

# Upstream Planning For Sustainable Infrastructure Projects

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## Urban 20 White Paper

An Inter-American Development Bank (IDB) White Paper for the Urban 20 (U20)



Authored by:



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## About Urban 20

Urban 20 (U20) is a new city diplomacy initiative developed under the leadership of Horacio Rodríguez Larreta, Mayor of the City of Buenos Aires and Anne Hidalgo, Mayor of Paris and Chair of C40 Cities Climate Leadership Group (C40). Launched on December 12, 2017 at the One Planet Summit in Paris, the initiative is chaired by the cities of Buenos Aires and Paris, and convened by C40, in collaboration with United Cities and Local Governments (UCLG).

What U20 seeks, is to highlight the expertise of cities in a range of global development challenges and to raise the profile of urban issues within the G20. U20 will offer solutions and clear recommendations to national leaders for their consideration ahead of the 2018 G20 Summit. The first year of the U20 initiative will culminate in the inaugural U20 Mayors Summit in Buenos Aires, October 29-30. With this event, U20 will remain a stepping stone toward ensuring an ongoing dialogue between cities and the G20.

In 2018, 26 cities have participated in Urban 20: Barcelona, Beijing, Berlin, City of Buenos Aires, Chicago, Durban, Hamburg, Houston, Jakarta, Johannesburg, London, Los Angeles, Madrid, Mexico City, Milan, Montreal, Moscow, New York, Paris, Rio de Janeiro, Rome, São Paulo, Seoul, Sydney, Tokyo, and Tshwane.

For more information, please visit: [www.urban20.org](http://www.urban20.org)

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## About the White Papers

Urban 20 is proud to present a series of White Papers from our Strategic and Advisory Partners that highlight the most relevant topics on the cities development agenda and the forthcoming urban trends. These papers define the challenges that local governments are currently facing and offer open recommendations supported by relevant, up-to-date research and data. The intention of this work is to broaden the understanding and perspective of decision makers and stakeholders as to enhance their ability to tackle these most pressing issues. The White Papers also represent the hard work and dedication of these agencies and organizations to keep the public well informed about the ongoing efforts to address the present and future challenges we share as humankind.

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Upstream Planning For Sustainable Infrastructure Projects is a White Paper prepared by IDB as a voluntary contribution to enrich the discussions of the Urban 20 process. Buenos Aires, Argentina.

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The IDB is the main source of multilateral financing in Latin America. It provides solutions to development challenges and support in the key areas of the region. We work to improve lives in Latin America and the Caribbean. Through financial and technical support for countries working to reduce poverty and inequality, we help improve health and education, and advance infrastructure. The Bank's current focus areas include three development challenges – social inclusion and inequality, productivity and innovation, and economic integration – and three cross-cutting issues – gender equality and diversity, climate change and environmental sustainability; and institutional capacity and the rule of law.

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The views, opinions, positions and recommendations expressed in this White Paper are solely those of the individuals and their organisations. They do not necessarily reflect those of Urban 20 or any of its chairs, conveners, partners and participating cities.

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# Executive summary

Upstream planning and institutional strengthening are central to ensuring a sound pipeline of infrastructure projects that are well-conceived and well-orchestrated. However, significant challenges exist, such as insufficient technical expertise, lack of reliable political frameworks, the silo mentality, and lack of funding capacity at the city scale. These challenges, among others, are preventing the integration of sustainability practices throughout the early phases of the infrastructure planning.

The interconnected and dynamic nature of cities, the frequent discrepancies between local, sub-national, and national requirements, in addition to cross-sectoral partnerships, add complexity to this already complex planning process. As a result, in order to ensure the integration of sustainability goals at the upstream planning stage, three strategic areas have been defined: (i) institutional sustainability and cost-effective infrastructure, (ii) social sustainability and inclusive infrastructure, and (iii) environmentally sustainable and climate resilient infrastructure; **In line with the IDB framework to guide sustainability across the Project Cycle.**<sup>1</sup>

The Institutional sustainability and cost-effective infrastructure strategic area aims to enhance multi-level government cooperation, to promote long-term territorial planning, and to enhance capacity-building as essential components for promoting infrastructure sustainability in a cost-effective manner. The social sustainability and inclusive infrastructure strategic area seeks to enhance social integration, leverage cultural contributions, and to minimize urban displacement. Additional consideration is given to ancillary goals such as providing affordable services, creating healthy and safe environments, and leveraging urban areas to boost productivity and development. Many of these matters have become more relevant in the last few years as cities have been recognized as amplifiers of positive and negative externalities. The third and last strategic area, environmentally sustainable and climate resilient infrastructure, includes goals related to further development of sustainable and renewable energy sources, urban resilience, mitigation of climate change, protection of the natural environment, and promotion of public transportation.

The use of interactive solutions, digital technology, and data-driven decision making are expected to play an increasing role in the planning process of infrastructure projects while cities seek potential solutions to these widely known challenges. To achieve the previously mentioned goals and challenges, several high-level policy recommendations and context-based solutions have been identified.

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<sup>1</sup> **The IDB Sustainable Infrastructure framework** forms the basis of the IDB Group working definition of sustainable infrastructure as “infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project”.

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# Glossary

## **Building Information Modeling (BIM):**

BIM is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure (Autodesk).

## **National Planning**

Territorial Planning for the whole territory of the State (UNESCO).

## **Nationally Determined Contributions (NDCs)**

NDCs are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change (UNFCCC).

## **Natural Capital**

Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible (World Forum on Natural Capital).

## **Regional Planning**

Territorial Planning for a part of a nationally significant territory of the State (UNESCO).

## **Sustainable Development Goals (SDGs)**

The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity (UNDP).

## **Sustainable Infrastructure**

Sustainable infrastructure refers to infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social, environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project.

## **Territorial planning**

Project created for a defined territory, which according to the Program of Social and Economic Development and regularities of development of society and environment, forecasts exploitation of a territory and

determines requirements of development of land and other exploitation (UNESCO).

## **Urban Areas**

An urban area is the region surrounding a city. Most inhabitants of urban areas have nonagricultural jobs. Urban areas are very developed, meaning there is a density of human structures such as houses, commercial buildings, roads, bridges, and railways. "Urban area" can refer to towns, cities, and suburbs. (National Geographic).

## **Urban Resilience**

The capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience (100 Resilient Cities).

