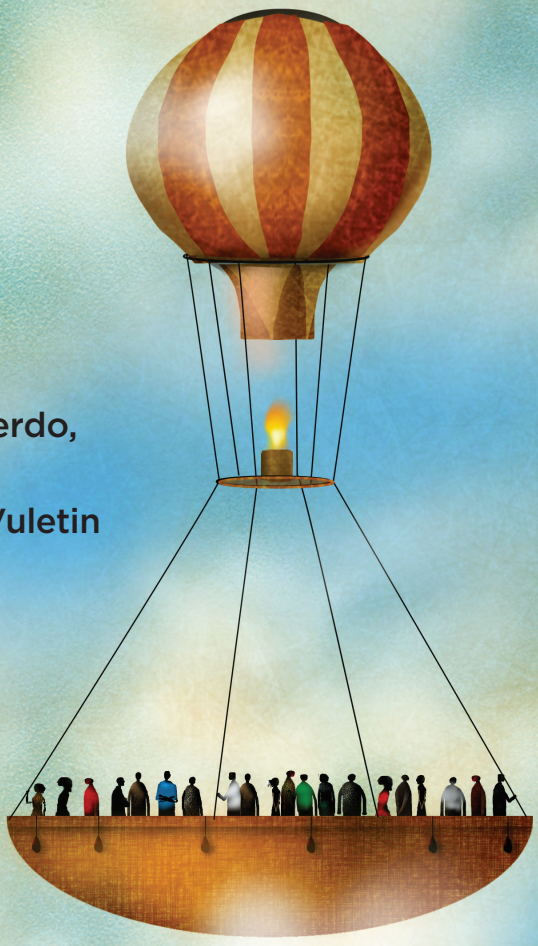
DEVELOPMENT IN THE AMERICAS

Better Spending for Better Lives

How Latin America and the Caribbean Can *Do More with Less*

Chapter 5



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IDB

Better Spending for Better Lives

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5 Public Infrastructure: Less Waste for Better Building

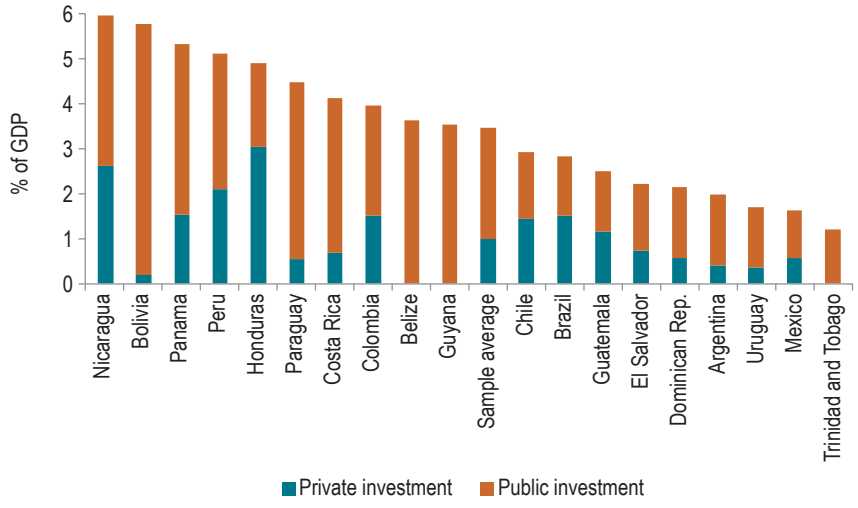
The decrepit state of infrastructure in Latin America and the Caribbean is well known. From pot-hole-ridden roads and bridges in disrepair to substandard airports and sea ports, the region's growth and the quality of life of its citizens suffers from its crumbling infrastructure. While bricks and mortar alone cannot assure growth and prosperity, without acceptable infrastructure services, a country is hard pressed to compete in today's world.

Why is infrastructure so subpar in the region? To begin with, countries in Latin America and the Caribbean do not invest enough in infrastructure. Public and private investment in infrastructure in Latin America and the Caribbean reached an average of 2.75 percent of GDP between 1992 and 2015 and an average of 3.8 percent from 2008 to 2015 (Figure 5.1). This level of spending is low compared with, for example, China (8.5 percent), Japan and India (5 percent), and the average in industrial countries (4 percent) (Powell, 2016). Moreover, as noted in Chapter 2, current investment figures have even dipped below those prevailing in the 1980s. To fill the infrastructure gap, the region would need to invest about 5 percent of its GDP over the next 20–30 years, which is equivalent to an additional $100 billion a year (Perrotti and Sánchez, 2011; Barbero, 2013; Serebrisky, 2014).[1]

Not surprisingly, low investment in infrastructure has led to poor infrastructure services. The quality of infrastructure in most Latin American and Caribbean countries—particularly in Argentina, Brazil, Paraguay, and Venezuela—is considerably lower than it should be given their income levels (World Bank, 2017). Only a few exceptions in the region—mostly in

[1] Perrotti and Sánchez (2011) calculate infrastructure investment needs based on estimates of consumer and producer demand, under the assumption of an average GDP growth rate of 3.9 percent. Investment needs in infrastructure are consistent with reaching an infrastructure stock that allows the region to grow at the aforementioned rate.

Figure 5.1 Investment in Infrastructure (Average between 2008 and 2015)

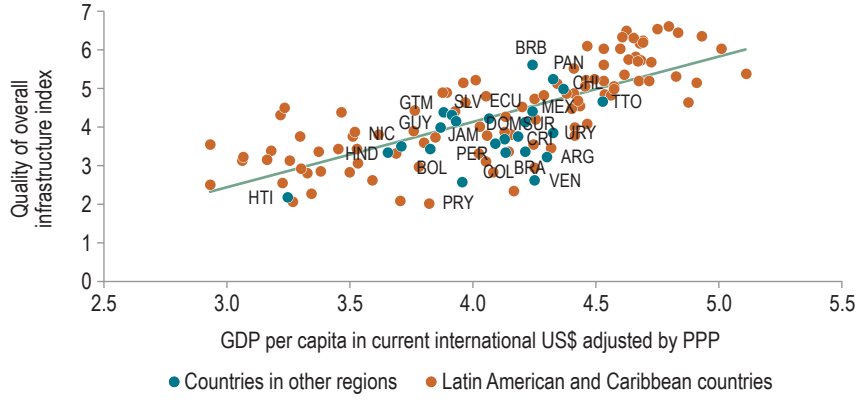


Source: Authors' calculation based on 2017 data from INFRALATAM, http://infralatam.info/.

Central America (Guatemala, Panama, and El Salvador)—have better-than-expected infrastructure quality (Figure 5.2).

Figure 5.2 Relationship between Quality of Overall Infrastructure and Income Level, 2014

Positive relationship between the quality of infrastructure and a country's level of development



Source: Authors' calculation based on the World Bank World Development Indicators Database and the World Economic Forum's Global Competitiveness Index dataset 2007–2017.
Note: Quality of overall infrastructure index ranges from 0 (worst infrastructure quality) to 7 (best infrastructure quality).

Policy reforms to attract private sector investment in infrastructure began in the mid-1990s, and increased private investment from a negligible amount to 1 percent of GDP by 2015 (Serebrisky et al., 2015). Despite the growing role of the private sector, the public sector however, accounts for more than two-thirds of total infrastructure investment in Latin America and the Caribbean (Figure 5.1). Private investment in infrastructure has varied across countries and sectors, and more can be done to mobilize it through policies supported by multilateral development banks (MDBs) in the region (UNDP, 2016).[2] But the experience of recent decades in Latin America and the Caribbean shows that the public sector may still play a substantial role in the funding of infrastructure.

