic issues and enhancing mobility. The challenge of upgrading the Old city area majorly in Buxibazar, Oriya Bazar informal settlement in Cuttack involves improving access to clean water, sanitation facilities, and electricity while ensuring the provision of affordable housing options and integrating the settlement with the surrounding urban fabric.

New Town Kolkata:

Major Challenge: Land Acquisition and Resettlement - New Town Kolkata encounters challenges related to land acquisition and resettlement for infrastructure projects. The integration process must address the complexities and sensitivities associated with land acquisition, ensuring the well-being of affected communities.

The development of the Rajarhat area in New Town Kolkata required the acquisition of agricultural lands, which resulted in the displacement of local farmers. Ensuring fair compensation, rehabilitation, and alternative livelihood opportunities are important considerations in the integration process. The challenge of integrating the Action Area III region in New Town Kolkata requires the provision of efficient transportation links, such as metro connectivity, road networks, and pedestrian-friendly infrastructure, along with the development of schools, healthcare centers, and commercial spaces to cater to the needs of residents.

Ranchi:

Major Challenge: Urban Sprawl - Ranchi faces challenges associated with urban sprawl and uncontrolled development. The integration process must focus on managing growth, preserving natural resources, and providing adequate infrastructure to accommodate the expanding urban areas.

The challenge of managing urban expansion in the Hatia-Dhurwa region and northern outskirts of Ranchi necessitates comprehensive land use planning to guide development, the establishment of green spaces and recreational areas, and the provision of efficient public transportation systems to minimize congestion and enhance the quality of life for residents

To collate on the overall matter, the below-given reasons are major threats as well as challenges to the integration process:

a) **Limited resources:** Research conducted by Sarkar and Bhattacharyya (2017) highlights the issue of limited resources in many Indian cities, which affects the development and implementation of comprehensive plans. This lack of resources can lead to incomplete or underfunded projects, which can further exacerbate existing problems.
b) **Inadequate data:** According to a study by Maiti et al. (2016), many cities in India lack the necessary data to develop comprehensive plans. This can hinder the development of accurate and up-to-date plans that reflect the needs and desires of residents.
c) **Limited public participation:** Research by Vaidya et al. (2018) indicates that public participation in the planning process is often limited in Indian cities. This can lead to plans that do not adequately reflect the needs and desires of residents, which can lead to ineffective implementation.
d) **Lack of enforcement:** Research by Goyal et al. (2016) suggests that even when integrated plans are developed and adopted, they may not be effectively enforced. This can lead to noncompliance and ineffective implementation of the plans.

Figure 10 - Challenges faced in the integration in the Eastern region of India (Source: Author)

e) **Lack of Funding**: Integrating infrastructure planning and land-use planning often requires significant funding, which can be a challenge for cash-strapped governments and private developers. For example, developing a new transit line and associated housing with commercial developments requires a substantial upfront investment.

2.6 ADVANTAGES OF INTEGRATED PLANNING PROCESS

Integrated infrastructure planning and land-use planning can provide several benefits, including:

1. **Enhanced Connectivity and Mobility -** Bhubaneswar can benefit from improved connectivity and mobility through the integration of land use and infrastructure planning. Coordinated efforts can result in efficient transportation networks, including well-connected roads, pedestrian-friendly pathways, and public transit systems. For e.g. by integrating the Baramunda Bus Terminal with nearby residential areas, commercial centers, and educational institutions, Bhubaneswar can enhance accessibility, reduce travel distances, and promote multi-modal transportation, benefiting both residents and commuters.
2. **Revitalization of Urban Centers -** Cuttack has the advantage of revitalizing its urban centers through integrated planning. By combining land use and infrastructure development, the city can rejuvenate commercial districts, preserve cultural heritage, and create attractive public spaces for social interactions. For e.g. Through the integration of land use planning and infrastructure improvements, Cuttack can transform areas like Badambadi Square into vibrant urban nodes with enhanced streetscapes, mixed-use developments, and public amenities, attracting businesses and promoting economic growth.
3. **Sustainable and Green Development -** New Town Kolkata can leverage integration to achieve sustainable and green development. By combining land use planning with eco-friendly infrastructure, the city can create green spaces, promote renewable energy, and improve environmental quality. For e.g. By integrating the design of New Town Eco Park with adjacent residential neighbourhoods, New Town Kolkata can provide residents with easy access to recreational spaces, promote biodiversity conservation, and contribute to a healthier and more sustainable urban environment. By integrating land use and infrastructure planning around the Janpath area, Bhubaneswar can create a vibrant mixed-use district with commercial spaces, recreational areas, and pedestrian-friendly streets, encouraging active transportation and reducing reliance on private vehicles.
4. **Balanced Neighbourhood Development –** Ranchi and Cuttack has the advantage of achieving balanced neighbourhood development through integration. By combining land use planning with the provision of essential amenities, the city can create self-sufficient neighbourhoods with diverse housing options, schools, healthcare facilities, and commercial centers. For e.g. Through integrated planning, Ranchi can develop areas like Ashok Nagar into self-contained neighbourhoods with a mix of residential, commercial, and institutional spaces, ensuring residents have convenient access to daily necessities and reducing the need for long-distance travel. By integrating land use and infrastructure planning in areas like Sector 9, Cuttack can develop mixed-income housing, recreational spaces, and community facilities within walking distance, fostering a sense of community and improving the overall liveability of the neighborhood.
5. **Smart and Sustainable City -** New Town Kolkata has the opportunity to become a smart and sustainable city by integrating land use and infrastructure planning, incorporating green spaces, and utilizing smart technologies for efficient resource management. By integrating land use and infrastructure planning in the vicinity of Eco Park, New Town Kolkata can create a green corridor with pedestrian-friendly paths, cycle tracks, and urban parks, providing residents with a sustainable and pleasant environment for recreational activities.
6. **Balanced Urban Growth -** Ranchi can achieve balanced urban growth by integrating land use and infrastructure planning, ensuring equitable access to amenities and services across the city, and preserving the natural environment. By integrating land use and infrastructure planning in the Morabadi area, Ranchi can develop a mixed-use neighborhood with educational institutions, healthcare facilities, and green spaces, providing residents with convenient access to essential services and promoting a balanced and sustainable urban environment.

