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Smart Urbanization and Green Infrastructure in Mitigating Climate Change in the Asia

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Abstract: The research paper entitled '*Smart Urbanization and Green Infrastructure in mitigating Climate Change in the Asia Pacific Region*' is a study of the challenges and opportunities of urban planning in the Asia Pacific region with a focus on climate change. The paper advocates the importance of sustainable financing, transparent management and effective governance to achieve sustainable urban planning without compromising on climate challenges. The other aspects covered in the study include role of UNESCAP in promoting green infrastructure, UN Habitat and Sustainable Urbanization, Effects of Global Pandemic on Urbanization and Sustainable Development Goals, Trends in Urbanization and its trajectories in Asia Pacific, Cities and the Energy Crisis, Urban Planning Policies and Frameworks, Integrated Urban and Territorial Planning, Measures Adopted for Promoting Smart Urbanization and Green Infrastructure in Asia Pacific Region, Issues concerning Green Resilient and Inclusive Cities, Capacity Building within urban climate resilience in the global south, Impact of Climate Change in the Wake of Rapid Urbanization in Cities in the Asia Pacific Region, the Global South and other regions and Urban Resilience Trust Fund (URTF) of Asian Development Bank in mitigating Climate Change in Asia Pacific region. It is observed that these issues are inter-linked and the overall focus of the study has been to examine these issues in the context of rapid pace of smart urbanization and green infrastructure taking place in the Asia Pacific and in developing strategies and suitable measures to resolving the burgeoning climate crisis which the Asia Pacific region is facing. It is learnt that the URTF has been a major instrument of ADB in providing technical assistance and investment grants in key thematic areas and in promoting integrated resilience planning, foster resilient infrastructure investments and facilitate a robust exchange of knowledge on climate and disaster risk mitigation in the Asia Pacific region. Overall, the paper suggests sustainable, human-centered approaches and effective resource management for balanced urban development in the Asia Pacific region. It also emphasizes a holistic approach and ongoing collaboration for sustainability. The key limitations and challenges of the study are financial difficulties, privatization, short political cycles and institutional limitations that need to be addressed.

Keywords: Smart urbanization; Green Infrastructure; Climate change mitigation; Asia Pacific, ADB, UNESCAP



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1. Introduction

The research paper identifies and highlights the challenges and opportunities of urban planning in the Asia Pacific region with a focus on climate change. The paper emphasizes the importance of sustainable financing, transparent management and effective governance to achieve sustainable urban planning without compromising on climate challenges. It is understood that climate issues are being discussed/deliberated in various international forums in coordination with key stakeholders such as inter-governmental agencies, multilateral development banks/financial institutions, national governments including sub-national governments, academic institutions, non-governmental organizations and civil societies to address these issues and arrive at concrete solutions to mitigate the burgeoning problem of climate change. A multi-stakeholder ship approach and a multi-pronged strategy would go a long way in mitigating the issue of climate change. In this regard, the Asia Pacific region plays a paramount role in climate change adaptation and mitigation measures by tackling the climate vulnerabilities, floods, hurricanes, tsunamis, earthquakes etc., that the region has been experiencing particularly in the LDCs and the SIDCs of the region. Climate measures such as climate adaptation and mitigation measures need to be adopted. It is learnt that urban planning is possible by adopting green infrastructure.

2. Climate Change and Green Infrastructure and Growth of Cities in Asia Pacific Region

Cultural, religious and socio-economic influences on awareness of green infrastructure are important parameters vital for advocating the promotion of environmental awareness and education. It is understood that climate risks are major impediment which threaten the sustainability of green infrastructure thereby necessitating resilient planning. Climate change is one of the most significant obstacles to the growth of cities, but despite it, a balanced approach has to be adopted to achieve the twin objectives of urbanization and growth of cities in one hand and environmental sustainability on the other. It is a well-known fact that urban green infrastructures are a way to achieve sustainable urban development by improving sustainability, resilience, and the quality of urban life,

reducing the impact of climate change, protecting biodiversity and enhancing the environmental health of cities in the region. This is a proven fact and most of the stakeholders working in these areas would appreciate this. Given the rapid pace of urbanization taking place in the Asian cities, government entities, local authorities, urban strategists and international experts are actively seeking ways to incorporate urban planning methodologies and environmentally friendly infrastructure in Asia Pacific cities. This is a welcome step, though it is a difficult task. In this regard, the issue of “Urban planning and green infrastructure under a changing climate in Africa” in the context of Africa may be referred as it is crucial, and emphasizing the need for urban planning in Africa to address the challenges posed by climate change while creating more resilient, environmentally friendly and livable urban environment. The same could be replicated in the Asia Pacific context, if found feasible. Therefore, this aspect could be considered to be implemented in the Asia-Pacific region while adopting and implementing green infrastructure strategies in the region.

3. Review of Literature

The review of literature on the research study covers the following aspects and its implications in the context of Asia Pacific region for envisaging the implementation of smart urbanization, green infrastructure and environmental sustainability in the region:

(i) Rapid urbanization is putting pressure on green infrastructures, which are essential components of compact and sustainable cities as indicated by **Brom et al. (2023)**. Hence, rapid urbanization could lead to promotion of sustainable cities in the region.