The role of the public sector in infrastructure is important not only because the sector makes up the lion's share of total investment but also because infrastructure investment has public good characteristics, including strong externalities and network effects. Providing electricity requires an efficient transmission and distribution network; urban transport systems need both trunk routes and feeders to provide adequate access to jobs and housing. If infrastructure development is not properly planned, the efficiency of services provided by the assets will be low. In addition, global agreements like the Paris Accord and the Sustainable Development Goals require governments to plan and set standards in order to create infrastructure that is resilient and meets mitigation targets.

Growth in Latin America and the Caribbean is declining and the region's macroeconomic prospects are weak. The region's baseline growth for 2017–2019 is 2 percent (Powell, 2017). Given this outlook, public investment in infrastructure is likely to face significant cuts in the next few years. Capital expenditures are procyclical in Latin America and suffer disproportionately large cuts when the economy faces difficult times (Ardanaz and Izquierdo, 2017; see also Chapter 2 for more details). Between 1987 and 1992—a period of financial and fiscal crises in the region—one-third of the improvement in fiscal accounts came at the expense of lower investment in infrastructure (Carranza, Daude, and Melguizo, 2014). At least since 1995, current expenditures have grown almost without interruption. Capital expenditures have been more volatile, including prolonged periods of cuts. Total public expenditure in Latin America and the Caribbean increased by 3.7 percent of GDP between 2007 and 2014, but more than 90 percent of it went to current expenditures; only 8 percent was devoted to longer-term investments (Cavallo and Serebrisky, 2016). These figures are consistent with the bias against public investment highlighted in Chapter 2.

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[2] See G20 International Financial Architecture Working Group (2017).

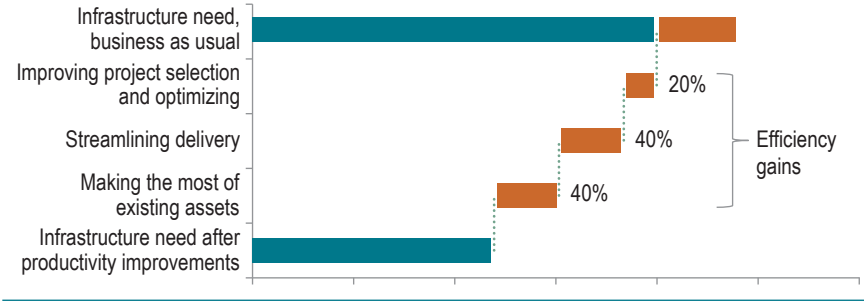
While this bias is resolved (see Chapter 9 on public expenditure composition rules to protect public investment), having fewer resources to invest forces countries to find ways to provide infrastructure services more efficiently. A study by the McKinsey Global Institute (Dobbs et al., 2013) concludes that countries could satisfy future demand for infrastructure services by investing just 60 percent of what demand forecasts indicate they should—that is, just by investing resources more efficiently, countries could save up to 40 percent on infrastructure expenditure (Figure 5.3). McKinsey's report identifies three components and processes of the project cycle of infrastructure service delivery that need to be improved to reach the 40 percent in efficiency gains: 1) improving project selection and optimizing infrastructure portfolios, 2) streamlining service delivery, and 3) making the most of existing assets. Each of them explains, respectively, 20 percent, 40 percent, and 40 percent of potential efficiency gains. This chapter adopts McKinsey's analytical structure and attempts to provide quantitative estimates of Latin America and the Caribbean's potential efficiency gains in public investment in infrastructure (Figure 5.3).

Making the Right Choices

Picking the right projects and optimizing infrastructure portfolios can go a long way toward improving the efficiency of infrastructure spending. Project selection can be improved in several areas. Proper planning can help countries take advantage of network effects and avoid expensive changes during implementation. Early-stage planning and design can offer key savings by reducing the need to make changes after construction begins.

One of the most powerful ways to reduce the overall cost of infrastructure is to avoid investing in projects that neither address clearly defined needs nor deliver sufficient benefits (Dobbs et al., 2013). Investing in the

Figure 5.3 Potential Efficiency Gains in Infrastructure Spending



Source: Authors' elaboration adapted from Dobbs et al. (2013).

investment process can raise returns on both public and private investment and ensure that investment generates the required growth dividends while maintaining fiscal and debt sustainability (Collier and Venables, 2008). Choosing the right combination of projects and eliminating wasteful ones could save $200 billion a year globally (McKinsey Global Institute, 2017). When upstream planning is done properly, countries select the projects with the highest social rates of return, avoiding white elephants (e.g., "bridges to nowhere").

The Public Investment Management Index (PIMI) developed by the International Monetary Fund (IMF) assesses the institutional environment underpinning public investment management systems at four project stages: appraisal, selection, implementation, and evaluation. Its sample of 71 countries includes 10 countries from Latin America and the Caribbean. The index—which ranges from 0 (least efficient) to 4 (most efficient)—indicates that while Latin America and the Caribbean performs well relative to other regions, it still has a long way to go in terms of efficiency. Its average (1.83) is slightly lower than the average for Eastern European countries (1.91) but relatively higher than the lowest-scoring region, Africa (1.56).[3] Brazil, Colombia, Peru, and Bolivia score above the average of the 10 Latin American and Caribbean countries included (Table 5.1). Nonetheless, the region is far from the best performer in the sample, South Africa, which has an efficiency score of 3.53.

The PIMI includes only 10 countries in Latin America and the Caribbean. To overcome this limitation, Contreras et al. (2016) of the IDB revised this methodology and used it to assess all countries in the Network of National Public Investment Systems (SNIP).[4] They added one new dimension and two subdimensions to the PIMI. A new dimension, labeled as "general characterization of the public investment cycle," captures operational characteristics with respect to all stages of the public investment cycle. The subdimension

[3] Countries in Africa are weak at all stages of the public investment management process. However, cross-country variations are large and for example, South Africa is the world's top PIMI performer.

[4] The Latin American and Caribbean region has tried to improve project selection by creating national systems of public investment (SNIPs, to use their Spanish acronym). SNIPs regulate public investment processes guiding projects from the early stages of formulation and feasibility to ex post evaluation. The hypothesis underlying the creation of SNIPs is that better analysis and evaluation of projects improve the quality and quantity of infrastructure projects. In 2010, a SNIP Network was created to help strengthen the functioning of these systems. The network, which is supported by the Economic Commission for Latin America and the Caribbean (ECLAC) and the IDB, includes Argentina, Bolivia, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay.

Table 5.1 Public Investment Management Index, 2015

Country	Appraisal	Selection	Implementation	Evaluation	Total
Brazil	3.00	2.80	3.33	3.33	3.12
Colombia	4.00	2.80	2.13	3.33	3.07
Peru	2.83	3.60	2.67	1.33	2.61
Bolivia	2.83	2.00	2.93	2.00	2.44
El Salvador	0.83	1.60	3.33	1.33	1.77
Jamaica	1.83	2.40	1.33	1.33	1.72
Barbados	0.50	2.00	0.93	1.33	1.19
Trinidad and Tobago	0.00	2.40	1.33	0.67	1.10
Haiti	0.00	1.20	1.73	1.33	1.07
Belize	0.00	0.80	0.27	0.00	0.27
Top performer (South Africa)	4.00	4.00	2.80	3.33	3.53
Average for Eastern Europe	1.63	2.18	2.34	1.48	1.91
Average for Latin American and Caribbean sample	1.58	2.16	2.00	1.60	1.83
Average for Asia	1.64	1.72	2.04	1.45	1.71
World average	1.33	1.60	2.00	1.33	1.57
Average for Africa	1.38	1.75	1.80	1.31	1.56

Source: Authors' elaboration based on Dabla-Norris et al. (2012).
Note: Values range from 0 (least efficient) to 4 (most efficient). Countries are ordered from most efficient to least efficient based on the total average index, i.e., a simple average of the four subcomponents.

