



Approaches to the Assessment and Implementation of Sustainable Infrastructure Projects in Latin America and the Caribbean

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Introduction

One of the crucial development challenges in Latin America and the Caribbean (LAC) is how to meet demands for the infrastructure to supply energy, water, sanitation, transport, and communication services while not compromising the environment and social conditions. Demands for these services have grown—driven by urbanization and the need for enhancing competitiveness. By their nature, infrastructure projects are complex, affect large areas, and have long life cycles. Meeting the demand for infrastructure will require management of numerous environmental, social, and economic risks. Furthermore, much of the future infrastructure in LAC will be developed in complex urban contexts, in sensitive habitats, or in rural areas. Risks will also be exacerbated by climate change, by increasing natural disasters, and by institutional changes, including decentralization of decision making to regions and municipalities with developing capacities.

Over the last 10 years there has been growing attention paid to innovative ways to meet infrastructure demands while managing environmental and social risks. Tools such as strategic and regional environmental and social assessments, cumulative impact assessment, and indirect impact assessment have been developed to better understand and manage the broader contexts of projects. There is a burgeoning literature on sustainability assessment and standards for infrastructure. This paper is not an encompassing review of these approaches; rather, it identifies the key characteristics of sustainable infrastructure in LAC, with the aim of supporting the implementation of the Sustainable Infrastructure Strategy of the Inter-American Development Bank (IDB) (Serebrisky, 2014).

The approach to infrastructure within the Bank is presented in that new strategy. It represents a shift from infrastructure being viewed as a fixed asset to infrastructure being conceived and implemented as a service for people. The strategy presents a new vision for infrastructure—a new vision that is urgently needed because of increasing demand for services and the risks of infrastructure projects failing to achieve economic, social, and environmental objectives. As such, infrastructure is a mechanism to improve lives and create opportunities for a sustainable future. The strategy also identifies the range of existing Bank activities in sustainable infrastructure and the need to consolidate and integrate teamwork across sectors. The key partners for achieving this vision include finance, sector, and planning ministries; regional and municipal governments; the private sector; other multilateral financial institutions; and civil society.

Implementing the Sustainable Infrastructure Strategy will require change. This in turn will require greater clarity on what sustainable infrastructure is across different sectors and within different economic, social, and environmental contexts. This clarity will provide the basis for measuring success in implementing the strategy and identifying critical areas for improvement. We also need to shift away from the general perception of sustainable infrastructure entailing high costs with little economic and financial return. And we need to empower staff to become part of the process of change—enlisting them to support the implementation of a new approach to infrastructure.

The purpose of this paper is to discuss innovative approaches to implementing the Bank's Sustainable Infrastructure Strategy in the region. It describes the challenge of infrastructure in LAC, overviews approaches to sustainable infrastructure, describes Bank sustainable infrastructure activities, and begins the process of describing an integrated approach to sustainable infrastructure. *Approaches to the Assessment and Implementation of Sustainable Infrastructure Projects in Latin America and the Caribbean* does not enter into the details of indicators and metrics for sustainable infrastructure, but it does look at criteria across the energy, transport, and water and sanitation sectors in both urban and non-urban contexts and describes sustainability concerns in LAC countries. This is therefore an initial step in the direction of establishing principles, criteria, and indicators for sustainable infrastructure in the Bank.

Infrastructure in Latin America and the Caribbean

1.1 Infrastructure for growth in LAC

Providing universal access to basic services such as water, energy, and sanitation is a major objective of many governments. However, 38 million people in Latin America and the Caribbean still lack access to electricity, 32 million people do not have improved water sources, and 120 million lack improved sanitation services (Serebrisky, 2014).

Improved infrastructure also increases competitiveness and reduces transport and input costs, which in turn enables small to medium-sized enterprises that are the predominant source of jobs in LAC (Serebrisky, 2014). For 50 years, competitiveness in LAC has stagnated at a 7% share of global exports, while the Asian share has grown from 4% to 22% (Serebrisky, 2014). Improved infrastructure is also critical to territorial integration and decentralization. It is a key driver of economic growth, as transport infrastructure can reduce product-to-market costs, particularly for key agricultural products (Mesquita Moreira, Volpe Martincus, and Blyde, 2008; Zeigler and Truitt Nakata, 2014).

There is a substantial gap between the present service capacities of infrastructure in LAC and the present and projected demand for services. Present infrastructure investment for new infrastructure and the maintenance and rehabilitation of past infrastructure is 2–3% of gross domestic product (GDP) (Serebrisky, 2014). Much of the increased demand for services arises from demographic shifts toward a middle class requiring high quality in transport, energy, communications, water, and waste management services (Serebrisky, 2014). At the same time, LAC countries are becoming increasingly urban: in the 1970s, 50% of people lived in cities, while in 2013 some 80% live in cities—many in irregular settlements (Da Gamma Torres, 2011; DESA, 2012; Serebrisky, 2014). This growth has outpaced the capacities of municipalities to deliver services to informal settlements with insecure property and rights in high natural-disaster-risk areas. Throughout LAC, the required investment in infrastructure to close the gap between actual and needed infrastructure so as to vitalize value chains, meet new urban services demand, and address energy demand was estimated to be 5% of GDP (US\$250 billion equivalent) in 2010 (Serebrisky, 2014).

1.2 Environmental and social risks in infrastructure projects

Filling the infrastructure gap in LAC may exacerbate social and environmental risks. The long life span, broad spatial effects, and inherent uncertainty of infrastructure projects mean that they often cause externalities that may be difficult to manage in early project design stages (Ainger and Fenner, 2014). These characteristics also mean that infrastructure projects are particularly susceptible to climate change and natural disaster risks (Shaw et al., 2012). This risk is particularly accentuated in LAC because of the high rates of urbanization and heightened climate change and natural disaster risks.

Climate change is an important determinant of overall crop productivity and the susceptibility of urban and rural areas to severe droughts and floods. The links between land use change, climate change, and health and poverty have become increasingly apparent. The frequency and intensity (and corresponding costs) of natural disasters have risen dramatically in the LAC region; economic losses in 1980–2010 exceeded US\$110 billion—more than the losses in the preceding 80 years (Serebrisky, 2014). The region exhibits the highest average economic damages of any region in the world from disasters such as storms, floods, droughts, landslides, and forest fires—an estimated 0.18% of GDP per event—with particular consequences for the poorest and most vulnerable groups, including the poor, indigenous people, and periurban populations (IDB, 2011). These natural disasters are exacerbated by climate change, through sea level rise, higher-intensity storm surges, and severe weather patterns that can affect the efficiency of water management infrastructure and coastal transport infrastructure (Simpson et al., 2012).

There is also a growing awareness in LAC of the need to mitigate climate change impacts. Business as usual in LAC will lead to a 60% increase in emissions by 2050 (Serebrisky, 2014). While the region is a relatively small contributor to global greenhouse gas (GHG) emissions, growth will be driven by energy demand and land use change (IDB, 2011) with intimate ties to infrastructure. Presently, 47% of LAC GHG emissions arise from land use, land use change, and forestry, and 28% come from from energy generation and consumption (IDB, 2011).