2.7 CURRENT STATUS OF INTEGRATION CITY-WISE IN THE REGION

Bhubaneswar: Bhubaneswar has made significant strides in integrating land use and infrastructure planning. The city has implemented Transit-Oriented Development (TOD) principles in areas around key transit nodes like Master Canteen Square, Baramunda Bus Terminal, and future metro stations. Around 40% integration of the whole system has been achieved in the process. This has led to the development of mixed-use districts with commercial spaces, residential complexes, and improved pedestrian infrastructure, enhancing the overall urban environment.

Cuttack: Cuttack has undertaken initiatives to upgrade informal settlements and improve infrastructure in areas like Tala Tota and Buxibazaar. Efforts have been made to provide basic services like clean water, sanitation facilities, and electricity to these settlements, while also integrating them with the surrounding neighborhoods which have been achieved around 30% with a future target of 60% by 2031 w.r.t to the

masterplan. Enhancing connectivity through well-designed pedestrian pathways and roads has been a focus to ensure seamless integration.

New Town Kolkata: New Town Kolkata has emphasized green and sustainable development in its integration efforts. The city has preserved natural areas and developed green spaces, such as the green corridor along the Rajarhat Expressway. Smart technologies for resource management, including energy-efficient lighting and water conservation systems, have been integrated into new construction projects that aim to achieve complete sustainability by 2041. The focus has been on promoting sustainable living and creating a healthier urban environment.

Ranchi: Ranchi has aimed to achieve balanced and inclusive neighborhood development. Efforts have been made to provide mixed-income housing projects and allocate spaces for educational institutions, healthcare facilities, and community centers within residential areas. Around 20-30% of the pedestrian-friendly streetscapes with wide sidewalks and adequate lighting have been designed, along with the establishment of green spaces and recreational areas. Community participation has been encouraged to ensure inclusivity and address the specific needs of different neighborhoods.

3RECOMMENDATIONS FOR AN INTEGRATED PLANNING PROCESS

3.1 PROCESS BASED RECOMMENDATIONS

Based on the literature review, case studies, and self-analysis, several recommendations can be made for policymakers, planners, and stakeholders involved in infrastructure and land-use planning, such as:

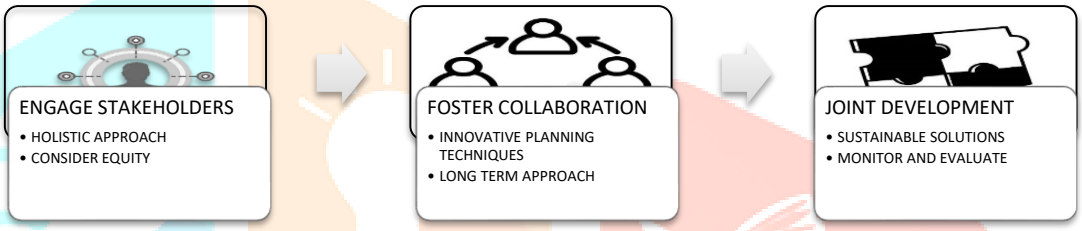

Figure 3 - With the bottom-top approach, the prime methodology is listed above (Source: Quikpik)