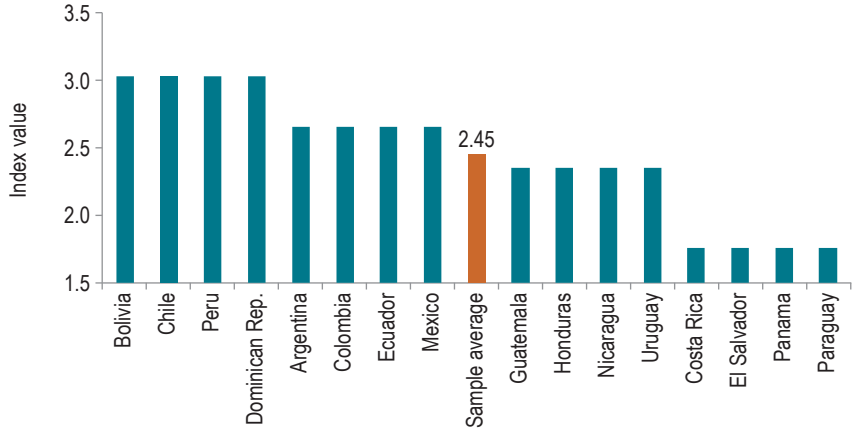
"methodologies on project preparation and evaluation/social pricing" is included in the "strategic guidance and project appraisal" dimension and the subdimension "selection criteria" is included in the "project section" dimension.

By this new measure, Bolivia, Chile, Peru, and the Dominican Republic are the top performers in the region (Figure 5.4). Countries that need institutional strengthening to reach the regional average level include Paraguay, Panama, El Salvador, Costa Rica, Uruguay, Nicaragua, Honduras, and Guatemala. Yet again the region's performance leaves considerable room for improvement, with an average of 2.45 out of a total possible score of 4.

No country in Latin America and the Caribbean reaches the highest efficiency performance level (4) on the Strategic Planning and Evaluation or Project Selection indices (Figure 5.5).[5] These results are consistent with other efficiency-related public management indices, such as the World Economic Forum's Global Competitiveness Index and the World Bank's Governance Index. One would expect a positive correlation between

[5] The other dimensions of the index are project implementation, project evaluation and audit, and general characterization of the public investment cycle.

Figure 5.4 Efficiency of Public Investment Management, 2016



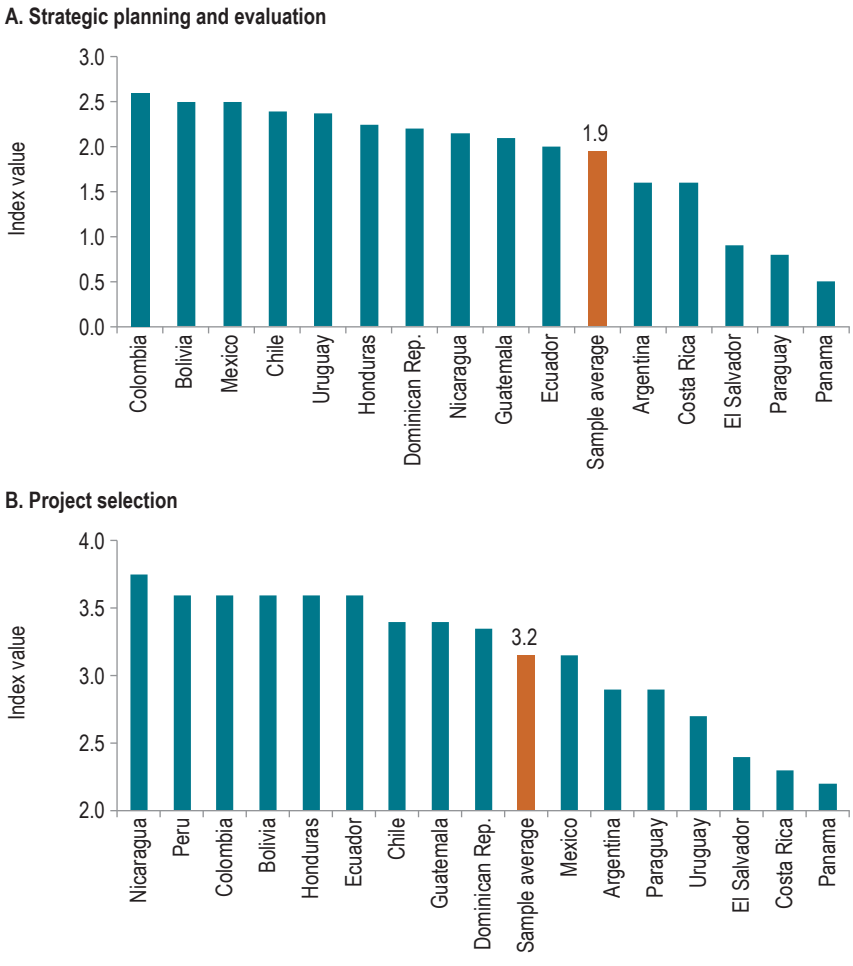
Source: Authors' calculation based on Contreras et al. (2016).
Note: Values range from 0 (least efficient) to 4 (most efficient).

efficiency of public investment management and competitiveness and governance. However, the correlation between the IMF and IDB efficiency indices and either competitiveness or governance indices is not significant. In fact, some countries with low PIMIs, such as Costa Rica, Uruguay, and Panama, have good competitiveness and governance rankings. Thus, even good levels of competitiveness and governance do not guarantee high efficiency of public investment management.

Another way to evaluate the efficiency of the public management of investment is to examine the private sector's views of the public procurement cycle. Since 2013, the World Bank has been measuring how the private sector does business with governments. Its Benchmarking Public Procurement (BPP) database assesses 180 economies and scores them from 0 (worst) to 100 (best). Among other dimensions, this indicator includes a needs assessment, a call for tenders, and bid preparation. Figure 5.6 shows the results for selected countries in Latin America and the Caribbean.

The 2017 BPP index identifies Russia (100), Canada (98), and the United States (98) as the top performers. The average for Latin America and the Caribbean is 62. Its top performers—Colombia, Mexico, Nicaragua, and Peru—have a score of 80. Surprisingly, the correlation between the bid preparation dimension of the BPP index and the PIMI efficiency scores for Latin American and Caribbean countries included in the sample is close to zero, a counterintuitive result as one would expect a positive correlation. However, this shows again that countries may be efficient in some

Figure 5.5 Indices of Subdimensions of Efficiency in Public Investment Management, 2016



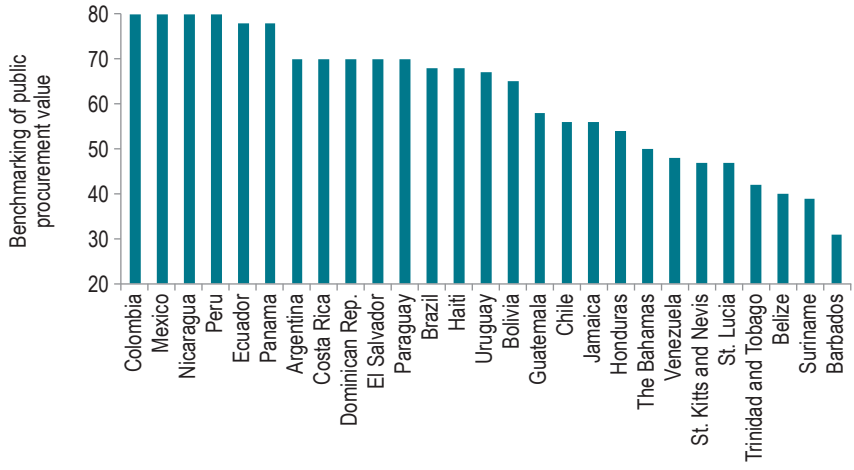
Source: Authors' calculation based on Contreras et al. (2016).
Note: Values range from 0 (least efficient) to 4 (most efficient).

dimensions and not in others—all the more reason to look at efficiency from different angles.