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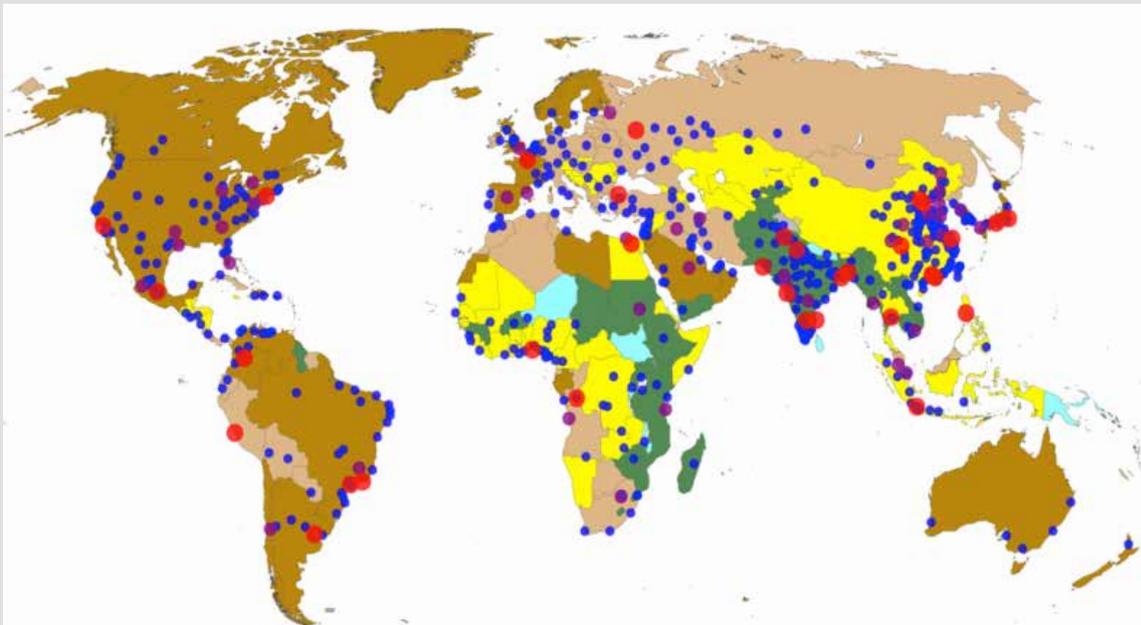
# 1. Introduction

## 1.1 Why urban sustainable infrastructure?

Throughout the last decades, cities have been referred to as the drivers of economic growth and productivity worldwide. As a result, promoting urbanization while bolstering infrastructure and urban planning has the potential to provide for critical development in many areas of the globe (UN Habitat, 2011). Investing in sustainable infrastructure is crucial to achieving three fundamental challenges facing society, all of which require adequate upstream planning. These are: promotion of economic growth, meeting the targets of the Sustainable Development Goals (SDGs), and preparation for, and mitigation of, natural disasters. (New Climate Economy, 2016). Solving these challenges will require a substantial increase in investment in infrastructure, estimated to be US\$90 trillion over the next 15 years (New Climate Economy, 2016).

According to the latest United Nations estimates, currently 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 (United Nations, 2018). The urban populations of the world have been growing at a rapid pace, exemplified by 82% of North Americans living in urban areas in 2018, and 81% in Latin America and the Caribbean. The level of urbanization in Asia is now estimated at 50% and has been steadily increasing throughout the last few years (United Nations, 2018). This growth is forcing cities to face unprecedented economic, demographic, fiscal, and environmental challenges which prompt a need for modern, efficient, and reliable infrastructure (Puentes, 2015). Cities may provide an ideal setting for sustainability-oriented innovation; however, if growth and development are not carried out correctly, cities have the potential to become a focus for inequality, lack of access to basic services, and the exploitation of limited resources. For this reason, it is important to consider that if the current trajectory does not change, cities could soon become the largest concentration of unsustainable and inequitable human activities across the globe (Allen et al., 2015).

**Figure 1. World Urbanization Prospects: The 2018 Revision**



**Source:** 2018 United Nations, DESA, Population Division.



Source: BID Ciudades Sostenibles

The inevitable need for new infrastructure to support rapid population growth represents a huge challenge, yet it also provides a unique opportunity for the creation of sustainable solutions. Sustainable development relies on the effective management of rapid urban evolution. This is especially true in countries with middle to low income economies, where the pace of urbanization is expected to be accelerated and aspects such as “planned densification”, access to services, and low-carbon and multimodal transportation systems play a much greater role.

The incorporation of sustainability requirements into policy, legislation, regulation, and organizations will create opportunities to develop infrastructure assets that:

- improve the quality of life of urban residents,
- are inclusive,
- identify and manage any potential social or environmental impacts,
- take the impacts of climate change into consideration while incorporating resilience strategies, and
- have adequate long-term management systems in place that can prevail throughout the project's lifecycle.

From this perspective, it is the responsibility of planners, government leaders, and society to understand and accept this need so that sustainability becomes the only way to think, design, and operate infrastructure in order to ensure the habitability and long-term growth of a city.

## 1.2 The urban planning process

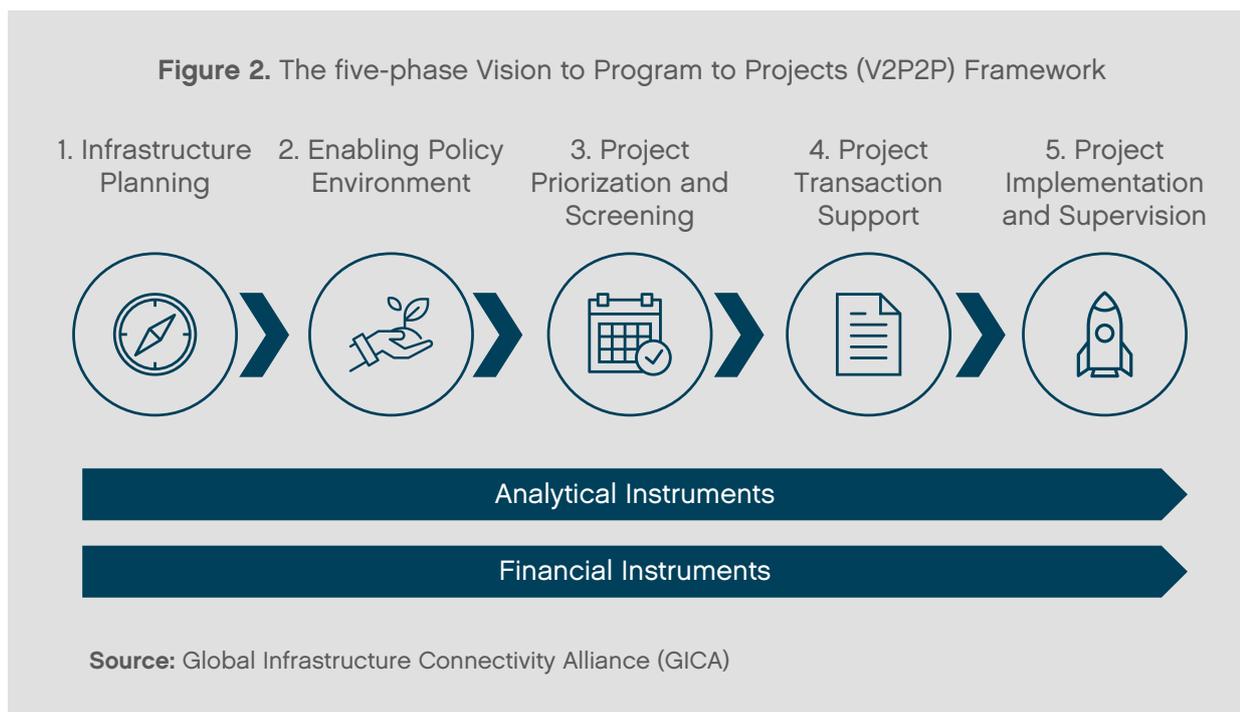
Improved sustainability outcomes along with more timely decision-making in terms of infrastructure planning processes is a goal in our current society. It is widely understood that sustainability and quality project outcomes are, and should be, considered synonymous. The greatest opportunities and ability to influence sustainability outcomes are at their highest levels during the early stages of the planning process, but this potential decreases as the project progresses from the planning and design stage to that of construction and operation.