(ii) Green infrastructure uses natural and environmentally friendly elements to address environmental issues such as climate change adaptation. Parks, wetlands, green roofs, and storm-water management systems are some of the features of green infrastructure as mentioned by **Culwick et al. (2016)**. Hence, adoption of effective green infrastructure would entail climate change adaptation.

(iii) As global climate change impacts urban areas, the need for green infrastructure is increasing as stated by **Evans et al. (2022)**. Thus, global climate change impacts urbanization.

(iv) Climate change may lead to significant

consequences, such as droughts, floods, and other disturbances in the ecosystem as described by **Matamanda et al. (2017)**. It is an alarming fact that the Asia Pacific region, particularly the Small Island Developing Regions are mostly affected by floods, droughts, tsunamis, earthquakes etc.,

(v) Cities in Asia Pacific region face climate change related challenges, including water management, food security, catastrophe resilience and adaptation to changing climatic conditions. According to **Sharifi (2021)**, rapid urbanization may exacerbate these problems. These are perennial problems affecting the region and would continue, if proper and adequate measures are adopted in the region.

(vi) Strategies for achieving this include developing environmentally sustainable structures, establishing green areas for temperature control and water conservation, promoting public transportation and implementing effective waste management systems as noted by **Chukwu et al. (2023)**. Thus, the whole aspect of environmental sustainability entails achieving these objectives.

(vii) **Whitten (2023)** argues that green infrastructures provide a conceptual framework and practical planning instrument to tackle complex environmental problems by integrating economic, ecological and social elements into planning policies and practices. This would go a long-way in promoting environmental sustainability.

(viii) Regionally, some of the largest cities were seeing a decline in net migration in 2021 compared to the rising urban-born population growth. (**IOM, 2021**).

(ix) Urban areas are ideally suited for financing and implementing green technologies that can lower per capita fossil fuel consumption (**UN-Habitat, 2022**). This is a welcome step.

(x) Disruption in fuel supply chains and growing energy demands has led to record prices for natural gas, coal and oil, prompting many Asia-Pacific countries to regulate prices and reduce non-essential energy consumption (**Yep, 2022**). Given the vulnerabilities which the region is facing and the rapid pace of urbanization taking place in the region, a call needs to be taken on this aspect to achieve the twin objectives of smart urbanization and environmental sustainability, without compromising climate change.

(xi) Projections also indicate that the proportion of elderly is expected to increase to 16 percent of the

population of Asia by 2040 (**Jong-Wha, 2018**). This is alarming due to fast-track smart urbanization taking place in the region.

4. Research Methodology and Key Outcomes

The research methodology adopted basically rest on the aspects/issues discussed/deliberated and relevant policy suggestions made in the research study. The aspects/issues dealt at length are viz; urban planning with a focus on climate change, role of UNESCAP in promoting green infrastructure, UN Habitat and Sustainable Urbanization, Effects of Global Pandemic on Urbanization and Sustainable Development Goals, Trends in Urbanization and its trajectories in Asia Pacific, Cities and the Energy Crisis, Urban Planning Policies and Frameworks, Integrated Urban and Territorial Planning, Measures Adopted for Promoting Smart Urbanization and Green Infrastructure in Asia Pacific Region, Issues concerning Green Resilient and Inclusive Cities, Capacity Building within urban climate resilience in the global south, Impact of Climate Change in the Wake of Rapid Urbanization in Cities in the Asia Pacific Region, the Global South and other regions and Urban Resilience Trust Fund(URTF) of Asian Development Bank in mitigating Climate Change in Asia Pacific region. It is observed that these issues are inter-linked and the overall focus of the study has been to examine these issues in the context of rapid pace of smart urbanization and green infrastructure taking place in the Asia Pacific and in developing strategies and suitable measures to resolving the burgeoning climate crisis which the Asia Pacific region is facing. Hence, an optimum and balanced approach is required to balance the between the twin objectives of achieving green growth and smart urbanization without compromising the issue of climate change and environmental sustainability in the region. It is learnt that the URTF has been a major instrument of ADB in providing technical assistance and investment grants in key thematic areas and in promoting integrated resilience planning, foster resilient infrastructure investments and facilitate a robust exchange of knowledge on climate and disaster risk mitigation in the Asia Pacific region.

5. Role of UNESCAP in promoting Green Infrastructure

The Economic and Social Commission for Asia and

the Pacific (ESCAP) is the most inclusive and robust intergovernmental platform functioning and working in the Asia-Pacific region for the development and growth of the region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five umbrella regional commissions of the United Nations. The ESCAP supports inclusive, resilient and sustainable development in the region by working on promotion of action-oriented knowledge, and by providing technical assistance and capacity-building services in support of national and local development objectives, regional agreements and the implementation of the 2030 Agenda for Sustainable Development.