In 2017, the Global Infrastructure Hub[6] launched InfraCompass, an initiative that identifies the foremost policies and practices that lead to sustainable and equitable infrastructure through efficient markets, better

6 GIH https://www.gihub.org.

Figure 5.6 Benchmarking of Public Procurement, 2017



Source: Authors' calculation based on World Bank Procuring Infrastructure Public-Private Partnerships database.
Note: Values range from 0 (worst) to 100 (best).

decision-making, and improved delivery. InfraCompass analyzes 49 countries, which together account for 90 percent of global GDP and 75 percent of the world's population. It indicates that emerging economies have dominated the list of top improvers over the past decade. Policy development—including better governance through reduced corruption, improved regulatory quality via enhanced rule of law, and simplified permit procedures and land administration—contributed to these economies' strong performance.[7] No country in Latin America and the Caribbean performed at the level of advanced economies or high-performing emerging economies.

Table 5.2 summarizes the results of Contreras et al. (2016), who expand coverage of the IMF's Public Investment Management Index for Latin America and the Caribbean, the World Bank's Benchmarking Public Procurement, and InfraCompass. Despite the differences in country scores observed among these indices, it is possible to rank Latin American and Caribbean countries into four groups in terms of their capacity for infrastructure planning and project selection optimization:

- Group 1 (very strong): Chile, Colombia, Mexico, and Peru
- Group 2 (strong): Bolivia, the Dominican Republic, Ecuador, and Nicaragua

[7] For more information on the specifics of data and methodology, see http://infracompass.gihub.org/static/data/GIH_InfraCompass_Technical_Methodology.pdf.

Table 5.2 Indicators of Infrastructure Delivery Institutional Capacity, 2017

	Public Investment Management Index			World Bank Benchmarking Public Procurement database	Global Infrastructure Hub InfraCompass**	
Country	Appraisal	Selection	Implementation	Preparation*	Evaluation	Total
Argentina	2.66	1.60	2.90	70	Medium	Low
Bolivia	3.03	2.50	3.60	65	Low	Low
Chile	3.03	2.40	3.40	56	Medium	High
Colombia	2.66	2.60	3.60	80	Medium	High
Costa Rica	1.76	1.60	2.30	70	Low	Low
Dominican Rep.	3.03	2.20	3.35	70	Low	Low
Ecuador	2.66	2.00	3.60	78	Low	Low
El Salvador	1.76	0.90	2.40	70	Low	Low
Guatemala	2.35	2.10	3.40	58	Low	Low
Honduras	2.35	2.25	3.60	54	Low	Low
Mexico	2.66	2.50	3.15	80	Medium	Very high
Nicaragua	2.35	2.15	3.75	80	Low	Low
Panama	1.76	0.50	2.20	78	Low	Low
Paraguay	1.76	0.80	2.90	70	Low	Low
Peru	3.03	2.7	3.6	80	Low	High
Uruguay	2.35	2.37	2.7	67	Medium	Low

Source: Authors' calculation based on Contreras et al. (2016), World Bank Benchmarking Public Procurement database, and G20 Global Infrastructure Hub.
Note: Values range from "very weak" (cells colored by red) to "very strong" (cells not colored). The darker the area, the worse the performance.
* It assesses procurement life cycles in 180 economies, which it scores from 0 (worst) to 100 (best).
** Framework to help countries deliver infrastructure more effectively, and to provide a better understanding of a country's infrastructure market.

- Group 3 (weak): Argentina, Costa Rica, Guatemala, Honduras, and Uruguay
- Group 4 (very weak): El Salvador, Panama, and Paraguay.

Streamlining Infrastructure Delivery

Streamlining the delivery of infrastructure requires action in several project-related areas and can account for 40 percent of the total potential efficiency gains in infrastructure delivery, according to Dobbs et al. (2013) (Figure 5.3). A variety of bottlenecks raises infrastructure construction costs. Land acquisition processes, environmental permits, and resettlement agreements usually lack institutional coordination and involve lengthy bureaucratic processes that delay project implementation. Failure

to use advanced construction techniques, the high incidence of informal labor, and weak incentives to implement lean supervision systems all increase construction costs. This section focuses on providing quantitative estimates of potential gains in public investment in infrastructure in order to avoid cost overruns and project implementation delays.

Trimming Construction Cost Overruns

Cost overruns are common in infrastructure (Box 5.1). In practical terms, cost overruns in an infrastructure project imply that the assets in the project could be built using fewer financial resources. There is a caveat, however: cost overruns are not always necessarily bad, or the result of inexperience, ineptitude, or corruption. Building infrastructure is a difficult endeavor, and cost overruns are often to be expected. Investment in infrastructure is large, lumpy, and involves high construction risks, mostly driven by the impossibility of anticipating contingencies. Complex geology, archeological remains, natural disasters, and physical and social constraints (for instance, resettlement processes that might trigger legal disputes) are among some of the variables that cause unavoidable cost overruns.[8] Other overruns are avoidable, though, and reducing or eliminating them can yield substantial savings.

Globally, cost overruns account for 28 percent of the total cost of infrastructure investment (Flyvbjerg, 2016). They usually arise because of incomplete information, lack of competition and transparency in bidding processes, weak project supervision, and an optimistic bias that underestimates costs. Box 5.1 shows the main theories for cost overruns in infrastructure projects.

Based on a sample of 806 projects worldwide, Flyvbjerg (2016) shows that projects in Latin America and the Caribbean have much higher cost overruns (48 percent) than the average project in the world (28 percent) (Table 5.3), and higher than in North America (24 percent) and Europe (26 percent). Flyvbjerg and Sunstein (2016) report that cost overruns have increased in Latin America and the Caribbean but decreased in Asia

[8] Further nontechnical reasons for cost overruns could stem from changes in inflation and the exchange rate. For example, if over the life of a loan, inflation in the destination country increases faster than in the country of origin of the funds (e.g., the United States) and/or the local currency appreciates, the project costs in US$ terms increase. If these changes were not anticipated, they can drive up costs significantly. Especially in the Latin American and Caribbean context, these macroeconomic considerations might have played an important role in recent decades.

and Europe (for Africa and Oceania there were no statistically significant trends). Other sources, based on anecdotal evidence, indicate that on average 75 percent of Latin American infrastructure projects experience cost overruns and 65 percent of projects experience delays of 6–18 months (Guasch, Suárez-Alemán, and Trujillo, 2016).

Is there a good benchmark against which cost overruns in Latin America can be compared? For this report, a novel dataset was built and analyzed on cost overruns on public infrastructure projects financed by multilateral development banks (MDBs), which usually provide 10–12 percent of public infrastructure investment funds in Latin America and the Caribbean (more than 20 percent in small economies, mostly in Central America) (Serebrisky et al., 2015). The working hypothesis is that infrastructure projects

BOX 5.1 COST OVERRUNS IN INFRASTRUCTURE: WHY THE PRICE IS NEVER RIGHT

The development of infrastructure projects takes time. Combining this fact with incomplete information sets the scene for cost overruns. First, contractors may have less incentive to minimize costs as projects are in more advanced stages because the threat of downsizing and removal is less credible as the project progresses (Arvan and Leite, 1990; Lewis, 1985). Secondly, the complexity of infrastructure projects often makes designs imperfect. This complexity, coupled with the impossibility of writing complete contracts, incentivize contractors to present lower costs for getting the contract, and then renegotiate a higher price later (hold-up) (Ganuza, 2007).