Energy generation projects, in particular hydroelectric dams, present numerous environmental and social risks: involuntary displacement of people and their activities, habitat and wildlife loss, deterioration of downstream water quality and sedimentation patterns, changes in hydrological regimes, increased risks from water-borne diseases, effects on indigenous rights, wholesale change in aquatic communities, loss of cultural sites, land use change, habitat fragmentation, dam failure risks, social and cultural change, alterations in broad ground and surface water hydrology, and even increased greenhouse gas emissions (Beck, Claassen, & Hundt, 2012; Ledec & Quintero, 2003; Partridge & Mejía, 2013; Sousa Júnior & Reid, 2010). Given these risks, infrastructure projects often lead to conflicts with landholders and key stakeholders.

Roads and other linear transportation projects also have well-documented environmental, social, and economic consequences. Roads are major ultimate drivers of land use change and deforestation (Carrero and Fearnside, 2011; Laurance, Goosem, and Laurance, 2009; Redwood, 2012a; Reymondin et al., 2013; Southworth et al., 2011) and potentially increase the probability of extinctions in some species (Vale et al., 2008). Commercial agriculture,

for which transportation networks are one of the most important enabling factors, is the most important driver (68%) of deforestation in LAC (Hosonuma et al., 2012). Logging and timber extraction, which is also highly dependent on the establishment of transport networks, accounts for more than 70% of the forest degradation in LAC (Hosonuma et al., 2012).

Often the purpose of road improvements in frontier areas is to open areas for development by reducing transport costs and increasing accessibility to land and other natural resources. The key impacts of such transport networks therefore tend to be indirect as new settlements and access points are created, resulting in changes in land use, the loss of habitats and biodiversity, increased GHG emissions, and many social changes.

The social impacts of roads include changes in land values, settlement patterns, occupations, and lifestyles of local stakeholders. As an example, the Pan American Highway through the Darien resulted in new migrants arriving in the area, expanded commercial activities in agriculture, cattle raising, and mining, and corresponding changes in land prices that forced resettlements (Redwood, 2012a). Social changes can extend to changes in public health and security conditions, particularly in situations where indigenous peoples are involved (Partridge and Mejía, 2013).

Some of the more important sustainability considerations for transport infrastructure include land use management; energy efficiency; material use; waste and contaminant management; direct and indirect emissions; climate change and disaster risk; travel costs and accessibility; improved mobility, supply, and distribution chains; and stakeholder involvement.

Similarly, the design and implementation of water and sanitation infrastructure involves consideration of numerous sustainability issues. These include energy use and efficiency, land use, material use (including regional materials), waste management, direct and indirect GHG emissions, ground and surface water quality, water availability, integrated water resource management, stakeholder engagement and increased public awareness, innovative regulatory and tariff mechanisms, local supply chain and employment linkages, and the management of water use conflicts.

1.3 Financial and economic risks associated with the environmental and social contexts of infrastructure projects

Infrastructure projects also have inherent economic and financial risks (Fay, Toman, Benitez, & Csordas, 2011; Hallegatte, Heal, Fay, & Treguer, 2012). These risks arise because infrastructure projects:

- Require substantial, long-term, and up-front capital investments, with benefits that accrue slowly over time.
- Affect wide spatial scales over long time periods and so economic, social, and environmental externalities are commonplace.
- Are often developed and implemented through complex institutional arrangements, making it difficult to plan for and manage financial and economic risks.

There is growing awareness of the links between environmental change, social change, and economic and financial costs. The Millennium Ecosystem Assessment (2005) detailed the links between environmental change and social consequences. Subsequent assessments have described the economic and financial risks associated with climate change (IPCC, 2014; Stern, 2007) and with the loss of biodiversity and ecosystem services (Sukhdev et al., 2010).

In the extractive and infrastructure sectors, there is a growing literature on the importance of effective stakeholder engagement in determining the success of projects and the share value of companies (Davis and Franks, 2014; Franks et al., 2014; Henisz, 2014). Davis and Franks (2011) examined social and environmental conflicts in Colombia that appear in the database of environmental justice, organizations, liabilities, and trade; 21% of these conflicts arose in infrastructure projects (transport and energy), while 61% were in the extractive industries. In particular, they looked at seven hydroelectric projects that inundated 107,000 hectares and affected 73,000 people. Detailed assessments of additional major costs are few and far between for infrastructure projects. But in the extractive industries, the main additional costs resulting from environmental and social concerns arise in increased senior staff time spent in conflict management, higher public relations efforts, production disruption, litigation, and increased security needs (Davis and Franks, 2011). The Belo Monte dam on the Xingu River in Brazil has also been studied from an economic-environmental perspective (Ansar et al., 2014; Sousa Júnior and Reid, 2010). Despite this work, it is notoriously difficult to empirically track economic and financial cost effectiveness in infrastructure projects (Ergas and Robson, 2009).

Infrastructure and sustainability

1.4 Frameworks for describing sustainability

The general concept of “sustainability” has been around for a long time (Gibson et al., 2005). The term appears to have been coined in the early 1970s and was discussed at the United Nations 1972 Stockholm Conference (Poveda and Lipsett, 2011). The Brundtland Report (World Commission on Environment and Development, 1987) provided an early definition of sustainable development. Since then there have been many discussions, definitions, and frameworks for sustainability assessment. Advances in defining sustainability are marked particularly by the Rio Agenda in 1992, the Millennium Development Goals in 2000, and the Sustainable Development Goals (Singh et al., 2012). A major challenge remains taking broad aspirational goals for sustainability and turning them into specific, measureable, achievable, relevant, and time-bound standards—including criteria, indicators, and metrics for nations, regions, corporations, or projects.

The most commonly used general framework for describing sustainability includes the pillars of environmental, social, and economic sustainability, or the “triple bottom line” at a corporate level (Georgoulas et al., 2010; Wallis, Graymore, and Richards, 2011). Singh et al. (2012) review a number of approaches to sustainability assessment. The ways in which these approaches are described and catalogued varies but reflect similar structures. For

example, the Building Environmental Quality Evaluation for Sustainability through Time adopts a broad framework of environment, equity, participation, and future benefit flows (Bentivegna, 2002). Approaches to urban infrastructure incorporate environmental (resource use and waste management), economic (capital, operations, maintenance costs, and innovation), and social (performance, accessibility, acceptability, and health and safety) characteristics (Sahely, Kennedy, and Adams, 2005). The Institute of Chemical Engineers Sustainability Metrics framework is environmental (resource usage, emissions, waste and effluents), economic (profit, value, tax, and investments), and social (workplace and society). There are numerous other examples of generic sustainability approaches, including, among others, The Natural Step, Community Capital, Ecological Footprint, and other frameworks reviewed by Poveda and Lipsett (2011).