6. Linkages between UN Habitat and Sustainable Urbanization

UN-Habitat works in close coordination and in tandem with governments and partners in promoting Sustainable Development Goals, in particular Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable. In the fast-changing urbanizing world, UN-Habitat promotes transformative change in cities and human settlements through knowledge, policy advice, technical assistance and collaborative action to leave no one and no place behind. This is done as per the UN Charter. Its programs aim to advance sustainable urbanization as an engine of growth and a driver of development and peace towards building a better quality of life for all in the region. As countries and cities across Asia and the Pacific struggle to recover from the health and socio-economic crisis resulting from the COVID-19 pandemic, the effects and vagaries of climate change continue to ravage the region in a sustained manner. The issue of climate change has been perceived as a global phenomenon by the United Nations which has been adopting a multi-stakeholder ship approach by coordinating with the various stakeholders and bring them into one platform to deliberate on these issues and find out tangible solutions to mitigate the issues of climate change. Geopolitical tensions and the growing food and energy crisis are undermining prospects for a true recovery and are, consequently, placing the aspirations of the New Urban Agenda

and localization of the Sustainable Development Goals in the region seemingly out of reach. This would result in delay in achieving the UN SDGs slated to be achieved by the turn of 2030.

Current data from the Economic and Social Commission for Asia and the Pacific (ESCAP) show that the Asia-Pacific region is not on track to achieve any of the Sustainable Development Goals and is regressing with regard to Sustainable Development Goal 13 on climate action, as climate change is a perpetual global crisis, if not addressed timely and effectively. Further, climate change issues are being deliberated in international fora on a sustained basis to arrive at concrete solutions to the global crisis not only in Asia Pacific region, but in the entire world in the near future. Progress has slowed down while the compounding crises have led to rising inflation globally. Higher prices are driving countries, especially low-income countries, into debt distress, thereby hampering the growth and development in the region. This seems to be a major cause of concern in the region.

7. Effects of Global Pandemic on Urbanization and Sustainable Development Goals

The socio-economic consequences of the pandemic and the subsequent energy and food crises and the food-climate-finance nexus including the global poly crisis which the region has been encountering and further worsened by the Ukraine crisis, though not directly linked to the region, are compounding existing challenges of urbanization in the region. In cities around the world, the COVID-19 pandemic has exposed long-standing vulnerabilities and highlighted the need to comprehensively address such issues of affordability and livability. Notably, the pandemic has served as a turning point, the need for the region's urban centers to build resilience to future shocks and stressors has never been more evident. Cities across the developing and developed world are again at the frontline of the multiple inter-linked crisis and city-level responses remain critical for building resilience and ensuring the achievement of the Sustainable Development Goals.

To strengthen urban and territorial planning, the research study has focused and analyzed the current dynamics faced by cities in the Asia-

Pacific region as they grow and evolve spatially, especially due to the consequences of unplanned accelerated urbanization. It is focused on the interconnected network of systems within cities, and the benefits of urban and land-use planning and compact cities to improve quality of life, resilience and sustainability. The role of holistic approaches to urban and territorial planning is fundamental to addressing the challenges related to all aspects of urban life in the region, including mobility, equitable access to services and affordable housing, especially for people living and working in informal settlements, have also been highlighted in the study, among other aspects.

8. Trends in Urbanization in Asia Pacific

Urbanization across Asia and the Pacific is driven by a variety of forces. A primary factor for urban population growth is the natural population increase from new generations of city-born urban dwellers. This population growth is alarming given the scale and pace of urbanization taking place in the region. Another important contributing factor is administrative re-classification, as urban boundaries expand or rural settlements urbanize through development and population growth. The demographic and geographic dynamics of the region affect the growth and development of the region thereby affecting environmental sustainability. Both internal and cross-border migration are also important contributors to urbanization in many countries, as millions of people move from rural areas or other countries to towns and cities in search of employment, education and other opportunities. As reported by World Bank (2022), the proportion of the rural population in India decreased significantly from 82 per cent in 1960 to 65 per cent in 2021, complemented by a concomitant increase in the urban population from 17.9 per cent in 1960 to 35 per cent in 2021.

9. Cities and the Energy Crisis

Though cities are often associated with negative environmental impacts, well-managed urban areas can benefit the planet, and in turn the region. Among other potentially positive outcomes, cities and towns can promote more compact land use and

deliver better access to essential services, such as sanitation, waste management and public transport. Thus, the issues of waste management, sanitation and transportation affect the region to a considerable extent on account of this crisis occurring in the region. They can also provide the necessary scale for energy-efficient services and infrastructure, resulting in lower per capita emissions. Rapid economic growth and urbanization has resulted in an increase in demand for energy in the region. The current energy crisis has aggravated and heightened existing issues, such as the high dependency on fossil fuels and an uneven power distribution network in the Asia-Pacific region, particularly in informal settlements. Higher energy prices push countries into debt-distress and further burden urban households affected by loss of income and food insecurities. Protests against rising and volatile energy costs are occurring in cities, which are prolonging economic recovery, thereby hampering economic development and environmental sustainability in the region. The energy crisis has exacerbated existing recovery challenges in cities. These include ensuring energy access for all, particularly power reliability and clean cooking in informal settlements and limited uptake of renewable energy technologies and efficiency improvements in key urban sectors, such as transport. Hence, there needs to be a multi-sectoral approach adopted strategically to tackle the burgeoning energy crisis in the region.