- **Use a holistic approach:** Adopt a holistic approach to planning that considers the interdependence between various sectors, such as transportation, housing, and environmental sustainability. This can help to identify synergies and conflicts between different sectors and ensure that planning decisions are made in an integrated way (Corrigan, 2004)
- **Adopt a long-term perspective:** Adopt a long-term perspective when developing integrated plans, taking into account future population growth, environmental challenges, and economic opportunities. This can help to ensure that plans are sustainable and resilient over the long term. (UNHSP, 2012)
- **Use technology and data:** Use technology and data to support integrated planning decisions. This can include using geographic information systems (GIS) to visualize and analyze data and using sensors and other technology to collect real-time data on traffic flows and environmental conditions (WB, 2017)
- **Consider equity:** Consider social equity and inclusiveness when developing integrated plans, to ensure that all members of the community have access to basic services and amenities, such as transportation, housing, and public spaces. This can include conducting equity analyses to identify areas of the city that are underserved or marginalized (NACTO, 2018)
- **Prioritize sustainable solutions:** Prioritize sustainable solutions, such as renewable energy, green infrastructure, and low-carbon transportation options, when developing integrated plans. This can help to reduce environmental impacts and build resilience to climate change (IISD, 2016)

3.2 PROPOSAL BASED RECOMMENDATIONS

Bhubaneswar:

Develop Transit-Oriented Development (TOD) Plans: Create master plans that promote compact, mixed-use development around transit nodes, such as major bus stops, railway stations, and future metro stations. This will reduce dependence on private vehicles and encourage walking, cycling, and the use of public transportation. Implement a TOD plan for the area surrounding the Jaydev Vihar Chowk and Vani Vihar, incorporating a mix of residential, commercial, and recreational spaces within walking distance of the transport zone, facilitating easy access and reducing traffic congestion. Designating the Baramunda Bus Terminal as a TOD zone would involve planning mixed-use developments, including residential, commercial, and recreational spaces, in close proximity to the terminal.

Cuttack:

Upgrade Informal Settlements: Implement slum upgrading programs that focus on providing basic infrastructure, such as improved water supply, sanitation, and electricity, in informal settlements. This will improve living conditions, enhance inclusivity, and ensure access to essential services for marginalized communities. Initiate an upgrading project in the Ganga Nagar slum area, incorporating improved housing, sanitation facilities, and community spaces, while involving the residents in the planning and decision-making processes. Focus on upgrading the Tala Tota slum in Cuttack by providing improved housing, water supply, sanitation facilities, and community spaces, while also integrating the area with nearby neighborhoods to enhance social cohesion and uplift the living conditions of residents.

New Town Kolkata:

Preserve and Enhance Ecological Features: Incorporate ecologically sensitive areas, such as wetlands, urban forests, and water bodies, into the city's master plan. Develop green corridors and ecological networks that connect these areas, ensuring ecological conservation, promoting biodiversity, and providing recreational spaces for residents. Designate the East Kolkata Wetlands as a protected area within the city's planning framework, preserving its unique ecosystem while creating nature trails, bird-watching spots, and eco-parks for residents and visitors. Develop a green corridor along the Rajarhat Expressway in New Town Kolkata, incorporating landscaped open spaces, cycling and walking paths, and stormwater management systems

Ranchi:

Plan for Balanced Growth: Develop a comprehensive land use plan that guides the city's growth in a balanced manner. Ensure the availability of social infrastructure, such as schools, healthcare facilities, and community centers, in all neighborhoods, including both established and emerging areas. Designate new growth centers, such as the Hatia-Dhurwa region, for mixed-use development, incorporating residential, commercial, and recreational spaces alongside essential services, allowing residents to access amenities within their neighborhoods. Focus on developing an inclusive neighborhood in Doranda, Ranchi, with affordable housing, mixed-income communities, and integrated social amenities fostering a sense of community and ensuring a balanced and sustainable urban environment.

4CONCLUSION

Integrating infrastructure planning and land-use planning can lead to more efficient, effective, and sustainable development outcomes. However, it also poses challenges, such as conflicting priorities, stakeholder resistance, institutional fragmentation, and funding constraints. Effective integration requires collaboration and coordination among multiple actors and sectors and innovative planning tools and techniques.

Policymakers, planners, and stakeholders should prioritize joint infrastructure and land-use planning that incorporates sustainability, equity, and resilience principles and objectives and ensure adequate funding and resources for planning, implementation, and monitoring. Monitoring and evaluating the impacts and outcomes of integrated infrastructure and land-use planning efforts is also critical for adjusting strategies accordingly. The integration of infrastructure planning and land-use planning is critical to achieving sustainable and equitable urban and regional development in India. While there are challenges to integration, several Indian cities have successfully integrated infrastructure planning and land-use planning, providing examples for other cities to follow. The benefits of integration include efficient use of resources, improved social equity, enhanced sustainability, and improved resilience.

To overcome the challenges, there is a need for coordination between multiple agencies and stakeholders, adequate funding, and political will and leadership to ensure that the benefits are distributed fairly across different communities and demographic groups. By prioritizing integration, Indian cities not only on the eastern frontiers but all over the country can ensure that they are equipped to meet the needs of their residents and businesses while also contributing to the overall development of the country. Ultimately, integrating processes is critical to achieving sustainable and equitable urban and regional development.

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