Other sustainability frameworks incorporate institutional in addition to the environmental, social, and economic dimensions. For example, the United Nations Commission for Sustainable Development 2001 framework for sustainability indicators is categorized (Wu and Wu, 2012) as:

- Social—equity (poverty and gender); health (nutrition, mortality, sanitation, water, healthcare); education (education level, literacy); housing (living conditions); security (crime); population (population change).
- Environmental—atmosphere (climate change, ozone layer, air quality); land (agriculture, forests, desertification, urbanization); oceans, seas, and coasts (coastal zones, fisheries); freshwater (quantity and quality); biodiversity (ecosystems and species).
- Economic—economic structure (economic performance, trade, financial status); consumption and production (material consumption, energy use, waste generation and management, transportation).
- Institutional—frameworks (international cooperation; strategic implementation); capacities (information access, communication infrastructure science and technology, disaster preparedness and response).

The Wuppertal Sustainable Development Indicator Framework looks at the following indicators: environmental; social (health, housing, social security, unemployment); economic (GNP, growth rate, and cooperation); and institutional (participation, justice, and gender) (Singh et al., 2012).

Achieving sustainability in infrastructure projects also requires an understanding of the integrated nature of social, economic, and environmental systems. It is important not to lose sight of the interactions among these various constructed organized sustainability “compartments” (Wallis et al., 2011). Some social, economic, and environmental models present the compartments (natural resources, socioeconomic resources, and cultural resources) but also present the social systems (institutions, cycles, and order) that govern the relationships among these compartments (Force and Machlis, 1997; Machlis, Force, and Burch, 1999; Machlis, Force, and Burch, 1997).

Sustainability criteria categorization frameworks present an integrated economic, environmental, social, and institutional view of the corporate entity or project being analyzed. This integrated framework needs to consider changes through the different

stages of project cycles or corporate development and take into account uncertainty. Sustainability frameworks and their criteria also need to be designed to effectively engage stakeholders, including the general public (Gasparatos, El-Haram, and Horner, 2008). For infrastructure projects, the sustainability framework must take a long-term perspective; incorporate the whole project cycle of planning, design, construction, operation, and decommissioning (Shaw et al., 2012); and consider the local and regional economic, social, environmental, and institutional context.

Achieving sustainability also requires measuring and assessing it—recognizing that these are two distinct but related processes (Poveda and Lipsett, 2011). Measurement is the determination of indicators, gathering of data on variables, and data analysis, while assessment entails the appraisal or comparison of the resulting analysis with set standards. Approaches to measurement and assessment force a fine-grained determination of indicators and metrics within an individual criterion and regional, national, corporate, or project contexts.

There are many approaches to sustainability assessment, as described in Wu and Wu (2012) and Poveda and Lipsett (2011), and a comprehensive review is beyond the scope of this paper. The majority of these approaches are designed to support knowledge sharing, stakeholder engagement, and recognition of general sustainability practices, even if they vary in the form of analysis, specific uses, categories for evaluation, and relative weighting across sustainability criteria (Clevenger, Ozbek, and Simpson, 2013). A key conclusion from reviewing these approaches is that it is possible to describe sustainability in specific terms set within a broader theoretical context of sustainability (Vanegas, 2003).

Although this paper focuses on sustainability assessment and safeguard approaches to sustainable infrastructure projects, it is important to recognize that sustainability criteria and standards at national, regional, or corporate levels have also been worked on extensively. (Criteria are the essential elements of sustainability, whereas standards are the thresholds, requirements, or expectations of particular assessment approaches.) Sustainability criteria and standards have been developed for regions, institutions, and processes. The criteria include those of the International Standards Organization (e.g., ISO 14001 and ISO 26000), resource production standards (e.g., Fairtrade, the Forestry Stewardship Council, and the Roundtables), and Leadership in Energy and Environmental Design (LEED)—a green building certification program designed for urban building strategies and practices (e.g., LEED Building Design and Construction, LEED Operations and Maintenance, and LEED Neighborhood Development); some standards are derived from international agreements (e.g., the Core Labor Standards of the International Labour Organization) (Gibson et al., 2005; Nguyen and Altan, 2011; Poveda and Lipsett, 2011; Reed et al., 2009; Singh et al., 2012).

1.5 Infrastructure sustainability assessment and risk management

The purpose of sustainability assessment (see Gibson et al., 2005) is to:

- Improve decision making.
- Ensure a comprehensive and integrated approach.
- Establish a framework and criteria for decision making.
- Ensure consistency and efficiency in decision making.
- Encourage effective and structured public engagement.
- Foster creative innovation and sustainability transitions.

Annex I describes and compares the main characteristics of six general and sector-specific sustainable infrastructure rating and assessment schemes: CEEQUAL, the IS Rating System, and ENVISION™ (which cover infrastructure), LEED for Neighborhood Development, the Hydropower Sustainability Assessment Protocol (HSAP, to guide performance in the hydropower sector), and INVEST (which is specific to transport infrastructure). This paper does not pretend to include a complete review of all tools, nor does it cover the specific tools developed for sustainable building systems, which are reviewed in other publications (Pollalis et al., 2012; Shaw et al., 2012).

1.5.1 Financial institution safeguard policies and sustainable infrastructure

The criteria used in the sustainability approaches of the World Bank, the International Finance Corporation (IFC), and the Inter-American Development Bank are reviewed in Annex II. The ultimate goal of environmental and social safeguards is to ensure sustainability in projects, a characteristic they share with sustainability assessment schemes. Over the last 10 years, a global consensus has emerged on core areas of good practice and performance standards for managing environmental risks. Many of the safeguard standards also reflect international agreements related to labor, hazardous materials, pollution, indigenous peoples, and biodiversity.

The earliest safeguard policies were established by the World Bank to address environmental and social challenges arising from controversial infrastructure projects in the 1970s and 1980s, such as the Polonoroeste Highway in the Brazilian Amazon (Hunter, 2007). Safeguard policies were extended to the IFC and the Multilateral Investment Guarantee Fund after complications surrounding the Pangué Dam in Chile in 1997. The IFC initially followed the World Bank safeguards policies but then developed a new performance standard framework in 2006, which was updated in 2012 (IFC, 2012).

Today, all multilateral financial institutions have developed environmental and social policies to support sustainability in the projects and programs they finance. An additional 80 financial institutions across 34 countries have adopted the Equator Principles as a risk management framework. All export credit agencies of the countries that belong to the Organisation for Economic Co-operation and Development have adopted what are known as Common Approaches on the Environment.

1.5.2 Comparing criteria used in sustainability assessment and safeguards

There are many commonalities among approaches to ensuring and assessing sustainability in projects. While different frameworks exist for organizing the key elements of sustainability, there is general agreement on the areas that should be addressed for a project to be considered “sustainable” (see Table 1). Process and outcome criteria are often mixed in these approaches, and there are differences in emphasis of particular criteria. There are also differences on when tools are applied in terms of addressing the different sustainability needs that appear at different stages of a project life cycle. A critical difference is the extent to which a particular critical enabling process—governance and management—is explicitly incorporated into the sustainability assessment. Different tools also vary in terms of their comprehensiveness, relative ease of use by stakeholders, and degree of scientific rigor.