10. Urbanization Trajectories in the Asia Pacific Region

Cities are the drivers and engine of growth in the Asia Pacific region. Urban and territorial planning can play a significant role in not only shaping the future of cities in the Asia-Pacific region, but also in improving quality of life and reducing inequality. Prioritizing equitable distribution and utilizing universal design principles ensures barrier-free access to services that consider the specific needs of marginalized and vulnerable population groups, including the elderly, women, people with disabilities and young people.

According to ESCAP, as of 2016, a total of 717 million young women and men aged 15 to 24 live in the Asian and Pacific region, accounting for

more than 60 per cent of the world's young people. Gender disparities are more acute in the urban areas. Women, especially those from marginalized communities, encounter barriers when trying to access basic services, such as water, sanitation, housing, transport, education and health care, as distance, affordability, safety and cultural norms, for example, present obstacles that prevent them from fully participating in urban life and accessing essential amenities.

11. Urban Planning Policies and Frameworks

National urban planning policies continue to evolve across the region in line with an increasing focus on sustainable urban development, resilience, inclusivity, climate action, smart cities and participatory processes. These policies facilitate an integrated approach and vision for urban and territorial planning that considers urban-to-rural linkages and fosters a common vision and cooperation across different levels of government and stakeholders, as advocated by the New Urban Agenda (NUA). Thus, the adoption of the framework and strategic urban planning policies would go a long way in achieving all round development of the region.

12. Countries in Asia Pacific Region adopting Integrated Urban and Territorial Planning

Several countries in the region are prioritizing integrated urban and territorial planning as a fundamental principle to support sustainable urban development. These efforts encompass promoting compact and well-planned cities, sustainable transport systems, energy efficiency, waste management and the conservation of natural resources. Malaysia, for instance, has successfully implemented national urban planning policies to guide sustainable development and urban growth, exemplified by the National Physical Plan (NPP). This is a unique achievement. The NPP is focused on long-term spatial planning policy, providing a comprehensive framework for land-use development across the country. Malaysia has been successful in guiding sustainable urban development and fostering balanced regional growth. However, the implementation of the plan has encountered

challenges due to limited capacity and resources, lack of coordination among different government agencies and levels, and difficulty in establishing effective monitoring and evaluation mechanisms. In view of this, it is suggested that other countries in the region need to promote such activities for the development of the region.

13. Measures Adopted for Promoting Smart Urbanization and Green Infrastructure in Asia Pacific Region

(i) Promote integrated, compact, mixed-use neighbourhoods and cities supported by public transport and active mobility to meet climate and sustainability targets

To promote the establishment of integrated compact mixed-use neighborhoods and cities during multiple crises with the objective to foster resilience, sustainability and social cohesion, Asia-Pacific governments must prioritize, develop and implement key strategies. This entails revising zoning and land-use policies to facilitate mixed-use development, developing guidelines and urban planning strategies that encourage universal design principles to ensure barrier-free access to cities and services, especially for women, the elderly, people with disabilities and young people, fostering public-private partnerships to support the development of these neighborhoods, engaging local communities, ensuring social equity investing in infrastructure and connectivity, reforming regulations to streamline processes, and establishing monitoring and evaluation mechanisms. By adopting these policy recommendations, governments can create urban environments that are compact, economically vibrant, socially inclusive and environmentally sustainable, which would result in improved livability and quality of life for residents in the region. A continued commitment and comprehensive approach to integrated transport and land-use planning can further enhance sustainable mobility. Financial support needs to be directed to public transport and active mobility infrastructure and services, including shared bikes, e-bikes, e-scooters and ride hailing. Safe road infrastructure and parking, clear regulations, affordable prices, and payment methods that are also accessible to low-income groups would, therefore, need to be

considered (ESCAP, 2021).

(ii) Scale up local-level adaptation by integrating climate adaptation considerations into decentralized governance processes and resources

It is a well-known fact that the countries in Asia and the Pacific are highly exposed to the adverse impacts of climate change. These impacts are largely manifested at the sub-national government level (both provincial or state governments and local government bodies) and the underlying drivers of vulnerability are inherently context specific. It is widely recognized that adaptation solutions at all levels are critical, as emphasized in the Paris Agreement 2015 of the UNFCCC. Many countries in the region have made progress in developing responsibilities related to climate adaptation and resilience building in sub-national governments through adoption of climate change and disaster risk management-related legislation and institutions which typically mirror the process of decentralization. However, actual implementation of decentralization of climate adaptation-related responsibilities on the ground remains limited because of gaps in technical knowledge and capacity, data, and limited financial resources. Institutional frameworks for climate change adaptation must be part of decentralized governance and administration processes in the region.