The importance of integrated planning for infrastructure projects has long been acknowledged, however, it is important to recognize that the structure and planning, vital to infrastructure production, requires a high degree of sophistication. The long-term lock-in effects of infrastructure, and the need to deliver on high-level global agreements such as the Sustainable Development Goals (SDGs), should be a key consideration when defining an upstream planning strategy. This strategy should help define programs and projects that address key questions, such as:

- Why is this project of merit?
- How does this project contribute to achieving other high-level goals?

- What will provide the revenue stream throughout the lifecycle of the project?
- Is this project affordable in the long-term?
- What alternatives have been considered?

Numerous groups such as the OECD, the World Economic Forum and initiatives like the Global Infrastructure Connectivity Alliance (GICA) hosted by the World Bank have highlighted the importance of “multi-sectoral and multi-dimensional planning strategies”. As a result, the Global Infrastructure Connectivity Alliance (GICA) recently published their Vision to Program to Projects framework, also referred to as V2P2P. This framework aims to identify the different phases and some of the existing tools to be used during the upstream level of an infrastructure project. These phases are: (i) Infrastructure Planning, (ii) Enabling Policy Environment, (iii) Project Prioritization and Screening, (iv) Project Transaction Support, and (v) Project Implementation and Supervision (Figure 2).



**Infrastructure Planning:** Strategic planning should start with identifying the need for infrastructure, followed by defining the long-term vision of the area of influence. This phase should integrate sustainability principles and develop a sector master plan in which the differences between sectors are taken into consideration, as are the synergies among them.

**Enabling Policy Environment:** Improvement to the investment environment, regulatory frameworks, and governance is central to attracting capital for sustainable infrastructure. Several tools such as the Country Readiness Diagnostics (World Bank, 2016), which measures the country’s “readiness” to implement PPPs or the Development Policy Financing (DPF) (World Bank, 2015) which “provides rapidly-disbursing financing to help a borrower address the financing requirements and promote policy reform” are some of the tools that can assist in identifying a more positive policy environment (GICA, 2018).

**Project prioritization and Screening:** This phase allows the government to select the most vital projects when multiple technical and economically feasible projects exist. Rigorous project prioritization will ensure that the funds are used on the most strategic projects, thereby creating the highest socio-economic impact. The planning process should also take into consideration the risks and uncertainties inherent in project selection, future uses of assets, as well as the potential positive and negative externalities generated by the selection.

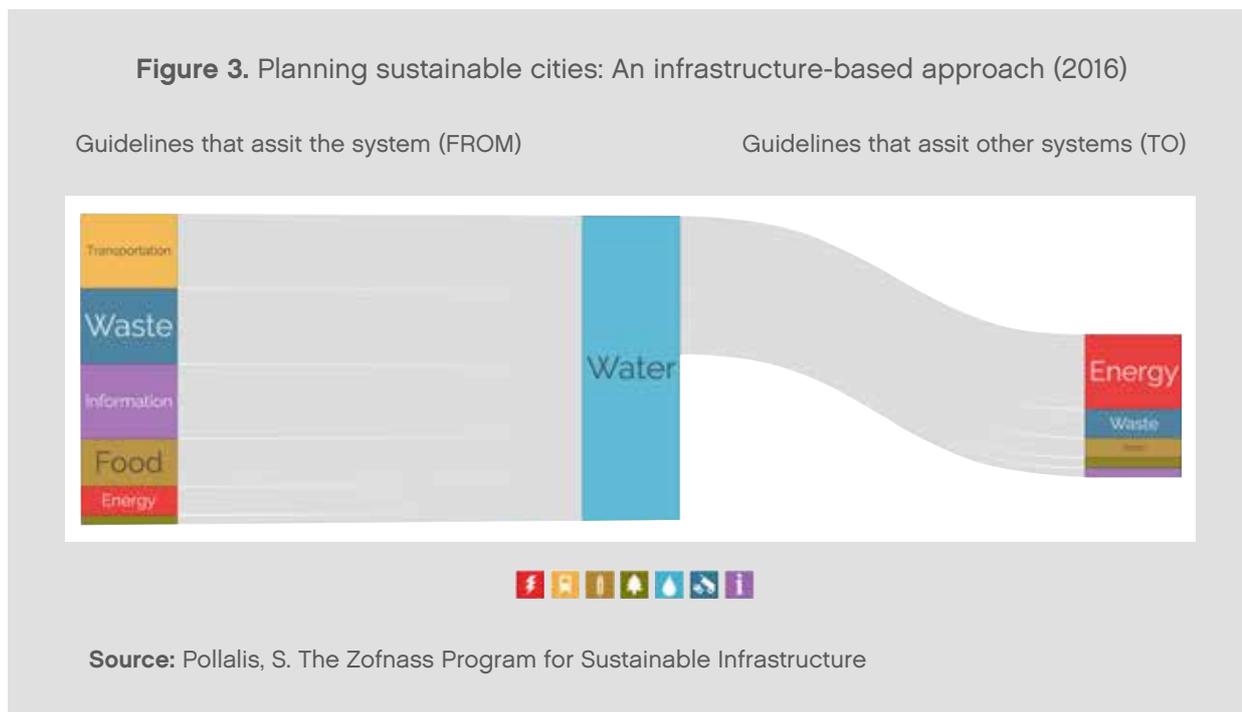
**Project Transaction Support:** Applied at the project level, this phase assesses the different sustainability requirements, technical or otherwise, that would ensure a successful project outcome. Adequate management of the infrastructure assets is necessary to elicit funding and/or financing, and to guarantee long-term affordability of the project (GICA,2018). The UK sustainable Infrastructure Program – administrated by IADB – is an example of a unique integrated approach to include sustainability elements at the project structuring phase stage, by combining technical cooperation, blended finance investments, and investment grants to aid throughout the project transaction and address barriers to investment for sustainable infrastructure in a systematic manner.