The literature points out four dimensions of cost overruns in infrastructure projects: technical, economic, political, and sociological (Flyvbjerg, Skamris Holm, and Buhl, 2002, 2003, 2007, 2008, 2016). Among the technical factors, the most important are forecast errors and risks, which in infrastructure projects are complex and difficult to specify (and quantify). Economic grounds include principal-agent problems among the public officials who assign the projects and the members of society who benefit (in principle) from them. The objectives of public agents and the public may differ. Thus, incentives are not always aligned, and the decision of public agents may not in fact maximize social welfare. Third, competition between cities or regions frequently leads to proposals with underestimated costs, with the aim of gaining the chance of developing the project in their territory and taking political advantage of it. Once the work is assigned to one city, reassigning it to another one is costly, especially once construction has begun. Finally, beyond strategic reasons, there is "appraisal optimism." This means that agents tend to think that the costs, the risks, and the execution time of the projects are smaller than is realistically possible. There is a bias toward

(continued on next page)

BOX 5.1 COST OVERRUNS IN INFRASTRUCTURE: WHY THE PRICE IS NEVER RIGHT *(continued)*

overestimating one's own capacity to carry out complex projects, which is reflected in underestimating costs and risks, and overestimating the benefits associated with projects (Flyvbjerg, Skamris Holm, and Buhl, 2002, 2004). Table B5.1 summarizes causes and explanations based on Flyvbjerg's categorization.

Table B5.1 Causes and Explanations for Cost Overruns in Infrastructure Projects

Explanation	Causes	Explanation	Causes
Technical	• Forecasting errors including price rises, poor project design, and incompleteness of estimations • Scope changes • Uncertainty • Inappropriate organizational structure • Inadequate decision-making process • Inadequate planning process	Psychological	• Optimism bias among local officials • Cognitive bias of people • Cautious attitudes toward risk
Economical	• Deliberate underestimation due to lack of incentives, lack of resources, inefficient use of resources, dedicated funding process, poor financing/contract management, strategic behavior.	Political	• Deliberate cost underestimation • Manipulation of forecasts • Private information

Source: Adapted from Cantarelli et al. (2010).

Table 5.3 Cost Overruns in Infrastructure Projects (Average between 1927 and 2012)

	Average cost overrun (percentage of the project value)	
Project type	Latin America and the Caribbean	Rest of the world
Dams	103	95
Rail	59	40
Power plants	36	36
Roads	53	23
Total	48	28

Source: Authors' calculation based on Flyvbjerg (2016).

financed by MDBs have lower cost overruns than other projects because they have higher quality standards for preparation and implementation, usually reflected in strict conditions regarding feasibility, procurement,

and supervision, than do national systems. These projects must also comply with rigorous internal requirements established by the banks. MDBs use standardized processes to estimate construction costs and are required to report actual construction costs at the end of construction. Some countries generate similar information, but national reporting systems vary and are seldom used to evaluate infrastructure. Thus, cost overruns financed by MDBs could represent a lower-bound estimate of cost overruns against which cost overruns in the region can be measured. In plain language, it can be assumed that cost overruns in projects financed by MDBs represent the minimum or "natural" level of cost overruns that can be expected from the process of building infrastructure. Countries could compare the level of cost overruns with that found in this analysis to identify potential efficiency gains in public spending in infrastructure.

The sample includes 231 infrastructure projects financed in Latin America and the Caribbean by the IDB (83 projects) and the World Bank (148 projects) between 1985 and 2012.[9] It includes 142 transport projects (road construction, maintenance, and rehabilitation); 73 water and sanitation projects (treatment plants, improvement and expansion of distribution networks); and 16 energy projects (generation and transmission).

Among projects financed by the IDB, 82 percent suffered cost overruns. In 5 percent of cases, the country asked for additional financing from the IDB; in the remaining 95 percent of cases, national counterparts assumed the cost. Cost overruns were, on average, 22 percent of the total costs of the projects. Among projects financed by the World Bank, 53 percent suffered cost overruns. In 20 percent of those cases, the World Bank covered those costs. Cost overruns accounted for 17 percent of the total costs of the projects on average.[10] A first look at the data can lead to the conclusion that cost overruns are generalized because most of the

[9] The IDB sample is distributed as follows: 35 percent of projects were in Brazil, 7 percent in Colombia, 6 percent in Haiti, 6 percent in Peru, 6 percent in Uruguay, and 5 percent in Bolivia. The remaining 35 percent was distributed among Argentina, the Bahamas, Barbados, Belize, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, and Trinidad and Tobago. The World Bank sample is distributed as follows: 26 percent of projects were implemented in Brazil, 10 percent in Argentina, 7 percent in Colombia, 6 percent in Peru, 5 percent in Honduras, 4 percent in Haiti, and 4 percent in Mexico. The remaining 28 percent was distributed among Belize, Bolivia, Chile, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Jamaica, Nicaragua, Panama, Paraguay, St. Lucia, Uruguay, and Venezuela.

[10] Awojobi and Jenkins (2015) seem to be the only other researchers to have estimated cost overruns in World Bank infrastructure projects. They found that cost overruns on hydroelectric dams financed by the World Bank were 27 percent.

projects have them. However, when the size of cost overruns is studied in more detail, less than 15 percent of IDB and World Bank projects have cost overruns of more than 50 percent, while 74 percent of IDB projects and 79 percent of World Bank projects have cost overruns of less than 20 percent.

Regarding the relationship between cost overruns and specific infrastructure sectors, on average, transport projects present slightly higher overruns than water and sanitation and energy projects (Table 5.4). However, the difference is not statistically significant.

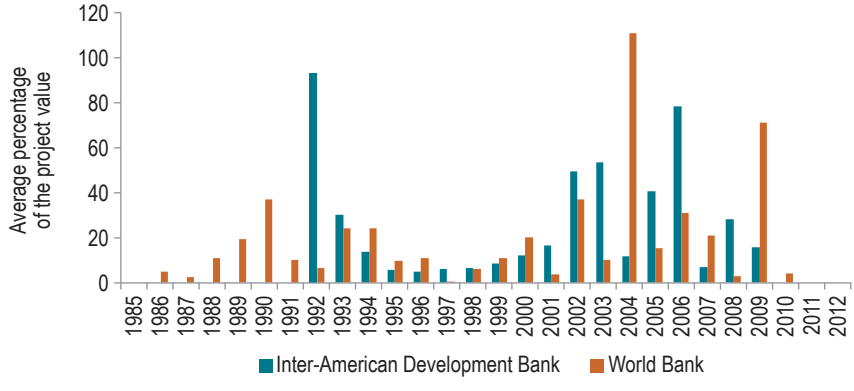
Cost overruns did not appear to be higher for complex projects such as dams, bridges, or tunnels, and the share of overruns did not appear to decline over time (Figure 5.7). Indeed, a large share of projects with high cost overruns (more than 60 percent) occurred from 2002 onward.

Table 5.4 Cost Overruns in Infrastructure Projects Financed by the Inter-American Development Bank and World Bank by Subsector (Average between 1996 and 2010)

	Transport	Energy	Water and sanitation
Inter-American Development Bank average	23%	16%	19%
World Bank average	18%	9%	17%
Inter-American Development Bank standard deviation	33%	21%	28%
World Bank standard deviation	38%	19%	34%
World Bank maximum value	144%	93%	138%
Inter-American Development Bank maximum value	191%	47%	174%

Source: Authors' calculation based on project loan documents and project completion reports from the Inter-American Development Bank and World Bank.