Table 1 summarizes the characteristics of the reviewed sustainability assessment and management approaches (see also Shaw et al., 2012). There are weaknesses in the criteria in the assessment and standards for economic (Vergara et al., 2014) and financial sustainability. In addition, environmental criteria tend to be better developed than institutional and social criteria (Shaw et al., 2012). Sustainability standards tend to look at social change resulting from environmental changes (e.g., noise, air and water contamination), but they may not look at complex changes in social systems and order (e.g., gender, organizational capacities, and education systems). Different approaches also have varied coverage of the whole project cycle—design, construction, operation, and decommissioning (e.g., HSAP)—and many focus only on the design phase of projects (Shaw et al., 2012). Another critical difference is the degree to which stakeholder engagement and participation are covered, as this is one of the main drivers of failure or cost increase in infrastructure projects. Finally, overall sustainability depends on higher-level decision making that occurs beyond, or temporally before, project design, including policy, sector, and land use or urban planning. Addressing this challenge is covered only patchily in the sustainability approaches, but this is a key success factor in achieving environmental, social, economic, and institutional sustainability in projects and project portfolios.

1.6 Table 1: Example of criteria used in the reviewed sustainability approaches

Social	<ul style="list-style-type: none"> • Meet legal requirements • Provide local employment • Labor and working conditions • Historical, cultural, and archaeological heritage • Maintain and enhance local organizational resources, including justice, commerce, education, leisure, and sustenance • Enhance public information • Ensure access, mobility, and affordability of services 	<ul style="list-style-type: none"> • Maintain or enhance community public health • Ensure community wellbeing and livelihoods • Community safety • Address specific indigenous and disadvantaged peoples' concerns • Address resettlement and compensation • Maintain or enhance equality based on gender, age, or class
Environmental	<ul style="list-style-type: none"> • Meet legal requirements • Efficient land use • Maintain or enhance landscapes • Efficient water use • Maintain or enhance water quality • Evaluate, adapt to, and ensure resilience to natural disasters and climate change • GHG emissions • Maintain amenity and other ecosystem service values • Compensate for losses • Maintain or enhance ecological values, habitats, soils, nutrients, and connectivity 	<ul style="list-style-type: none"> • Maintain, restore, or enhance endangered biodiversity and living assets • Manage invasive species • Efficient energy and fuel use • Reuse, recycle, and increase efficiency in material use • Manage hazardous materials • Manage waste production in air, soils, and water, and on land • Manage noise
Economic & Financial	<ul style="list-style-type: none"> • Support sustainable growth • Financial viability • Support economic development through local supply and service chains • Reduce poverty 	
Institutional	<ul style="list-style-type: none"> • Place project in a national and regional governance context including policy and sector planning • Strategic demonstration of need • Set project in an integrated land use planning or urban planning context • Effectively manage workforce • Project management • Provide public information • Consult and engage with stakeholders to ensure full participation 	<ul style="list-style-type: none"> • Build institutional and individual capacities through training, education, and information sharing • Manage sustainability in procurement and value chains • Assess, manage, and monitor environmental and social risks and impacts • Track delivery of sustainability commitments

Sustainable infrastructure—the IDB and LAC

1.7 Sustainable infrastructure in the IDB

Multilateral financial institutions provide support for an estimated 10–15% of infrastructure projects in the LAC region, with the IDB share being 4–5.5% between 2009 and 2011 (Serebrisky, 2014). The IDB is therefore a key strategic partner in infrastructure for member countries. As such, the institution has historically played an important role in the region’s major infrastructure development programs, including the Initiative for the Integration of the Regional Infrastructure of South America, the MesoAmerica Project, the Pacific Corridor from Puebla to Panama City, the Central American Electric Interconnection System, and the Andean Interconnection System (Serebrisky, 2014).

The IDB’s commitment to sustainable infrastructure is expressed through strategies, policies, and initiatives. While each one focuses on a specific element, the interplay of all of them provides an opportunity to leverage support within the region for investments in sustainable infrastructure.

The IDB’s Sustainable Infrastructure Strategy offers a new vision for infrastructure that is consistent with existing Bank initiatives. The IDB’s ninth Capital Increase Report (GCI-9) set the framework for the Bank’s support for sustainable infrastructure. The GCI-9 has the overarching objectives of reducing poverty and inequality and achieving sustainable growth in the region (IDB, 2010c). The GCI-9 also describes the sector priorities for the Bank:

- Social policy for equity and productivity.
- Infrastructure for competitiveness and social welfare.
- Institutions for growth and social welfare.
- Competitive regional and global international integration.
- Protect the environment, respond to climate change, promote renewable energy and ensure food security (IDB, 2010c).

The Bank’s Integrated Strategies for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy (IDB, 2011) and Sustainable Infrastructure (Serebrisky, 2014) establish a framework for the Bank’s work in sustainable infrastructure.

The Climate Change Strategy describes key sustainable infrastructure characteristics relating to vulnerability to the potential impacts of climate variability and change (including disaster risk management) across water resource management, energy production and distribution, transportation, and urban development. The strategy also examines climate mitigation opportunities in energy, transportation, and water and sanitation infrastructure.

The Sustainable Infrastructure Strategy describes the links among infrastructure, sustainable growth, competitiveness, access to infrastructure services, and regional and global integration. It emphasizes that infrastructure should include:

- Cross-sector analysis and planning.
- Regional and/or urban infrastructure planning.
- Social inclusion.
- Resilience against climate change and natural disasters.
- Climate change mitigation.
- Gender considerations in design and implementation.
- Adhere to environmental and social safeguard best practices.
- Support biodiversity and ecosystem services.

The IDB has developed and implemented a suite of **environmental and social safeguard sustainability policies** (see description in Annex II and prior references). These policies are designed to address environmental and social challenges in IDB projects to support sustainability. In 2010, the IDB established an Independent Consultation and Investigation Mechanism to increase the transparency, accountability, and effectiveness of the application of these policies.

The **Sustainable Energy and Climate Change Initiative** was established in 2006 and was institutionalized in 2009 as the Sustainable Energy and Climate Change Unit. In 2012 this became a Division that works across the Bank to support:

- Climate change vulnerability analysis.
- Reduced climate change impacts in water supply and quality.
- Reduced vulnerability to climate change in coastal and marine systems.
- Strengthened resilience of forests and other fragile biomes.
- Reduced climate change impacts in agriculture.
- Reduced GHG emissions from land use change.
- Low-carbon transport.
- Reduced GHG footprints of energy production.
- Understanding and mainstreaming of climate change in IDB operations.
- Improved access to climate finance.
- Expansion of private sector investments in climate change.

The **Regional Environmentally Sustainable Transport Action Plan** was established in 2010 to help guide member countries to mainstream climate change mitigation and adaptation in transport operations. The priorities include to enhance knowledge bases on climate mitigation and adaptation, strengthen public and private institutions for climate action, develop tools for mainstreaming climate mitigation and adaptation in IDB transport operations, and develop lending and technical assistance support for low-carbon transportation.

The IDB has worked closely with the International Water Association to establish a rating system called **AquaRating** that assesses the performance of water and sanitation service providers. This tool provides detailed assessments, including of critical sustainability areas such as access to service, quality of service, operating efficiency, planning and investment execution efficiency, business management efficiency, financial sustainability, environmental sustainability, and corporate governance. During 2015, AquaRating will enter into implementation through the International Water Association.