**Project Implementation and supervision:** This phase will require the incorporation of sustainability related performance indicators and management plans which would allow for the monitoring, management and supervision of a project consolidation. Specific tools and standards have been created in recent years to help anchor the quantification of the project's success in clearly defined objectives. These objectives can be financial, social, environmental, etc.

## 2. Analysis

### 2.1 The urban challenge

Cities are a large web of complex and interconnected systems. The connections and overlaps between these systems need to be understood to take full advantage of their synergies and to improve upon their efficiency (Figure 3).



Sustainable infrastructure is vital to the creation of sustainable cities, and integrated planning is vital to the creation of sustainable infrastructure. However, significant challenges exist for the incorporation of sustainable practices in the early phase. The most relevant obstacles are (i) lack of technical expertise, (ii) lack of reliable political frameworks and standardized solutions, (iii) the silo mentality and, (iv) lack of funding capacity.

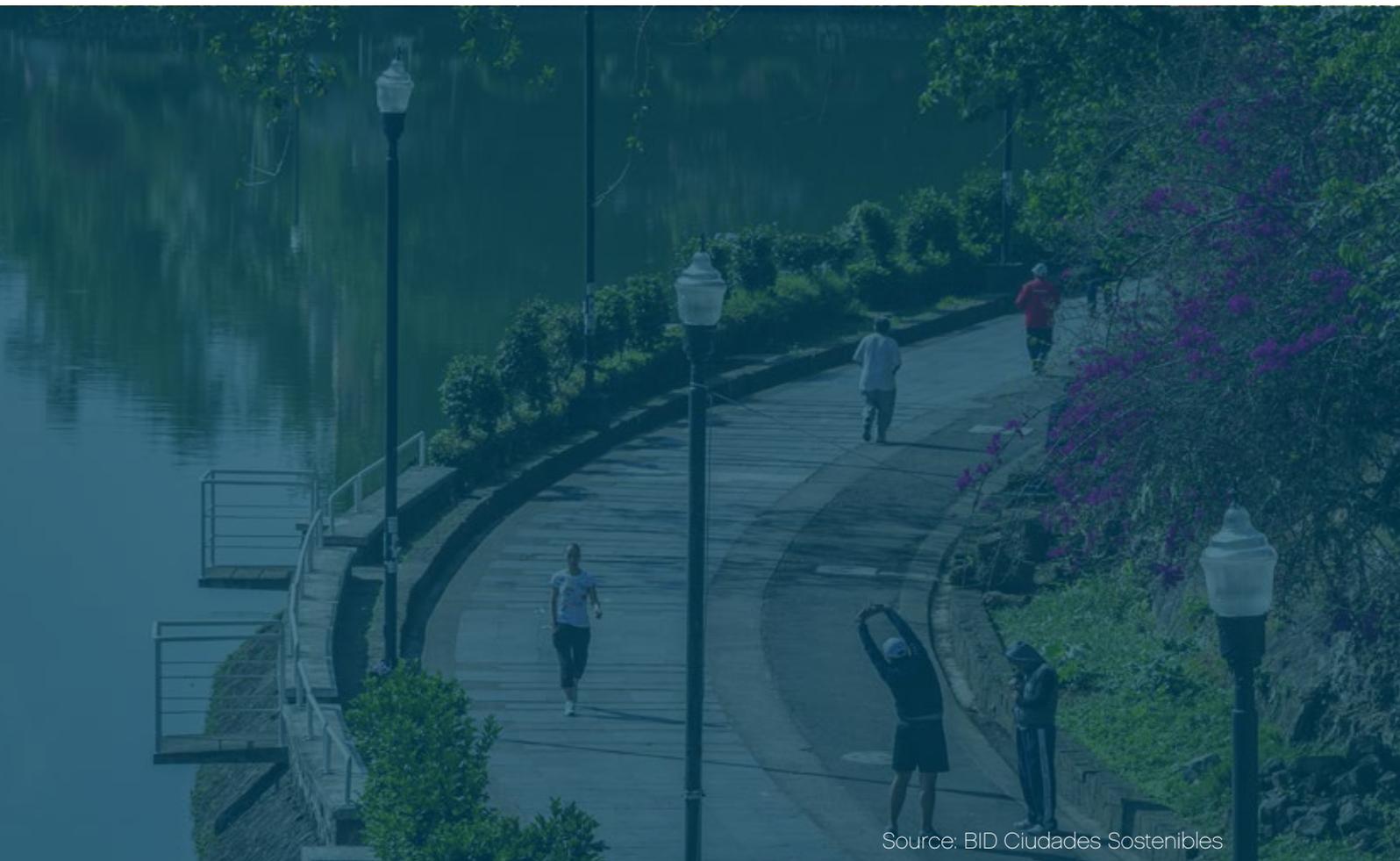
(i) **Lack of technical expertise.** Medium sized cities (from 100,000 to 500,000) are experiencing

the fastest rates of growth around the world (United Nations, 2016). However, these areas often lack the technical and political expertise to ensure effective sustainable infrastructure planning. This lack of capacity generates bottle-necks during project delivery, establishing a “business-as-usual” alternative, thereby limiting the capacity to incorporate sustainable practices during the upstream phase.

**(ii) Lack of reliable political frameworks and standardized solutions.** The creation of a well-developed urban context requires frameworks that ensure an orderly planning process as well as the possibility to replicate solutions in a consistent manner. The divergence among local, sub-national, and national requirements and the lack of standardized solutions creates systemic inefficiencies and adds unnecessary complexity to the incorporation of sustainability applications.

**(iii) The silo mentality.** Considering the interconnected nature of cities, a cross-sectoral approach is central to delivering on the common urban agenda. Recognizing obstacles which prevent institutions from connecting, as well as establishing special incentives for collaboration, and identifying third-party intermediaries, are some of the strategies that can help to break down these silos (Roth, R., 2015). Research shows that some of the main obstacles preventing cooperation include ambiguity of roles, fear of conflict, blurry geographic boundaries, and leadership struggles, amongst others (Froy & Giguère, 2010).

**(iv) Lack of funding capacity.** Key decisions regarding sustainable infrastructure will be made at the local level. However, lack of creditworthiness in addition to limited financial resources generates a significant bottleneck in the development of well-executed infrastructure projects. As a result, new financing mechanisms are needed to mobilize resources for the project’s preparation phase, thereby ensuring the design of the most desirable alternative.