Figure 5.7 Cost Overruns in Public Infrastructure Projects Financed by the IDB and the World Bank in Latin America and the Caribbean



Source: Authors' calculation based on IDB and World Bank project databases.

In summary, cost overruns do not seem to vary substantially by infrastructure sector or size of project, and there is no clear indication that cost overruns have decreased over time.

In sum, cost overruns on projects financed by MDBs in Latin America and the Caribbean averaged 17–22 percent—less than half the 48 percent estimated for all infrastructure projects in the region. Assuming that cost overruns of projects financed by MDBs represent a lower bound for cost overruns in the region, the potential for substantial cost overrun reductions is in the 26–31 percent range.[11] As public expenditure on infrastructure accounts for about 2.5 percent of regional GDP, reducing overruns to the lower bound could result in cost savings of more than 0.65 percent of regional GDP.

Avoiding Delays in Construction

Delays in the construction of infrastructure receive much less attention than cost overruns, but they can increase a project's financial costs significantly. Delays immobilize physical and financial capital. During the delay, unit prices can increase, trained staff can leave the project, and the needs and priorities of beneficiaries can change (Leurs, 2005).

As with the cost overrun analysis, this analysis of the costs of delay draws on data from projects financed by MDBs. It focuses on two types of delay: in authorizing the start of construction and in disbursements. The analysis is based on a sample of 317 IDB infrastructure projects approved between 1997 and 2016.[12,13]

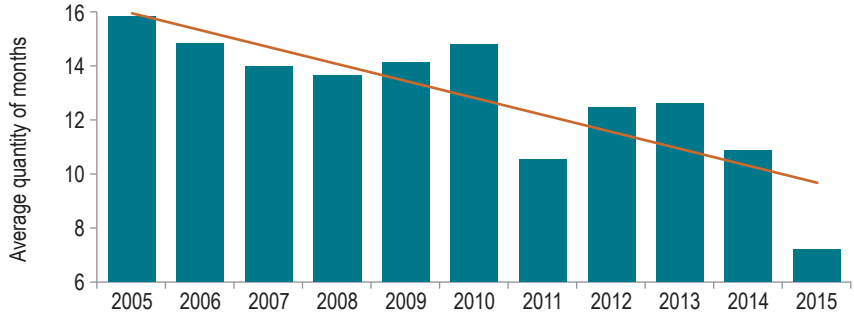
An investment loan approved by an MDB is ready to be implemented only when the authorities of the borrowing country (usually the executive and/or the legislative branch of government) declare it eligible. Figure 5.8 shows that the time between approval and eligibility has decreased over time. In 2005, for example, the average time between the approval of a

[11] The assumption in the calculation is that cost overruns are reduced from 48 percent (regional average according to available literature) to 17–22 percent (result from the analysis of cost overruns in IDB and World Bank projects).

[12] The dataset started with 407 projects. It was reduced to 317 projects after the data were filtered for missing values and inconsistencies. The average project size was $97 million.

[13] The unit of observation is annual project disbursements (2,152 observations). For each project, information is available on the amount disbursed, the project approval date, the project expiration date, the signature date, the eligibility date, and the total amount disbursed or expected to be disbursed. The analysis includes only investment projects. Disbursements for emergency loans, policy-based loans, and other types of loans are handled differently and usually do not involve the financing of public works that require laying out a disbursement scheme at the time of loan negotiation.

Figure 5.8 Months Between Approval and Eligibility of a Sample of IDB-Financed Infrastructure Projects

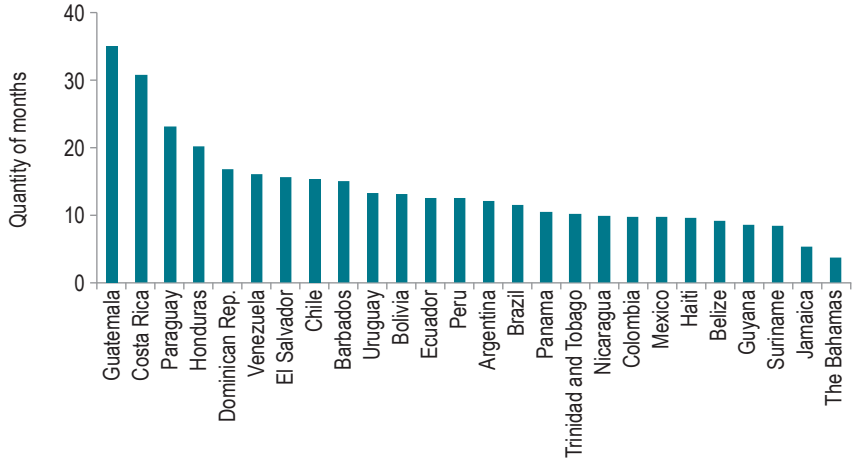


Source: Authors' calculation based on IDB project database.

loan and eligibility was 16 months; by 2015 this gap had decreased to 7 months. This reduction is clearly good news and indicates the region is becoming more agile in granting bureaucratic approvals needed to start project construction.

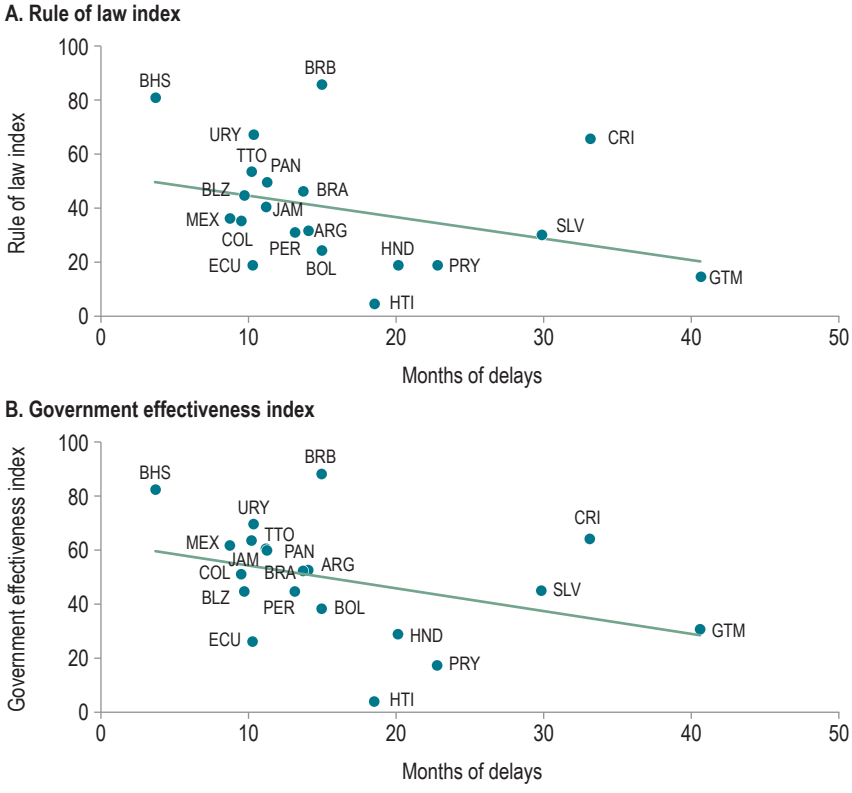
An analysis of delays in IDB infrastructure projects reveals significant variation among countries in the region. Some can take up to 35 months between approval and eligibility—as in Guatemala—while others can take less than a year. Projects in the Bahamas move the fastest, with only 4 months between approval and eligibility on average between 2005 and 2015 (Figure 5.9).

Figure 5.9 Months Between Approval and Eligibility of IDB-Financed Infrastructure Loans (Average between 2005 and 2015)



Source: Authors' calculation based on IDB project database.