The **Emerging and Sustainable Cities Initiative** of the Bank was established as a platform in 2011 to be a technical assistance program to support local governments in the development and execution of sustainability plans. The initiative has an interdisciplinary focus and looks at environmental and climate change sustainability, urban sustainability, and fiscal and governance sustainability. To date, the focus of this initiative has been on working with key local government partners to support diagnosis, prioritization, action planning, feasibility, monitoring and ultimately investments in sustainable cities, including infrastructure.

The **Biodiversity and Ecosystem Services Program** was established in 2012 to support the protection and use of natural capital in LAC to generate social and economic development. The program supports member countries through integrating biodiversity and ecosystem services in key economic sectors, protecting priority regional ecosystems, building effective environmental governance capacity, and creating private sector biodiversity and ecosystem services investment opportunities.

The **INFRASTRUCTURE 360° Private Sector Infrastructure Sustainability Awards** were established in 2014 by the private sector of the Bank with the objective of identifying and promoting sustainability approaches in the private sector in LAC. The initiative uses a modified sustainability rating system (ENVISION) developed and applied by Harvard University and the Institute for Sustainable Infrastructure (see Annex I). The Awards mechanism recognizes infrastructure projects in LAC that reflect outstanding sustainability practices in the region emphasizing climate and environment, in addition to social impact management, governance, and innovation.

The Structured and Corporate Finance Department of the private sector within the Bank has also been exploring partnerships with clients to move forward **shared value opportunities** (investments that increase financial return while delivering social and environmental value) so as to enhance innovation and increase human capital.

Operationalizing the new vision for sustainable infrastructure reflected in the Sustainable Infrastructure Strategy in conjunction with the existing initiatives directed toward sustainability could contribute to lower project costs, better resource use efficiency, environmental and social risk reduction, positive employee engagement, and an enhanced corporate image, reputation, and brand (Shaw et al., 2012; Stapledon, 2012).

1.8 Characteristics of sustainable infrastructure projects in LAC

In Annex III, several case studies are described. These, along with additional case studies available in Reed et al. (2014), reflect the sustainability criteria listed in Table 1. But they

emphasize the importance of four areas as key determinants of success in sustainable infrastructure projects.

A first area of importance is fully **integrating infrastructure projects with local communities**. This integration can occur through value and service chains, employment, local capacity building, local organizations, local social systems, enhanced access and affordability of services, and support for community livelihoods and well-being. Infrastructure projects that provide local incentives can balance the perception that such projects provide service benefits to distant populations while entailing costs for communities close to the infrastructure. Establishing programs and management procedures that create incentives for local people and help build local capacity can ensure that local well-being is not diminished but instead is improved through the project. Local employment and associated training, technology, and knowledge transfer—using local materials sourced from local suppliers, supporting local service providers, and supporting the development of additional infrastructure such as roads or leveraging local health and education programs—are all mechanisms through which local communities can benefit from infrastructure projects.

The case studies also describe the importance of **effective engagement of stakeholders**—particularly, in LAC, indigenous peoples. Effective stakeholder engagement can improve the design, integration, acceptance, and support for infrastructure projects. The importance of effective stakeholder engagement is emphasized in situations where stakeholder engagement and consultation have failed and there are concomitant costs. Institutional arrangements and organizational relationships are crucial to ensure effective stakeholder engagement and guarantee that such engagement continues throughout the project.

Upstream integrated cross-sector, urban, regional, and project planning is a prerequisite for sustainability and provides additional benefits for long-term investments (Quintero, 2012). Integrated planning of infrastructure projects can reduce maintenance and operation costs, decrease expropriation and resettlement costs, make it easier to incorporate information technology control over infrastructure, increase investment efficacy, decrease aquatic and terrestrial habitat fragmentation and support functioning ecosystems, ensure adaptation to climate change risks, and support disaster risk management. Integrated urban and regional planning and integrated sector planning are normally undertaken by the public sector while either the public or the private sector may undertake project construction and operation. Greater clarity of the relationship between public and private roles in the planning, design, construction, and operation of infrastructure projects not only supports more-sustainable infrastructure projects but can also help unlock investments because it establishes certainty for investors.

From an economic and financial perspective, **data on the costs and benefits of infrastructure** projects is critical to understanding sustainability. This understanding should address the cost-effectiveness of investments, the inclusion of externalities, and improved approaches to monitoring and analysis of financial and economic sustainability. Innovative funding mechanisms, including public-private partnerships, are increasingly being adopted for the development of sustainable infrastructure projects.

Conclusions

There is demand for new and updated infrastructure to supply energy, water, sanitation, transport, and communication services in Latin America and the Caribbean, driven by increasingly urbanized populations, historical investment gaps, and regional competitiveness. Infrastructure projects are complex by nature because of the broad spatial scales over which they have consequences and the usually long time frames over which they are designed, constructed, and operated (Georgoulas et al., 2010). These projects are also financially and economically complex because of high up-front investment costs with returns over long periods, making the analysis of economic and financial sustainability of infrastructure projects difficult. At the same time, there is growing awareness of the environmental and social risks associated with infrastructure development, particularly those that relate to climate change, disaster risk management, and stakeholder engagement and their relationship with financial and economic sustainability.

A range of approaches have been developed to set standards to assess and improve sustainability in projects. Sustainability criteria, indicators, and metrics have been developed for infrastructure projects that support decision making for sustainability throughout the project cycle (Georgoulas et al., 2010; Wallis et al., 2011). The IDB has also developed several tools and approaches, including environmental and social policies and the management of climate change and disaster risks to enhance sustainability.

Critical challenges exist for LAC regions to plan, build, and operate more-sustainable infrastructure. These challenges include the needs to integrate local people effectively, engage stakeholders successfully, collaborate across sectors, and understand the economic and financial costs and benefits of projects. Integrating local people in decision making will also serve to help minimize externalities.

These challenges can be partially addressed through improved upstream strategic integrated regional and sector planning (Gill, Opperman, and Harrison, 2013; Pollalis et al., 2012). Sustainability can also be improved through assessing institutional, environmental, economic, and social sustainability outcomes and associated costs and benefits through project preparation, design, construction, and operation (Shaw et al., 2012). Adopting a new approach to sustainable infrastructure is complicated. The silo-like institutional arrangements of governments at policy planning, institutional, and project scales affect collaborative and integrated thinking across sectors. A lack of understanding and agreement on principles, criteria, and indicators among a broad range of stakeholders limits progress toward sustainable infrastructure. Finally, there is a need for data and analysis that demonstrate the economic and financial benefits of sustainable infrastructure over business as usual in order to secure the support of key public sector stakeholders.

Operationalizing the Bank's new vision for infrastructure as reflected in the Sustainable Infrastructure Strategy could contribute to lower project costs, resource use efficiency, environmental and social risk management, positive employee engagement, and an enhanced corporate image, reputation, and brand for the Bank.