## 2.2 Sustainability considerations at the upstream planning stage

The definition of sustainability goals is oftentimes framed around the integration of triple bottom line targets (social, environmental, and economic) within the project lifecycle. However, as previously mentioned, the integration of policy and institutional guidelines is key to ensuring compliance with the law and maintaining alignment with more ambitious strategic goals and a long-term vision. The core sustainability considerations to be integrated during the early phase of an infrastructure asset are divided into three main groups (i) building institutional sustainability and cost-effective infrastructure, (ii) creating more socially sustainable and inclusive infrastructure, and (iii) environmentally sustainable and climate resilient infrastructure.

### 2.2.1 Building institutional sustainability and cost-effective infrastructure:

**“It would be disastrous if bad planning policy meant that today's new developments become tomorrow's climate slums”.**

Tim Yeo MP, chairman of the House of Commons  
Environmental Audit Commission, 2007

In each of the numerous infrastructure systems, different players operate over broad spatial scales including those existing at local, regional, national, and international levels. Added to these complexities, every actor is driven by distinct interests and constraints, resulting in a very complex task for those trying to optimize each system to provide economically efficient, spatially equitable and environmentally sustainable outcomes (Oughton and Tyler, 2013).

Municipalities have an extensive scope of functions, primarily regarding the conformity and enforcement of national policies, that encompasses planning management, comprising proper allocation of licenses and permits, and the delivery of proper public services. Rigid policies and overregulation are, amongst others, facets which inhibit the integration of sustainability practices within local governments and prevent the establishment of common objectives between different levels of governance (OECD, 2010). Ambiguity exists among the different levels of government. While policymakers at a national level consider pushing the boundaries of legal and management frameworks to be appropriate, local level officials on the other hand are apprehensive about breaking rules to implement non-streamlined practices (Froy & Giguère, 2010). As such, flexibility in the management of government policies has been identified by some as one of the key requirements for policy integration at the local level. This flexibility may include the capacity to influence the design of policies and programs, the power to decide how budgets are allocated, the facility to negotiate and define performance targets, and the ability to designate frameworks to be applied during the process (Froy & Giguère, 2010). This flexibility will also allow for the integration of sustainability goals as part of the infrastructure design and will ensure coherence between sectoral policy targets.

To attain systemic change, a holistic approach to infrastructure planning should be achieved. Nowadays, however, projects are optimized on a project by project basis, and insufficient attention is given to the analysis of the synergies between two or more infrastructure projects. Because infrastructure projects tend to have an impact beyond that of the distinct sub-sector for which they are designed, it is vital to identify, analyze, and plan urban infrastructure with a systems approach, thus integrating the different governance structures of all of the numerous infrastructure sectors and sub-sectors. This will allow for the maximization of positive impacts of multi-sector projects from the early planning stages.

Integration of innovative solutions and different procurement methods along with obtainment of new skills will require increased levels of institutional capacity. This is recognized by the SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development, and is specifically acknowledged by its target, 17.9 in regard to capacity-building. Effective-targeted capacity-building is necessary to support the implementation of sustainable development (also applicable to infrastructure sustainability).

Early phase policy frameworks should ensure the most cost-effective allocation of resources to achieve sustainability outcomes. Therefore, project profitability, service affordability, and maintenance cost should be considered from the early phase of the project while accounting for positive and negative externalities. Each of these considerations should be grounded in a long-term vision of the urban area to be defined, as exemplified in the case below (Box 1).

## Box 1: Long-term institutional sustainability. The case of Singapore

Sustainability has always been important to Singapore's urban planning. In the 1960s, when the country was facing high unemployment rates with an unskilled labor force, along with a lack of key urban assets that support public infrastructure such as adequate sanitation, decision makers chose to transform the country into a green livable place. In lieu of the fact that Singapore was a newly industrialized country, several bold steps were taken towards this goal, thereby ensuring long term sustainability. Starting in 1963, the Garden City campaign took a leading role. This initiative was followed by a larger public cleaning plan, the Keep Singapore Clean campaign, in 1968. Shortly thereafter, the Clean Air Act was introduced in 1971, which helped to reduce air pollution.

Singapore's sustainability efforts were integrated into a systematic framework following three main principles: boost the country's economy, maintain a sustainable environment, and enhance people's quality of life. Most importantly, the leaders were aware that solutions to achieve one outcome could create opportunities for another, exemplifying the importance of a holistic approach towards sustainable territorial planning.

The foundation of Singapore's integrated urban planning is based on the use of digital planning tools which assist in the provision of future land use by merging data from government entities at each level. The government and private institutions have at their core a well-thought-out process for engagement and cooperation (MEWR, 2015).

To develop and implement integrated policies with sustainable approaches, Singapore has adopted a Whole-of-Government approach, which helps to establish a more creative and sustainable policy-making process. This method of governing involves the sharing of information among all public agencies, thus unveiling challenges and opportunities by widening decision-makers' worldviews early on. Accessing key aspects of the country from multiple perspectives decreases the spillover effect that normally comprises policies developed by different levels of government, in this way making the national policy framework more robust and concise. Singapore has also designed the Inter-Ministry Committee, which helps the country achieve its Sustainable Development Goals (SDGs) (MFA, 2018).

## 2.2.2 Creating a more socially sustainable and inclusive infrastructure:

**“It is difficult to design a space that will not attract people. What is remarkable is how often this has been accomplished”.**

The Social Life of Public Spaces, William H. Whyte (1980)

**Source:** Design for Social Sustainability. A framework for creating thriving new communities, 2011.

Urban environments are considered melting pots of different cultures and traditions. Planning processes should recognize this cultural diversity and create spaces where cultural identity can be shared with a larger audience, in this way fostering vibrant urban communities and human connectivity. The attraction of residents from different ages or backgrounds is central to creating communities where people will be willing to live in the long term (Caistor-Arendar, L. et al, 2011).

The creation of this social capital and the enhancement of urban diversity should also account for the preservation of rights of current and future residents. When looking at the future occupants of cities, several populations should be considered: those stemming from the rural-to-urban migration that has been transpiring globally for decades, as well as those displaced due to conflict, violence, or climate change. According to the United Nations (2009) and, several years later, to the International Organization for Migration (2015), an estimated 3 million people are moving to cities every week (Caistor-Arendar, L. et al, 2011). Because of these rapidly-changing demographic patterns, the planning process should design analytical methods which anticipate possible changes in infrastructure demand allowing for an adept response. The integration of residents and other stakeholders in the decision-making process is key to ensuring that the strategic long-term plan is aligned with community needs, and that different programs and projects are able to rely on public support. Stakeholder engagement and public consultation should follow a clearly defined process where feedback is integrated into the project design, construction, and operation of the asset.