Figure 5.10 Relationship between Delays in Approving Infrastructure Projects and Rule of Law and Government Effectiveness Indices (Average between 1996 and 2015)

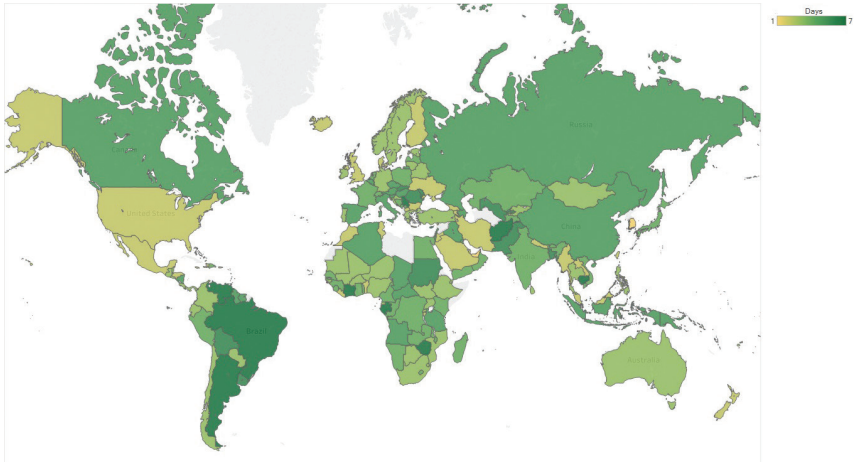


Source: Authors' calculation based on IDB project database and World Bank Government Effectiveness Index.
Note: Applies to a sample of IDB-financed infrastructure projects. Rule of law and government effectiveness indices range from 0 (worst value) to 100 (best value).

Are delays in obtaining all necessary approvals and paperwork required to start project implementation related to government ineffectiveness or a country's institutional characteristics? While the evidence is not conclusive, there seems to be a negative correlation between project delays and institutional proxies such as the World Bank's Government Effectiveness Index and the Rule of Law Index. This implies that better-ruled and more effective governments tend to have shorter delays (Figure 5.10).

How do these delays compare with international standards? A clear-cut comparison is not possible because data on MDB delays are not readily available or may be nonexistent in developed countries. But a comparison can still be made relying on data that identify delays in obtaining all necessary approvals and permits (most of them related to environmental safeguards) to start

Figure 5.11 Days Required to Complete Permitting and Approval Procedures for Infrastructure Projects, 2016



Source: Authors' elaboration based on World Bank's Doing Business 2016.

construction. As expected, developed countries have shorter delays than developing countries (Figure 5.11). The Republic of Korea has the shortest delays, with only 27.5 days to complete all permitting and approval procedures. The average delay in Latin America and the Caribbean is 181.5 days—about a month longer than in Organisation for Economic Co-operation and Development (OECD) countries. In Barbados, the worst performer in Latin America and the Caribbean, it takes 442 days to obtain all permits and approvals. Overall, Latin America and the Caribbean is the worst performer as it has the longest delays.

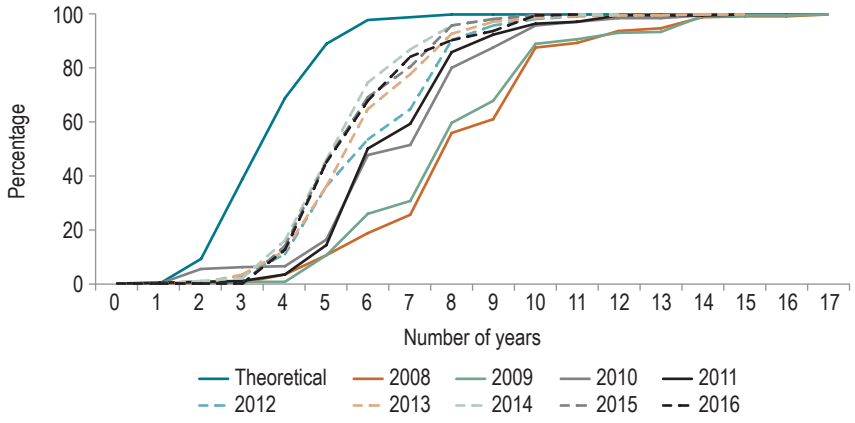
Delays not only increase the financial costs of infrastructure projects, but they also reduce political credibility and improvements in services and tie up resources that could be allocated to alternative uses.

Only limited data are available on the financial costs of delays, however, because it is extremely difficult to obtain information about both planned implementation schedules and actual implementation milestones. Most of the evidence is, therefore, based on case studies and anecdotal information.

To better understand the costs of delays, a theoretical project disbursement curve was built based on information on programmed disbursements for more than 100 project documents prepared for approval by the Board of Directors of the IDB between 2003 and 2016. This curve is compared against a curve based on data on actual disbursements for 317 infrastructure projects.

The leftmost line in Figure 5.12 shows the disbursements that should have been made, according to program documents (i.e., the theoretical

Figure 5.12 Theoretical and Actual Cumulative Disbursements of IDB-Financed Infrastructure Loans (by year)



Source: Authors' calculation based on IDB and World Bank project databases.

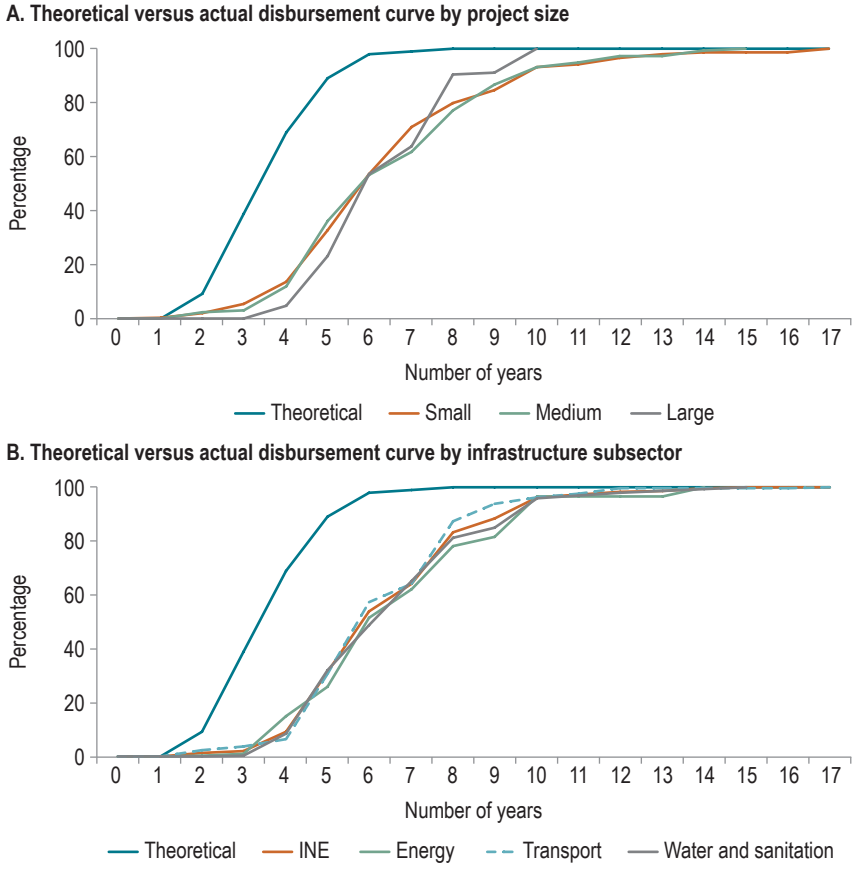
disbursement curve). The other lines show actual disbursements over the years. Although performance improved between 2008 and 2016—that is, a larger share of loans was disbursed according to schedule, indicating that a learning process was taking place as projects approached the theoretical disbursement curve—delays remain and there is some additional room for improvement.