Annex I: Approaches to assessment of sustainability in infrastructure

The **Civil Engineering and Environmental Quality Assessment and Award Scheme** (CEEQUAL) was developed in 2003 by the Institution of Civil Engineers in the United Kingdom (Pollalis et al., 2012; Shaw et al., 2012). This is an evidence-based self-assessment tool-and-awards scheme for improving sustainability in civil engineering projects that has become the U.K. industry standard for assessing sustainability performance in public sector civil engineering projects. There is an international version that can be used outside of the U.K. (CEEQUAL for International Projects). The tool is focused on environmental and almost all social issues and economic factors—but it does not effectively address social acceptability (normally determined through formal evaluation procedures) or client economic success (normally looked at from a corporate perspective). The CEEQUAL process is separated into the project or client contract strategy in terms of how the project or client is integrated within a broader sustainability agenda for infrastructure, civil engineering, and sustainable development.

The second section focuses on the sustainability of the project or contract and looks at how sustainability is integrated through management. The framework includes: (1) training and procurement; (2) people and communities—legal requirements, consultation, participation, engagement, and employment; (3) land use and landscapes—land and water, land acquisition, water use, flood risk, landscape change, amenity values, compensation, and mitigation; (4) historic environment—baseline studies, conservation and enhancement measures, public information for cultural artifacts; (5) ecology and biodiversity—ecological values, endangered species, surveys, conservation, enhancement, habitats, and monitoring; (6) water environment—for marine and freshwater systems, impacts, legal requirements, and enhancement where practical; (7) physical resource use and management—carbon emissions, energy use, material use, and waste management; and (8) transport—location, transport elements, workforce movements, and access.

CEEQUAL is often cross-referenced in other assessment tools and approaches, such as in ENVISION™ and the Australian Green Infrastructure Council Infrastructure Sustainability Assessment (AGIC IS)(Shaw et al., 2012), and is supported with additional educational manuals. The proposed benefits from using the tool include enhancing demonstration, improving best practices, minimizing complaints, managing environmental and social risk, minimizing reputational risks, improving public relations, reducing long-term costs, and enhancing work force and team spirit.

The **Infrastructure Sustainability Rating Tool** (IS Rating Tool) is a rating scheme for infrastructure developed and administered by the Infrastructure Sustainability Council of Australia. The tool can be applied to transport projects (airports, cycle ways and footpaths, ports and harbors, railways, and roads), to water projects (sewerage and drainage, storage and supply), to communications projects, and to energy projects (electricity transmission and distribution and gas pipelines). The tool is a comprehensive rating scheme that can evaluate sustainability across design, construction, and operations of infrastructure

projects. The scheme provides a certification mechanism and is supported by educational and training materials and activities.

From a thematic perspective, the scheme covers (1) management and governance—management systems, procurement, purchasing, and climate change adaptation; (2) resource use—energy and carbon, water, materials; (3) emissions, pollution and waste—discharges to air, land and water, land, waste; (4) ecology; (5) people and places—community health, well-being, health and safety, heritage, stakeholder participation, and urban and landscape design; and (6) innovation.

Envision™ is the result of an alliance between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design (with the collaboration of the Center for the Environment and the School of Public Health) and the Institute for Sustainable Infrastructure of the American Public Works Association, the American Council of Engineering Companies, and the American Society of Civil Engineers (Georgoulis et al., 2010; Institute for Sustainable Infrastructure & Zofnass Program for Sustainable Infrastructure of the Graduate School of Design Harvard University, 2012; Pollalis et al., 2012). The tool covers transport, energy, water, and waste management projects, and it cuts through exploration, planning/design, construction, operations, and decommissioning phases of the project cycle. However, only the planning, design, and construction phases have been so far developed. The tool is a holistic approach to support the adoption of sustainability solutions and to address both the question of whether the project is being done right as well as whether the project is the right project. While the tool was initially designed for North America, it has been adapted for LAC (e.g., INFRA 360). The main purpose of the tool is to support sustainability knowledge dissemination and education, rather than being used to rate and rank projects. The framework can also be used as a template for planning, designing, constructing, and operating projects.

The framework for evaluation includes: (1) quality of life—quality of life, sustainable growth, local skills, health and safety, community development, mobility and access, cultural and historic resources, well-being, aesthetics, amenities, and space; (2) leadership—collaboration, stakeholder engagement, management, integration, and long-term planning and addressing conflicts; (3) resource allocation—material use, using local sources, managing waste, energy management, and protecting water; (4) natural world—siting, preserving habitats, wetlands, productive lands, land and water management including storm water, contamination, biodiversity, invasive species, soils, and wetland functions; and (5) climate and risk—greenhouse gas emissions, climate threat, vulnerabilities, long-term adaptability, and resilience.

The levels of achievement within criteria are determined as follows: the lowest level is the state of the practice, followed by improved practices, enhanced practice, superior practice, conserving practice—with no negative impacts, and restorative practices, which includes additional restoration actions. The system also specifically recognizes significant and relevant innovations.

LEED for Neighborhood Development is a rating system from the LEED (Leadership in Energy and Environmental Design) family that applies to new land development projects or redevelopment projects containing residential uses, nonresidential uses, or a mix. Projects

can be at any stage of the development process, from conceptual planning to construction. It includes five different criteria: (1) smart location and linkage, (2) neighborhood pattern and design, (3) green infrastructure and buildings, (4) innovation and design process, and (5) regional priority credit.

LEED UP is framework being developed for rating infrastructure for upgrading informal settlements. The framework consists of the following settlement components and relevant LEED systems: (1) housing—safety, durability, adequacy; (2) water—supply, distribution, storage; (3) sanitation—toilets, showers, laundry, drainage; (4) food—growing, marketing, preparation; (5) education and health care—schools, clinics; (6) access and mobility—internal circulation, external linkages; (7) common spaces—plazas, parks, recreation facilities; (8) energy and communications—power, thermal energy, voice and data; (9) solid waste—collection, recycling, disposal; (10) restoration and resilience—natural hazards, ecosystems. LEED UP is a participatory process intended for residents of settlements that have some degree of land tenure security and local governance. Initial field tests of such a rating approach are being applied to the Vale Encantado, a slum located in Rio de Janeiro, in cooperation with the Green Building Council of Brazil.

The **Hydropower Sustainability Assessment Protocol** (HSAP) was initially developed by the International Hydropower Association in 2006 and updated in 2010. The approach is based on earlier studies on the environmental and social aspects of hydroelectric projects (Ledec and Quintero, 2003; World Commission on Dams, 2000). The purpose of the HSAP is to provide a sustainability assessment framework for hydropower development and operation. The protocol includes assessment of four different stages of project development: early stage tool for risk assessment and dialogue, preparation, implementation, and operations.