Potential displacement of residents due to the creation of new infrastructure projects can also create challenges, especially when existing communities are located within the area of influence. The upstream planning process should anticipate the relocation that will accompany the various alternatives considered, paying special attention to the risk of segregation, gentrification, displacement and speculation. This is particularly important in areas with a large concentration of minorities, those with a considerable aging population, and those in which vulnerable groups are more prevalent.

The Creation of healthy and safe environments is central to the delivery of a more sustainable infrastructure. Hence, the direct and indirect safety and health implications of an “unsustainable solution” should also be considered. Exposure to air, water or soil pollution, as well as other poisonous hazards, can have a long-term impact on people's health and likewise can threaten the safety of the community in other ways (UNOPS, 2012). Comprehensive planning should encourage the adoption of healthy and active lifestyles by developing cities which are walkable and have ample outdoor recreational spaces. These spaces should integrate the aging population together with other diverse groups.

Efficient and reliable access to basic services is necessary for a city to flourish, however, the fact that cities are growing so rapidly, the significant number of people living in irregular settlements, the lack of sufficient financial resources, and poorly planned infrastructure systems makes

access to these basic services inadequate, and unaffordable for certain groups, particularly the poor (OHCHR, 2017). In many countries (principally non-developed or developing countries) access to basic services such as water, energy, and transportation represents a significant portion of the available household income. Consequently, access to safe and affordable quality services should be considered during the early phases of the decision-making process.

Finally, according to the IDB's recently published report "Four Decades of Infrastructure Project-Related Conflicts" (Watkins et al., 2017), it is worth noting that deficient planning, lack of community benefits, lack of adequate consultation, and impact on local values are listed as the principal drivers of conflict. Accordingly, the recognition of matters previously identified in this section is important not just for the creation of more sustainable infrastructure, but also to avoid the distress and potential conflict generated by an "unsustainable" planning process.

## Box 2: Paradigm shift. The case of Medellín, Colombia.

All the three dimensions of the triple bottom line- environmental, social and economic - are interlinked. An intervention in one dimension will inevitably have consequences on the others. For example, provision of affordable and quality transportation results in greater access to jobs, an increase in productivity and improved levels of development. This multidimensional web of interconnected factors was examined in Medellín, Colombia. The city of Medellín is no longer considered one of the most violent cities in the world, but alternatively it is considered inclusive and resilient. By properly implementing violence prevention programs along with a deep commitment to higher livability standards, Medellín has created opportunities for a better life for its inhabitants and has provided them with pathways that lead them away from poverty, while at the same time generate urban assets as a means of economic growth.

Sense of belonging and genuine community participation is critical for developing robust sustainable urban policies. The success of Medellín's development programs was possible because community input was taken into consideration and was valued by the administration. Several programs were created to improve quality of life, such as "Medellín Solidaria", which provided the population with housing and water and likewise sought to enhance the health, economic situation, and development of the families involved. Access to inclusive and quality transportation was also approached in the development plan of the city. The decision-makers understood that streets and public spaces were the most democratic spaces within a city, therefore the plans always focused on the improvement of such assets (e.g. pedestrian streets, parks, and urban promenades). This approach resulted in the creation of 1.6 million square meters of green space, therefore creating a more inclusive city with higher rates of quality of life, as well as reduced violence (UN, 2012). Medellín focused on vulnerable populations and transformed them by way of co-producers of safe streets and public spaces.

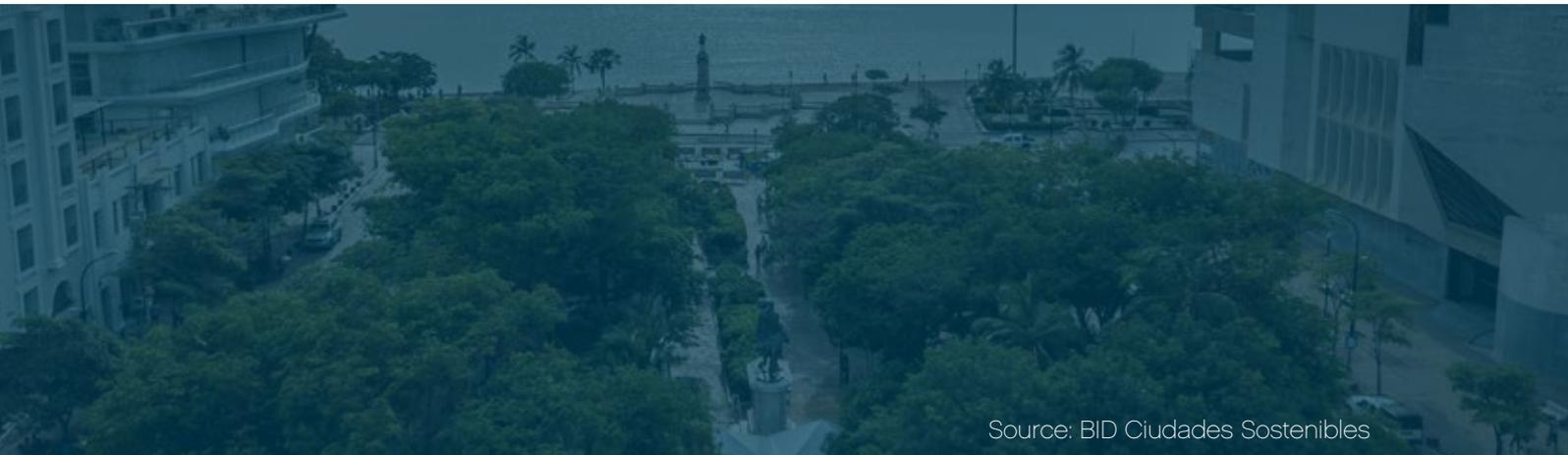
### 2.2.3 Creating a more socially sustainable and inclusive infrastructure:

**“Climate change increasingly poses one of the biggest long-term threats to investments”.**

Christiana Figueres, Executive Secretary of the UNFCCC, 2015.

Numerous environmental and climate resilient considerations should be integrated during the early phase of an infrastructure process. Some important factors are efficient use of limited resources, protection of green spaces, promotion of urban resilience, mitigation of climate change, as well as the reduction of pollution.

Urban densification is one of the most commonly known strategies traditionally associated with efficient use of resources at the city scale (Ahlfeldt et al., 2018). However, comprehensive upstream planning and a long-term vision are necessary to ensuring that this is accomplished in an orderly manner, while still safeguarding access to resources for all. When defining the various strategies, it is important that land be looked upon as a limited resource that must be employed and developed efficiently. Medium to high build densities allow for more efficient public transportation systems while reducing cost per capita (Habitat, U. N., 2016). The promotion of efficient and multimodal transportations systems (including non-motorized options), can create a significant impact on the area’s sustainability, not just from the perspective of resource efficiency, but also to drastically minimize overall greenhouse gas (GHG) emissions (Habitat, U. N., 2016).