14. Green Infrastructure for Urban Development Planning to help Cities Adapt to Climate Change Threats in the Asia Pacific

Green infrastructure (GI) in cities is increasingly acknowledged as a way to contribute to tackling the challenges posed by climate change. However, studies analyzing ‘urban inhabitants’ attitudes towards green infrastructure when dealing with climate change effects are still scarce. Raising public awareness of climate change has been a prerequisite for the implementation of urban policies aiming to tackle their threats (e.g. heatwaves, storms, droughts and floods). Green infrastructure (GI) is increasingly acknowledged as fundamental for the adaptation of cities to climate change (Ramyar, Ackerman, & Johnston, 2021) since it provides thermal comfort as well as helps to control storm water flow (Kabisch, Stadler, Korn, & Bonn, 2016; Li & Wang, 2021). Despite several studies proposing different GI

solutions for adapting to climate change (e.g., Demuzere et al., 2014; Lo & Byrne, 2017), Byrne, Lo, and Jianjun (2015) emphasize that there is a need for studies analyzing in-habitants’ attitudes towards green infrastructures (GIs) as an accepted way for cities to adapt to climate change in the region. Behind this need is the assumption that planning for climate adaptation requires public participation and engagement in order to allow the definition of successful policies by public entities, despite the absence of a large confirmatory empirical evidence that such relationship exists (Wamsler et al., 2020). In fact, the involvement of the public in complex and conflicting problems does not necessarily generate better public decisions. (Burton & Mustelin, 2013). & Mustelin, 2013).

Rapid global urbanization is increasing the vulnerability of cities to climate change effects, thereby increasing urban social and environmental challenges, and in this context, GIs can play a crucial role in climate risk adaptation.

15. Issues concerning Green Resilient and Inclusive Cities

It is a well-known fact that cities in high and upper middle-income countries are major contributors to climate change whereas the contribution of cities in lower-income countries is modest and low. Globally, about 70 percent of anthropogenic greenhouse gas emissions, the bulk of which are fossil carbon dioxide emissions, emanate from cities. Asia Pacific region contribute to a sizeable amount of it due to massive urbanization taking place in the region. Cities in lower-income countries, however account for only about 14 percent of all global urban carbon dioxide emissions in 2015 and cities in low-income countries contributed less than 0.20 percent. The greatest mitigation challenge for cities in lower-income countries is to develop without following the historic carbon dioxide emissions trajectories of cities in higher-income countries.

16. Impact of Climate Change on Cities in Asia Pacific region

Climate change related shocks and stresses can affect the greenness, resilience, and inclusiveness of cities through a wide array of direct and indirect channels in the region. Moreover, these shocks often do not occur

in isolation and can be compounded by underlying urban challenges that arise from the pressure of growing urban populations on urban infrastructure, the supplies of basic services, land and housing, and the environment. Climate hazards can also cascade into cities from surrounding rural areas, as well as from areas on which a city might depend for its water supply. Inequalities within cities, which, especially for many cities in low and lower-middle income countries, are already large, may be further exacerbated by climate change related shocks and stresses. And, while cities have traditionally been thought of as providing escalators out of poverty (Glaeser 2012), climate change may slow the speed of these escalators. The climate change related shocks and stressors that affect green, resilient and inclusive development in cities do not occur in isolation but often interact and compound, both with each other and with other urban stressors. Tropical cyclones and extreme heat events are related and often occur simultaneously frequently in the region. Poorly managed urban development pressures that lead to the removal of urban trees and destruction of urban wetlands could compound the effects of heat waves and floods in the region. Losses in agricultural production from heat and drought, compounded both by the excessive loss of fertile agricultural land on the peripheries of cities due to sprawl associated with poorly managed urbanization and by heat-induced reductions in the productivity of workers, could affect the food supply. Risks can spill over across populations, places, and sectors, leading to cascading impacts. Rural migrants fleeing drought events can settle in precarious informal settlements in urban floodplains, with cascading risks for some groups of people and locations. Wildfires in agricultural regions can increase urban air pollution while also disrupting the supply, and thus prices, of essential food products. The general interdependence within cities of critical infrastructure, such as transportation systems and power grids, means that failure of one element or node could result in a cascade of adverse events. Thus, storm surges and extreme heat could lead to power outages. Other underlying stresses within cities not necessarily related to climate change can also exacerbate its effects. For example, high rates of informal dumping of waste worsen pluvial floods because of the accumulation of refuse in drains, waterways, and open spaces. According to the Intergovernmental

Panel on Climate Change, multiple climate hazards will continue to occur simultaneously, thereby compounding overall risk and causing risks to cascade across sectors and regions (IPCC 2022).

17. Green Infrastructure and Climate Resilience of Urban Neighborhoods and its Implications for the Asia Pacific Region

It is noticed that recent years have witnessed the emergence of various initiatives in response to the changing global climate and its impacts on the built environment in the region. These actions encompass parallel efforts to mitigate future negative climate change manifestations and foster climate resilience. To that end, collective intelligence, defined as the capacity of people and their joint action to address complex challenges, has been increasingly recognized as a crucial factor in tackling climate-related problems and achieving sustainable development, as evidenced by studies, in the region.