The evaluation framework is built around four main topics: environmental perspective, social perspective, technical perspective, and economic/financial perspective. The early stage tool evaluates the demonstrated need; the assessment of options, policies, and plans; political risks; institutional capacities; technical issues and risks; social issues and risks; environmental issues and risks; and economic and financial issues and risks. The preparation, implementation, and operations tools cover, to different extents, twenty five areas as follows: communications and consultation; governance; demonstrated need and strategic fit (preparation only); siting and design (preparation only); environmental and social impact assessment and management; integrated project management (not operations); hydrological resource (not in implementation); asset reliability and efficiency (operations only); infrastructure safety; financial viability; project benefits; economic viability (preparation only); procurement (not in operations); project-affected communities and livelihoods; resettlement; indigenous peoples; labor and working conditions; cultural heritage; public health; biodiversity and invasive species; erosion and sedimentation; water quality; waste, noise, and air quality (only implementation); reservoir planning, preparation, filling, and management; and downstream flow regimes. The criteria for assessment are that level 3 reflects basic good practice, level 5 describes proven best practice, while levels 1, 2, and 4 reflect intermediary stages (International Hydropower Association, 2010).

The **Infrastructure Voluntary Evaluation Sustainability Tool** (INVEST) was developed by the U.S. Federal Highway Administration. It is designed for voluntary educational and learning to improve sustainability in projects. The tool covers system planning, project development and operations, and project maintenance. The system planning module includes the following evaluation criteria: (1) integrated planning; (2) economic development; (3) land use; (4) natural environment; (5) social; (6) access and affordability; (7) safety planning; (8) multimodal transportation and public health; (9) freight and goods movement; (10) travel demand management; (11) air quality; (12) energy and fuels; (13) financial sustainability; (14) analysis methods; (15) transportation systems management and operations; (16) living asset management and planning; (17) infrastructure resiliency; and (18) linking planning and the National Environmental Policy Act.

The project development module includes: (1) economic analyses; (2) life cycle cost analyses; (3) context-sensitive project development; (4) highway and traffic safety; (5) educational outreach; (6) tracking environmental commitments; (7) habitat restoration; (8) storm water; (9) ecological connectivity; (10) pedestrian access; (11) bicycle access; (12) transit and heavy occupancy vehicle access; (13) freight mobility; (14) information technology services for system operations; (15) historical, archaeological, and cultural preservation; (16) scenic, natural, or recreational qualities; (17) energy efficiency; (18) site vegetation; (19) reduced use and reused materials; (20) recycle materials; (21) earthwork balance; (22) long-life pavement design; (23) reduced energy and emissions in pavement materials; (24) contractor warranty; (25) construction environmental training; (26) construction equipment emission reduction; (27) construction noise mitigation; (28) construction quality control plan; and (29) construction waste management.

The operations and maintenance module includes (1) an internal sustainability plan; (2) electrical energy efficiency and use; (3) vehicle fuel efficiency and use; (4) reuse and recycle; (5) safety management; (6) environmental commitments tracking system; (7) pavement management system; (8) bridge management system; (9) maintenance management system; (10) highway infrastructure preservation and maintenance; (11) traffic control infrastructure maintenance; (12) road weather management program; (13) transportation management and operations; and (14) work zone traffic controls.

Other Urban Sustainability Rating Tools. A recent publication of Criterion Planners (CRITERION, at www.crit.com) on global urban sustainability rating tools found about 54 different tools in 22 countries that are being used to measure aspects of urban sustainability (including tools for cities, neighborhoods, landscape and parks, transport and infrastructure, and tools for other special purposes). In general, a few of these systems look at green building practices, but the majority of the tools consider integrated approaches to measure how neighborhoods and cities are including social, environmental, and economic elements into planning, project development and execution.

Annex II: Environmental and social policy approaches to sustainability

Performance standards have been increasingly gaining in acceptance, having been pioneered by the International Finance Corporation (IFC) and then adopted by the European Bank for Reconstruction and Development and the Asian Development Bank and by commercial banks. A first draft of the new **World Bank Environmental and Social Framework** was released for consultation in July 2014. The standards address the following general areas related to sustainability: (1) assessment and management of environmental and social risks and impacts; (2) labor and working conditions; (3) resource efficiency and pollution prevention; (4) community health and safety; (5) land acquisition, restrictions on land use, and involuntary resettlement; (6) biodiversity conservation and sustainable management of living natural resources; (7) indigenous peoples; (8) cultural heritage; and (9) information disclosure and stakeholder engagement.

This draft document is modeled after the structure of the **2012 International Finance Corporation Sustainability Framework** that includes the IFC Policy on Environmental and Social Sustainability, Performance Standards, and an Access to Information Policy. The Policy is intended to put into practice the IFC's commitments to environmental and social sustainability. The standards include the following sustainability areas: (1) assessment and management of environmental and social risks and impacts; (2) labor and working conditions; (3) resource efficiency and pollution prevention; (4) community health, safety, and security; (5) land acquisition and involuntary resettlement; (6) biodiversity conservation and sustainable management of living natural resources; (7) indigenous peoples; and (8) cultural heritage.

The first of the **Inter-American Development Bank (IDB) Safeguard Policies**, on Involuntary Resettlement, was established in 1998 (IDB, 1998). This was followed by the Environment and Safeguards Compliance Policy (IDB, 2006a), the Operational Policy on Indigenous Peoples (IDB, 2006b), the Disaster Risk Management Policy (IDB, 2007), the Gender Equality in Development Policy (IDB, 2010b), and the revised Access to Information Policy (IDB, 2010a). These policies are intended to enhance long-term development benefits by integrating environmental sustainability in all bank operations and ensuring that operations were environmentally sustainable.

The IDB Safeguard Policies cover the following sustainability elements: (1) compliance with local laws; (2) procedures for the screening and review of projects; (3) assessment of risk factors beyond the project, such as sector-related risks, vulnerability to disasters (see also the Disaster Risk Management Policy), and sensitive environmental and social concerns; (4) environmental assessment and management of projects; (5) consultations and stakeholder engagement; (6) transboundary impacts; (7) natural habitats and cultural sites; (8) hazardous materials; and (9) pollution, including greenhouse gas emissions (IDB, 2006a).

The Involuntary Resettlement Policy covers the need to avoid or minimize the need for involuntary resettlement (including affectation of livelihoods and access to resources) and, where displacement is unavoidable, to establish an effective plan to ensure people receive

fair and adequate compensation and rehabilitation (IDB, 1998). The Indigenous Peoples Policy requires that Bank projects both support the development with identity of indigenous peoples and safeguard indigenous peoples and their rights against adverse impacts and exclusion (IDB, 2006b). The Gender Equality Policy requires that projects prevent or mitigate adverse impacts on women or men and manage the risks of exclusion due to gender (IDB, 2010b). The Disaster Risk Management Policy requires Bank projects to address both the risks associated with natural disasters on the project and the risks that the project may exacerbate risks for others (IDB, 2007).

The IDB Safeguard Policies also include directives that are designed to mainstream sustainability within Bank operations. Mainstreaming includes incorporating environmental issues in Bank country programs and strategies, supporting environmental and natural resource management in client countries, mainstreaming environmental issues across sectors, supporting regional initiatives and international agreements, tracking environmental sustainability indicators, assessing national-level environmental risks and opportunities, and promoting corporate environmental responsibility. The Independent Advisory Group (2011), contracted by the Bank to review implementation of the Environment and Safeguards Compliance Policy, specifically recommended that the Bank consider establishing a strategic framework for translating the concept of sustainability into operational terms and to contribute to greater consistency and applicability of sustainability standards across LAC.