Source: BID Ciudades Sostenibles

Adequate policy frameworks, incentive alignment, and upstream infrastructure planning are key drivers to ensure the use of more renewable energy sources. This will enhance environmental protection, reduce Greenhouse Gas (GHG) emissions and promote innovation. Public commitment to energy-efficiency targets and behavioral change has been proven to be a central driving force for a low-carbon transition (Barbu et al., 2013). In 2015, 196 countries came together under the Paris Agreement to transform their development trajectories towards one of sustainable development. Nationally determined contributions (NDCs) are at the core of increasing each participating country’s ability to adapt to the adverse impacts of climate change, and to foster both climate resilience and low-carbon development. Following this global agreement, in the last years numerous initiatives have been developed as drivers of change at the city scale such as the Global Covenant of Mayors, or the C40 Cities Climate Leadership Group.

Infrastructure development has been perceived as one of the core strategies towards climate

change disaster risk reduction, mitigation, and adaptation. When planning and developing these strategies, special attention to vulnerable areas will be necessary, because these areas are likely to be those most exposed to climate threats and be the areas with fewer resources for disaster protection (Dorland et al., 2003).

When considering environmental sustainability at the urban scale, access to green spaces and natural areas is one of the core elements to be considered. Access to natural areas tends to be limited in urban settings; accordingly, recognizing the importance of its protection is vital. Preservation of surface and groundwater, flora and fauna, as well as natural capital in general, is central to ensuring a sustainable outcome. Apart from the positive recreational value generated in these areas, the mitigation and adaptation potential to climate change provided by green infrastructure is notable. Solutions such as street planters, green rooftops, and permeable pavements, among others, can generate significant positive effects on the reductions of stormwater runoff, thereby reducing the risk of flooding. Countries like China have integrated several of these strategies at scale with the aim of transforming their urban developments into what have been referred to as “sponge cities”. This seeks to achieve a dual goal which aims to (i) guarantee sustainable water-use and (ii) control flooding (Chan et al., 2018). Through a collaborative project, UN Environment, the Inter-American Development Bank, Acclimatise, and UN Environment World Conservation Monitoring Centre (UNEP-WCMC) aim to understand the barriers and enablers to private sector uptake of Nature-based Solutions (Green Infrastructure), findings will be published early 2019.

Pollution control is a topic intimately related to the preservation of the natural environment, as well as health and safety which was covered in the section on social sustainability. In some cases, high levels of air pollution, water pollution and chemical compounds have been identified as the downside of development. However, high levels of pollution, and inadequate solid waste management are creating “non-livable places” all around the world. To minimize pollution, and poor solid waste disposal and its potential risks for human health and the environment, it is important to design solid and transparent planning strategies in which specific goals and thresholds are identified. As well as to identify the possible effects of pollution or of methane emissions coming from organic waste. Adequate monitoring plans and mitigation strategies should be defined at the early phases of the project looking at the entire lifecycle rather than any specific phase.

## Box 3: New York as a living laboratory for resilience.

New York City (NYC) has tackled resilience in a holistic setting. According to One New York, The Plan for a Strong and Just City, NYC will upgrade private and public buildings to ensure greater energy efficiency and resiliency in the face of climate change. Adaptation to infrastructure (e.g. transportation, telecommunication, water, and energy) that would allow it to withstand possible disruptive events is also a key aspect of New York’s resilience plan. In its city-wide campaign, resilient design is intended to become an integral part of the sequential project planning process for both agencies and their designers.

The Office of Recovery and Resiliency in its Climate Resiliency Design Guidelines proposes the following actions:

- 1) Integrate “soft” resilience strategies (operational measures and investments within the scope of green infrastructure) and “hard” resilience strategies (human-built,

complex infrastructure)

2) Address multiple climate hazards with single interventions

3) Reduce climate change risk in conjunction with other goals (e.g., energy efficiency or reduction in greenhouse gas emissions)

## 2.3 Factoring innovation into the sustainable infrastructure planning process

Developing business-as-usual infrastructure is not enough to achieve the transformational results necessary for a sustainable future (UN SDSN, 2016). While infrastructure development is a continuous and long-term process, there are several instruments available to integrate innovation and enhance sustainability performance during the infrastructure planning process.

The use of digital technology can help decision-makers deliver a more profitable and resilient infrastructure while granting better supervision and transparency within the industry (UN SDSN, 2016). Technology aids in infrastructure by developing platforms that create, communicate, and evaluate options, hence making communities more connected and sustainable. Development and proper use of digital technologies and processes (e.g. BIM) can have a large-scale impact such as an annual global savings of 10-25% in the engineering and construction phases, and 8-13% in the operations phase (Autodesk, 2017). The use of digitalization (e.g. Building Information Modeling (BIM), big data, cloud computing, and analytics) supports decision-makers during each phase of the project- from planning to operation, powering collaborative process while decreasing environmental burdens (Autodesk, 2017).