Urban growth, especially in developing countries, often conflicts with sustainable growth. Green infrastructure emerges as a critical element of the quality of the urban environment. The importance of green infrastructure is multi-faceted. Significantly, green infrastructure possesses the unique capacity to actively enhance the quality of the living environment, while other sustainability-related measures primarily focus on mitigating environmental damage.

Numerous international studies have highlighted the positive role of green infrastructure in mitigating the effects of climate change on different components and aspects of urban areas, including urban built infrastructure, socio-economic needs, energy consumption, flora and fauna, the urban heat island (UHI), ambient temperature, air quality, human health, and others in the region. A direct correlation exists between the quality of green infrastructure and climate resilience. Furthermore, the concept of nature-based solutions is applicable across diverse climates and human settlements in the region. Given the inherent connection to human nature, it is reasonable to expect that people may be more receptive to engaging in spatial actions related to nature-based solutions. At the national level, therefore, it is necessary to identify climate resilience as a high priority

item, to determine the neighborhood as an optimal spatial scale to deal with resilience, and to assign to neighborhood communities the role of principal contributors. Achieving these goals will necessitate revision of existing and introduction of new spatial, social, and climate policies, clear assignment of roles and responsibilities, and appointment of appropriate decision-makers. At regional and local levels, specific action plans that operationalize the national program need to be developed and put into place. This would go a long way in promoting smart urbanization, green infrastructure backed by attainment of environmental sustainability in the region.

18. Capacity Building within urban climate resilience in the global south

Capacity building for urban climate resilience is essential for strengthening both cities' own capacities and multi-level governance, which are instrumental for the successful operationalization of the Paris Agreement. In fact, the Paris agreement focuses on technical assistance, financial assistance and capacity building in the developing countries which include the Asia Pacific region and the global south. Strengthening the capacities for planning, managing and developing cities is required to support an urban resilient transition in a context of high complexity and uncertainty, especially in the Global South. The main objective is to investigate the differences in understanding of capacity building in urban climate resilience in the Global South. Specifically, the focus is on the main approaches, aspects, components and end users for capacity building in the frame of urban climate resilience. Identification of a set of parameters such as Capacity Building Parameters and Enabling Factors which are Purpose, Transformative Capacity, Multi-actor, Participation, Knowledge and Learning, Transdisciplinary as well as Data and Finance is paramount to develop the skills and capacity building of the community at large in the region. The Capacity Building Parameters and Enabling Factors can serve as a basis to develop an analytical framework to assess existing capacity building initiatives and to support the development of new capacities for planning, management and developing cities for an urban resilient transition in the region.

19. Impact of Climate Change in the Wake of Rapid Urbanization in Cities in the Asia Pacific Region the Global South and other regions

Climate change is imposing significant impacts on the Global South, exacerbating existing vulnerabilities, particularly in the context of rapid urbanization. This phenomenon and the consequential expansion of major urban centers in the Global South have coincided with the rapid emergence of highly vulnerable urban populations (Revi et al., 2014). Projections indicate that the Global South will experience the fastest urbanization rates in the coming decades (UN, 2018), with Africa and Asia expected to contribute to 90 percent of the projected 2.5 billion increase in global urban population between 2018 and 2050 (Lwasa et al., 2022). Specifically, Asia is projected to account for a significant portion of global urban population growth, with over half of the world's urban population residing in the region by 2050. Meanwhile, Africa is undergoing rapid urbanization, with its urban population projected to triple by 2050. In contrast, urbanization in Latin America and the Caribbean, is already high, with over 80 percent of the region's population living in urban areas, and the growth rates are slowing down (UN, 2018). Moreover, cities, including those of Global South are confronted with significant threats posed by climate change, including more frequent and intense weather events such as hurricanes, droughts, cyclones and flooding with sea-level rise resulting in negative impacts (IPCC, 2023). The effects of climate change can further exacerbate existing vulnerabilities and urban challenges, thereby rendering it difficult to address the persistent issues, such as poverty, inequality, deficits in proper housing and others. Therefore, capacity building emerges as a vital aspect for addressing the impacts of climate change, especially in rapidly urbanizing areas, yet it poses a particular challenge, in the context of the Global South (Klinsky and Sagar, 2022), where vulnerability to those impacts is most pronounced (Bulkeley and Castán Broto, 2013).

The rapid pace of urbanization within Global South is currently surpassing existing policies, tools, means and capacities required to manage it adequately (Spaliviero et al., 2020). This urban expansion is compounded by inadequate capacities to address climate related risks (Solecki et al., 2018). In particular, the implementation

of local climate measures in these cities faces obstacles stemming from insufficient institutional, financial and technical capacities (Sharifi et al., 2017; Lwasa et al., 2022; Pillai and Narayanan, 2022) as well as a lack of political commitment (Susskind and Kim, 2022). Particularly challenged in terms of capacity building are the small and medium size cities experiencing rapid urban growth, thus are likely to be more exposed and vulnerable to climate risks (Solecki et al., 2018). These cities encounter further constraints, including limited access to technology, financial resources and skilled human capital.