Annex III: Sustainability lessons learned from infrastructure projects

The IDB has worked closely with project sponsors to develop infrastructure projects that are increasingly being seen as, and are used as, models for sustainable infrastructure. These projects include, among others, the Porto Velho–Rio Branco Road in Acre Brazil, the Reventazón Hydroelectric Project in Costa Rica, and the Barbados Coastal Zone development. This Annex draws some key lessons learned from overview analyses of these projects and other projects in LAC. The majority of these lessons learned are drawn from Reed et al. (2014) unless otherwise indicated.

Two Bank loans for US\$59.5 million were approved in January 1985 for the **Porto Velho–Rio Branco section of federal highway BR-364** in Acre, Brazil. The impassability of this road was the basis for elevated transportation costs for products from this region and therefore it threatened economic sustainability. The project incorporated a component to help support the management of regional ecosystems and indigenous people; subsequently, this component was substantively enhanced. The projects were reviewed by Redwood (2012b), with the following key sustainability lessons learned:

- Integrate projects with local and regional knowledge and organizational systems.
- Establish and track clearly defined objectives and targets.
- Explicitly incorporate local institutions at the design stage.
- Ensure close Bank supervision and accompaniment.
- Go beyond standard environmental assessment to integrate economic, social, and environmental concerns.
- Assess and manage infrastructure projects in the broad spatial contexts through which they effect change.
- At the design stage, incorporate as an integral element of the infrastructure project itself the measures that will ensure sustainability.
- Ensure that sustainability elements are transferred to the contractors, including those that improve environmental and social sustainability, along with the financial resources to strengthen government and civil society organizations responsible for managing sustainability in the area.

A follow-up loan of US\$64.8 million—the Acre Sustainable Development Project—was approved in 2002. This project embedded the road component in a broader multi-sector spatial development program, including improved management of forest resources and additional infrastructure investments. The main lessons learned from this project were the benefits of applying an enhanced range of sustainability criteria, including particularly those relating to stakeholder participation, and the importance of obtaining a high-level political commitment to move ahead with an infrastructure project of this scale.

Two Bank loans for US\$450 million were approved in 2012 for the **Reventazón Hydroelectric Project** in Costa Rica. This 305 megawatt (MW) project will represent 10% of the country's installed generation capacity. The Bank projects incorporated additional

technical cooperation financing of US\$466,000 to help enhance sustainability, particularly to focus on ecological connectivity in the MesoAmerican Biological Corridor, which the reservoir affected, and to establish one of the first aquatic offsets in Latin America and the Caribbean. The initial lessons learned from this work are: (1) the need for integrated energy sector, river basin, and land use planning to ensure sustainability; (2) the importance of working closely with knowledgeable local and international organizations involved in land and river use planning; (3) the importance of recognizing and compensating for residual cumulative impacts on rivers that result from hydroelectric projects; (4) during the design stage, the need to incorporate analysis and identification of the financial resources and institutional mechanisms to ensure long-term sustainability; and (5) the need to evaluate the institutional capacities of owners and construction firms to deliver broader sustainability outcomes.

A Bank loan for US\$17 million was approved in 2002 to support coastal infrastructure investments in Barbados and a loan for US\$30 million was approved in 2010 for a **Coastal Risk Assessment and Management Program**. The original drivers for these investments were concerns about coastal erosion and risks to coastal areas arising from natural disasters. A Coastal Zone Management Unit (CZMU) that had been established by Barbados with support from the Bank in 1996 has been instrumental in improving management. The CZMU has a fully integrated approach that incorporates research, pollution control, erosion control, and institutional mechanisms to manage coastal development. These investments are key to supporting the tourism sector in Barbados—the country's main employer, generating annual receipts of over US\$22 billion. The key lessons learned from the work have been: (1) the importance of good governance, stakeholder engagement, transparency, and cross-sector integrated planning; (2) the importance of incorporating climate change disaster risk management and resilience in infrastructure planning and investments; (3) the value of establishing and maintaining project management capacities; (4) the value of public education to build and maintain support for sustainability initiatives; (5) the value of using an integrated approach to planning that incorporates activities from different sectors that are managed by separate institutions; and (6) the importance of increasing local institutional and individual capacities that support collaboration and teamwork.

A Bank loan for US\$41.7 million was approved in 2012 to support the **Palmatir Wind Farm** and transmission line in Tacuarembó, Uruguay. The capacity of the wind farm is 50MW; it consists of 25 turbines each with 2MW capacity, 34 kilometers (km) of aboveground cables, and 20 km of subterranean cables. The main sustainability lessons learned were: (1) the need to design projects to generate jobs, transfer technology, and build capacity; (2) the importance of focusing on community well-being as a prime determinant of sustainability; (3) the importance of community feedback in decision making; (4) the need for effective environmental and social management plans to address noise and electromagnetic fields in order to minimize impacts on health and gain the full support of the community; (5) the need to protect historical sites; (6) the need for project management to explicitly include collaboration and stakeholder engagement (several public hearings were held, from which the expansion and repair of the local road network was coordinated between the project proponents and the local community); (7) the need for project siting to avoid areas of high ecological value; (8) the need to minimize water

use; and (9) adherence to international standards in the absence of national legislation relating to wind farms.

The Honduran corporation *Desarrollos Energéticos S.A.* (DESA) and the Chinese state-owned company Sinohydro are constructing the 22MW **Agua Zarca Hydroelectric Project** in the Department of Santa Barbara. The Central American Bank for Economic Integration, the Finnish Fund for Industrial Cooperation, and the FMO Entrepreneurial Development Bank are providing financing. While this project was considered to bring sustainability benefits arising from clean and renewable energy sources, the project is presently on hold and Sinohydro has withdrawn.

The sustainability lessons learned from this project are the need for: (1) effective stakeholder engagement and consultation that meets international standards, particularly with indigenous communities (ILO 169); (2) participatory context-specific impact significance and trade-off assessment between local ecosystem services and energy production; (3) explicit consideration of indigenous community perspectives and cultural values; (4) an address of conflicting claims as they relate to land use and tenure; and (5) collaborative approaches to integrated management of natural resource use—in this case, water.

Bogota has established a **Bus Rapid Transport (BRT) System–TransMilenio** and a **Bike Path Master Plan** to support non-motorized transport. The BRT can transport 1.2 million people each day; at the same time, the system has reduced traffic fatalities in the city by 92%, travel time by 32%, and air pollutants by 40% in the first 12 months of implementation, with emissions per passenger expected to decrease by 45% by 2015. The bike system includes 400 km of bikeways established since 1998, and bicycle use has grown from 0.5% in the mid-1990s to 5% in 2006. The costs per km were substantially reduced compared with using road transport. The main lessons learned from these sustainable infrastructure systems are the importance of: (1) holistic and integrated planning approaches to transport infrastructure; (2) a linking of public information and public accessibility to ensure high use and broad acceptance; (3) public communication approaches to shift public perceptions about public transport and infrastructure; (4) integrating incentives, public education, and regulation; (5) innovative public-private partnerships for financing; (6) political leadership and will; and (7) stakeholder engagement and ongoing civil society participation.

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