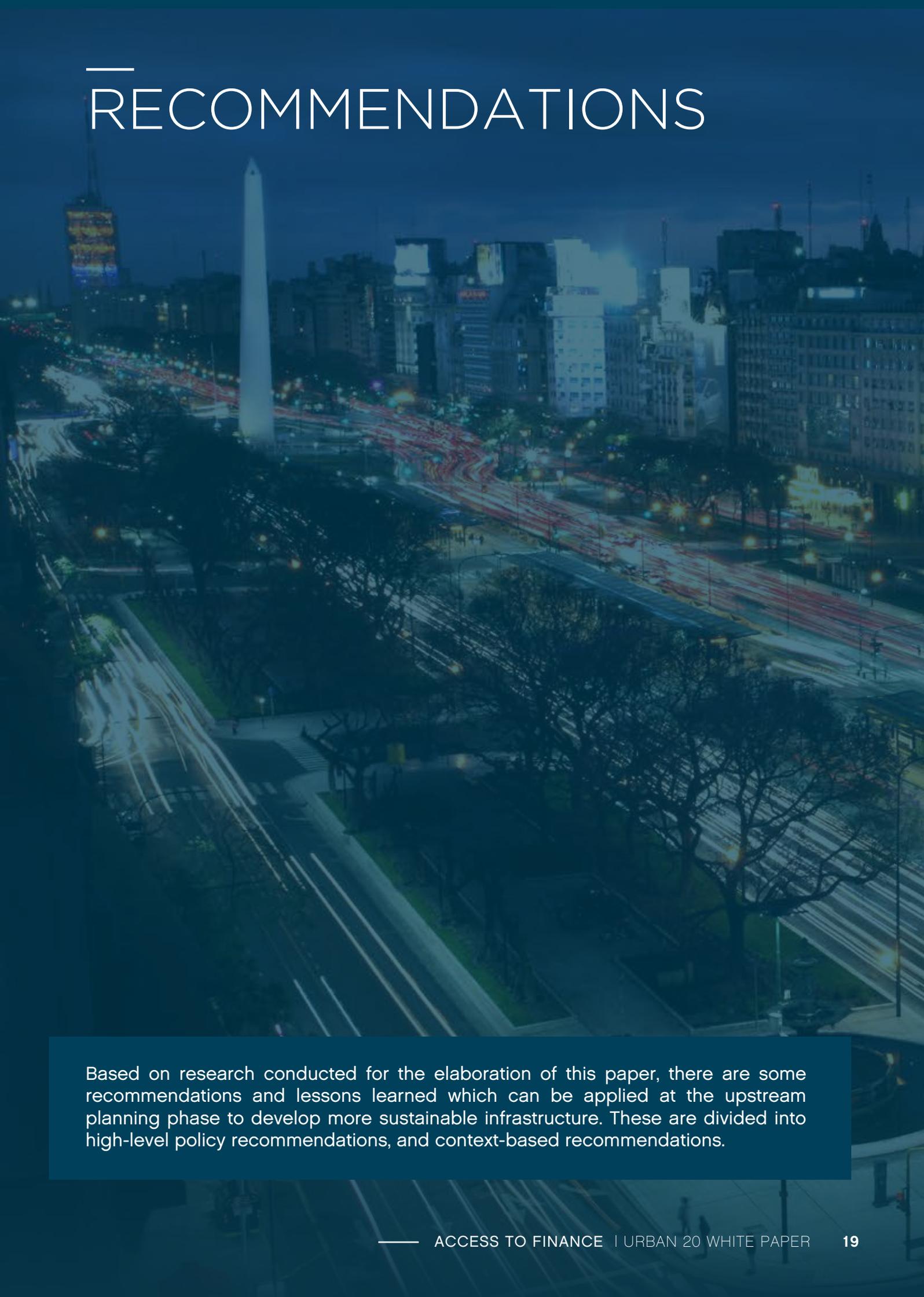
### Box 4: Innovation for rapid sustainable urban growth in Shenzhen, China.

Known as the sustainable lab of China, Shenzhen is an example of rapid sustainable urban growth, transforming from a fishing village in the 1950s, to the city of 10-million inhabitants that it is today. One of Shenzhen's most influential actions towards a sustainable future has been its innovative transport sector planning. The city was built using an infrastructure referred to as Transit-Oriented Development (TOD), in which all activities were prioritized and designed around the public transit sector. Lofty achievements were reached using techniques such as innovative financing, flexible zoning, integrated planning, as well as effective stakeholder dialogue. The city implemented regulations, incentives and support measures that enabled a rapid shift to low-low carbon, zero-pollution transportation.

The National Development and Reform Commission created a mandate which provided even more force and fiscal incentive to the Low Carbon City concept upon reaching a municipal level. Shenzhen has become the most successful city in China to implement the low carbon city approach. Within this model lies spatial planning, which assisted in eliminating car-oriented zoning and sprawl, the promotion of multi-use urban fabric; the delineation of ecological baselines and the promotion of green spaces to benchmark environmental protection and sequester carbon (WWF, 2014).

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# RECOMMENDATIONS

An aerial night photograph of Washington, D.C., featuring the Washington Monument as a central landmark. The image is overlaid with long-exposure light trails from city traffic, creating vibrant streaks of red, white, and blue across the streets. The city skyline is visible in the background, with various buildings illuminated against the dark sky.

Based on research conducted for the elaboration of this paper, there are some recommendations and lessons learned which can be applied at the upstream planning phase to develop more sustainable infrastructure. These are divided into high-level policy recommendations, and context-based recommendations.

## High-level policy recommendations:

- **Recommendation 1:**

**Standardized policy frameworks:** Orderly planning process requires the standardization of approaches towards better regulation and its enforcement. There is a need to bring together the national and local levels of government for regular debate on issues of mutual interest, such as a common upstream planning framework as well as breaking up silos among cross-sectoral agendas. To help tackle these challenges and to deliver more sustainable infrastructure, the Inter American Development Bank Published in May 2018 sustainable infrastructure principles providing an analytical framework for incorporating sustainability elements into the project level. The IDB is currently developing an upstream framework to provide guidance at the policy, regulatory and planning stages

- **Recommendation 2:**

**Transparent and flexible decision-making:** As previously specified, there is a significant need for clear and transparent coordination among different levels of government, however the cultural diversity and multi-stakeholder nature that characterizes the urban context calls for flexible and inclusive processes where all the different parties are represented. These processes should account not just for the profile of the current residents, but for future ones as well.

- **Recommendation 3:**

**Strategic territorial planning:** Sustainability solutions should be cemented and aligned with larger scale territorial planning strategies. These will include, among others, mixed-use development aimed to achieve higher level principles such as social integration, poverty reduction and economic development. Adequate territorial planning ensures a long-term strategy while allowing for the development of synergies among different jurisdictional scales and infrastructure systems (e.g., coordination among urban planning and transportation systems, as well as recreational spaces).

- **Recommendation 4:**

**Capacity-building and innovation:** Significant resources should be devoted to ensuring institutional capacity-building, and know-how transfer in matters related to sustainable infrastructure. Capacity-building should address technical and business innovation, as well as sound data collection and monitoring strategies.

## Context based recommendations:

- **Recommendation 5:**

**Clean energy technologies:** Promoting supportive policies and increased sustainable profitability can boost society's progress towards a clean energy industry. National standards that embrace energy-efficiency can increase social capital investments in energy and can

launch financing channels for energy investment projects. Furthermore, adopting a multi-energies model is an important approach for the future of clean energy growth.

- **Recommendation 6:**

**Promotion of urban resilience:** A holistic approach along with improved collaboration among players is needed to allow infrastructure sectors to properly allocate resources and to unfold opportunities that could enhance infrastructure robustness and resilience, thereby preventing human and economic losses.

- **Recommendation 7:**

**Innovative transportation techniques:** An efficient transportation system is a key driver of economic growth and productivity in densely populated urban areas. A multimodal transportation system requires full integration with other infrastructure projects during its early phase. Additionally, the appropriate use of data is extremely important when it comes to mobility efficiency. Understanding passenger flow and using available technology allows for the design of a fully customized and smarter network, while optimizing the use of available resources.

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