20. Capacity Building for Climate Action in the region and Role of UNFCCC and Paris Agreement

Capacity building for climate actions is becoming increasingly important within the frame of major international policies and treaties at the global level, including the United Nations Framework Convention on Climate Change (UNFCCC). The Marrakesh Ministerial Declaration in 2001 at the 7th Conference of the Parties (COP 7) of the UNFCCC launched two frameworks addressing the needs, conditions and priorities for capacity building in developing countries and countries with economies in transition (UNFCCC, 2002). In 2011, the COP 17 launched the first Durban Forum to share experiences and good practices in building the capacity of developing countries to respond to climate change (UNFCCC, 2012). Capacity building became prominent within the global scene especially since 2015 when COP 21 adopted the Paris Agreement, specifically Article 11, stating that capacity building should increase capacities and abilities of developing countries, to take effective climate change action, facilitate technology development, and enhance aspects of education, training and public awareness (UNFCCC, 2015). COP 21 also established the Paris Committee on Capacity-Building (PCCB) (Ferraz da Silva, 2022; Nautiyal and Klinsky, 2022), which is a mechanism to address current and emerging gaps and needs, in implementing and further enhancing capacity building in developing countries, particularly those that are most vulnerable to the impacts of climate change. The PCCB facilitates the identification of capacity building needs, priorities and gaps, and aims to enhance countries capacities to implement climate actions plans and adapt

to climate change effects (UNFCCC, 2016, 2017). Therefore, the PCCB plays a crucial role in helping developing countries build the necessary institutional, technical and human capacities to meet the Paris Agreement obligations.

21. Multilevel Governance System Approach

Multilevel governance system is needed at the country level to manage the urbanization and climate effort at the local level enhanced by capacity building processes. Moreover, there is a need to enhance sub-national level capacity for climate change mainstreaming for institutions to carry out effective climate risks and opportunities assessments (Fatemi et al., 2020). In terms of the local governments, they are fundamental actors responsible for managing their territory, thus being on the front line of urban climate resilience. They are also the first public reference to local communities. However, cities (local governments) are often side-lined in case of a disaster, while they should be strengthened as highlighted in, among others, in Pickett, Goedverwacht and Velddrif, South Africa (Moser and Pike, 2015; Ziervogel et al., 2016). Moreover, local governments need to change their governance approaches to meet climate change challenges better and recognize the priorities of and include the urban poor, which is of the most fundamental requirements for building capacity (Susskind and Kim, 2022). This can be done by practicing diverse modes of governance, using formal, informal, centralized, and decentralized actor networks, and supporting intermediaries as they connect different stakeholders and governance levels, exemplified, again, in the urban context of South Africa (Ziervogel, 2019). Multi-actor approach is already a recognized practice within capacity building that further needs global mainstreaming. It can be promoted and implemented in the Asia Pacific region to a great extent. In addition, working with the capacity building across international, national and local levels is fundamental, as disasters and climate change cannot be targeted only on the local level but should be built by actors representing various governance levels. Hence, a multi-actor approach to capacity building involves engaging diverse stakeholder groups that represent all the social and political domains of a city, essential for mutual learning and effectively framing and addressing challenges. Furthermore, it requires the participation of multiple governance levels

to provide support and facilitate coordinated efforts, thereby enhancing the impact of actions.

22. Urban Resilience Trust Fund of Asian Development Bank in Mitigating Climate Change in Asia Pacific region

Urban Resilience Trust Fund (URTF) of ADB was instituted in 2023 as a collaborative multi-donor trust fund, which is dedicated to mitigating climate change and disaster risks for select cities across Asia and the Pacific. It provides technical assistance and investment grants in key thematic areas. URTF aims to support integrated resilience planning, foster resilient infrastructure investments and facilitate a robust exchange of knowledge on climate and disaster risk mitigation. This would go a long way in mitigating climate change and disaster risks in the region.

The URTF aims to play a pivotal role in safeguarding cities in Asia and the Pacific from climate related impacts and disasters in eight thematic areas viz;

- (i) Integrated urban policy, regulations, strategic planning and assessment,
- (ii) Nature-positive solutions
- (iii) Air quality management
- (iv) Integrated water, sanitation and solid waste management
- (v) Disaster resilience
- (vi) Green house gas reduction, energy efficiency and adaptation measures
- (vii) Urban mobility and social services improvement
- (viii) Community Empowerment

The list of approved projects undertaken under URTF through ADB financing are:

- (i) Bangladesh: Salinity Management Study for Khulna Water Supply Project Phase 2
(URTF Direct Charge Support: \$225,000)
- (ii) Indonesia: Nusantara GREEN Project - Growing Resilience and Ensuring Equality in Nusantara
(URTF Technical Assistance Support: \$2,000,000)
- (iii) Regional: Leveraging the ADB Climate and Health Initiative to Strengthen Low-Carbon and Resilient Health Systems in Urban Areas
(URTF Technical Assistance Support: \$3,000,000)
- (iv) Regional: Scaling up Investments in New Business Areas in the Water and Urban Development Sector
(URTF Technical Assistance Support: \$3,000,000)

(v) Regional: Capacity Development and Knowledge Support Facility for Urban Resilience

(URTF Direct Charge Support: \$225,000)

(vi) Palau: Koror-Airai Sanitation Project – Additional Financing

(URTF Investment Grant Support: \$2,000,000)

(vii) Solomon Islands: Resilience and Engagement for Advanced Community Waste Management in Western Province

(URTF Technical Assistance Support: \$2,000,000)

23. Cities Development Initiative for Asia Trust Fund (CDIA-TF) of Asian Development Bank (ADB)

CDIA TF was approved and established by ADB in October 2017 under the Urban Financing Partnership Facility (UFPF). CDIA's objectives include (a) assisting secondary cities in ADB's developing member countries in preparing sustainable and bankable urban infrastructure projects, (b) ensuring financing for these projects and (c) strengthening stakeholder capacities in the preparation of high priority investments. Using a demand-driven approach, CDIA supports the identification and development of urban investment projects that emphasize two or more of the following impact areas viz; (a) urban environmental improvement, (b) urban poverty reduction, (c) climate change mitigation and adaptation and improved governance.

a) Partnership Building Initiatives on conduct of events by CDIA for tackling climate crisis and mainstreaming climate finance in the region

CDIA has established new partnerships and maintained existing ones with international and national organizations to pursue PPSs, capacity development, and outreach opportunities. It collaborated with key network partners for the following activities:

• Twelfth Session of the World Urban Forum

CDIA has partnered with United Cities and Local Governments Asia-Pacific, Cities Climate Finance Leadership Alliance, United Nations Capital Development Fund, ADB Urban Resilience Trust Fund, CDP and Sustainable Infrastructure Foundation to organize five events at the World Urban Forum on 4–8 November 2024 in Cairo, Egypt. In line with the WUF12 theme of “It All Starts at Home: Local Actions for Sustainable Cities and Communities,” these sessions

featured insightful discussions for tackling the climate crisis and mainstreaming climate finance in cities.

- **Urban-Act Webinar Series**

CDIA was invited by Urban-Act: Integrated Urban Climate Action for Low-carbon and Resilient Cities Project to present at their webinar titled “An untapped frontier? Matchmaking and city to city exchange for climate financing” on 27 March 2024. The webinar provided an opportunity for CDIA to engage with participants on the challenges and solutions for securing financing for cities.

Organization of these seminars/webinars in the region for making people aware and in developing their capacities and knowledge would help in tackling climate crisis and mainstreaming climate finance in the region.

24. Limitations of the Study and Concluding Observations

The key limitations and challenges of the study are financial difficulties, privatization, short political cycles and institutional limitations that need to be addressed in the region, apart from other issues. Legal gaps hinder urban planning implementation, underscoring the need for appropriate legal frameworks. Coordination between government levels and long-term vision is essential to addressing political and administrative challenges. Overall, the study suggests sustainable, human-centered approaches and effective resource management for balanced urban development in the Asia Pacific region. It also emphasizes a holistic approach and ongoing collaboration for sustainability, and more so, environmental sustainability.

- The following policy pathways are suggested for consideration by policy makers which rests on a discussion on how they could be implemented in the Asia Pacific region. These aspects/issues broadly cover urban planning, affordable housing, transport, extreme weather events, climate-related hazards, low-carbon and resilient urban cities, enhanced data collection and evidence for informed decision to accelerate climate action in cities and platforms for monitoring, reporting, verifying and integrating multi-level climate action. The details are reflected below :

- Create a policy environment for transformative and resilient urban planning, enabled by multi-

level governance.

- Ensure capacity-building and coordination for effective urban planning and local action.

- Develop holistic housing, urban planning, and disaster-risk management policies, strategies and regulations to tackle the affordable housing crises in cities.

- Promote integrated, compact, mixed-use neighbourhoods and cities, supported by public transport and active mobility to meet climate and sustainability targets.

- The Asia-Pacific region remains vulnerable to extreme weather events and climate-related hazards which carry significant implications for cities. The rapid pace of urbanization, often coupled with rising greenhouse gas emissions, inadequate infrastructure, limited financial resources and competing development priorities, complicates efforts to implement effective climate mitigation measures.

- To advance low-carbon and resilient urban futures, cities in the Asia-Pacific region should consider adopting the policy recommendations supported by an enabling environment at the national, sub-national and regional levels.

- Integrate urban communities as key actors to build resilience against climate and other shocks.

- Deploy innovative urban adaptation pathways to address existing and new climate risks.

- Enhance data collection and local evidence to inform and accelerate climate action in cities.

- Shift to low-carbon sources to tackle the urban energy crisis.

- Provide platforms for monitoring, reporting, verifying and integrating multi-level climate action.

- Harmonize and enhance nature in cities to address climate, clean air and biodiversity crises.

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