Moreover, no significant differences in disbursements seem to exist across project sizes (Figure 5.13A) or infrastructure subsectors (Figure 5.13B). However, disbursements of infrastructure projects vary across sectors (that is, among purely infrastructure projects and those in social sectors such as health and education). As shown in Figure 5.14, the disbursement gap is larger in infrastructure than in social sectors.

What does this gap between the theoretical and actual curves imply? All these delays represent substantial inefficiencies in disbursement that in turn generate further costs. Time is money and delayed disbursements could be invested elsewhere. The opportunity cost of the money that was not disbursed as scheduled was estimated using potential interest rates that could be earned on the (immobilized) capital. Calculations were carried out using the difference between the theoretical curve and the average disbursement curve. The results assume an average-sized project ($100 million) and a total implementation time of 14 years.[14] Considering

[14] By the tenth year, 96 percent is already disbursed. The remaining 4 percent represents closing-related procedures.

Figure 5.13 Theoretical and Actual Cumulative Disbursements of IDB-Financed Infrastructure Loans (Average between 2003 and 2016)

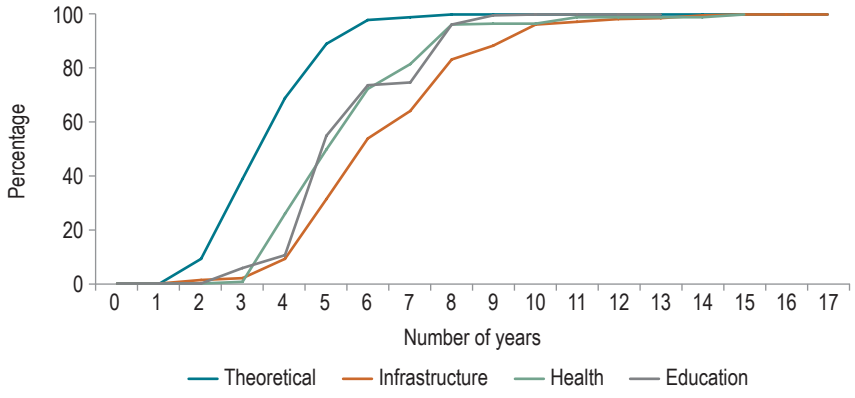


Source: Authors' calculation based on IDB and World Bank project databases.

the average IDB interest rate over the period of analysis (3.1 percent), disbursement inefficiencies would add up to 10.5 percent of project costs. However, because of interest rate variation over time, these disbursement inefficiencies can range anywhere between 2.8 percent and 19.7 percent of project costs.[15] These figures show that timely implementation can

[15] The analysis has considered the interest rate effectively charged by the IDB, which is between 0.99 percent (the lowest interest rate historically since 1997) and 7.03 percent (the highest interest rate historically since 1997). The interest rate varies over time and this causes variation in the results shown. However, these interest rates were used to obtain lower and upper bound scenarios in order to identify the potential size range of the savings.

Figure 5.14 Theoretical and Actual Cumulative Disbursements of IDB-Financed Infrastructure Loans by Sector (Average between 2003 and 2016)



Source: Authors' calculation based on IDB and World Bank project databases.

increase efficiency, and if disbursements follow the stipulated schedule, savings could account for up to 19.7 percent of the total of the project. Since public expenditure on infrastructure is about 2.5 percent of regional GDP, savings from an improved disbursements schedule could reach up to 0.5 percent of regional GDP.[16]

Making the Most of Existing Assets

According to Dobbs et al. (2013), making the most of existing assets could save about 40 percent of infrastructure spending (see Figure 5.3). And what about improving the efficiency of the existing stock of infrastructure? By increasing the efficiency of supply (that is, the capacity of service providers to supply more services with the same assets), savings could be obtained by avoiding construction of new infrastructure to respond to demand growth.

How efficient are the various infrastructure subsectors in Latin America and the Caribbean? Unfortunately, few studies assess the efficiency of infrastructure asset performance. Serebrisky et al. (2016) find that the average technical efficiency of ports in the region rose from 52 percent in 1999 to 64 percent in 2009. Suárez-Alemán et al. (2016) find that ports in Latin America and the Caribbean are far less efficient than top-performing

[16] If the difference between the theoretical curve and the actual curve for 2014 (the most efficient one) were used instead, disbursement inefficiencies would add up to 6.4 percent of the project costs and could reach up to 0.16 percent of regional GDP.

ports in China. They show that private sector participation, less corruption in the public sector, improvements in liner connectivity, and the existence of multimodal links increase port efficiency in developing regions. Based on information on 150 airports worldwide, Serebrisky (2012) concludes that Latin American and Caribbean airports are less efficient than airports in Asia and North America. Technical efficiency in Latin America and the Caribbean varied widely, with only 6 of the 22 Latin American and Caribbean airports in the sample on the efficiency frontier. On average, airports in the region were only 69 percent as efficient as the most efficient airports.

Other infrastructure sectors, such as energy, water, and sanitation, are far from being efficient benchmarks. As an example, Estache, Rossi, and Ruzzier (2004) find that South America's electricity sector averages 76 percent out of 100 in efficiency levels.

Bonifaz and Itakura (2014) analyze urban water utilities in Latin America and the Caribbean. They find that private sector firms outperform public enterprises and that inefficiency is positively correlated with firm size and network length. According to their estimates, inefficiency raises the costs of water infrastructure in Latin America and the Caribbean by an estimated 32 percent. Table 5.5 summarizes the findings of these studies, showing that infrastructure sectors in the region are far from efficient.

In 2015, the IMF attempted to aggregate inefficiencies in making the most of existing assets with its Public Investment Efficiency (PIE-X) indicator, following a Data Envelopment Analysis (DEA) methodology. Using a large sample of countries, it estimates the relationship between the public capital stock and indicators of access to and the quality of infrastructure assets. Countries are given efficiency scores based on their distance from

Table 5.5 Results of Selected Studies on Infrastructure Efficiency

Study	Sector	Main results	Year
Bonifaz and Itakura (2014)	Water and sewerage	Inefficiency increased costs 32 percent.	1999–2010
Estache, Rossi, and Ruzzier (2004)	Electricity	Efficiency was just 76 percent (intraregional average).	1994–2000
Serebrisky (2012)	Airports	Efficiency was just 69 percent (intraregional average).	Average 2005–2006
Serebrisky et al. (2016) Suárez-Alemán et al. (2016)	Ports	In intraregional comparison, port infrastructure efficiency in Latin America and the Caribbean was just 64 percent (intraregional average). In comparison across developing regions, efficiency in Latin America and the Caribbean was just 55 percent. Efficiency increased 10 percent from 2000 to 2010 (interregional average).	Average 2000–2010 Average 2000–2010

Source: Authors' elaboration summarized from Serebrisky et al. (2017).

the frontier of best performers (the less efficient the country, the greater the distance to the frontier and the lower its PIE-X efficiency score).[17] Inputs are the public capital stock and income per capita; output is an aggregate physical indicator comprising the coverage of infrastructure networks (the length of road network, electricity production, access to water), social infrastructure (number of secondary teachers and hospital beds), and a quality of infrastructure indicator from the World Economic Forum (WEF) database. Results show that the efficiency gap is 40 percent in low-income developing countries, 27 percent in emerging markets, and 13 percent in advanced economies. Given that Latin American countries fall within the first two groups, room for improvement in the use of existing assets seems substantial. Of course, such a complex aggregation may be subject to several caveats, but results do suggest that much remains to be done in Latin America and the Caribbean to make more of existing assets.

These aggregate measures have very palpable counterparts in a myriad examples: average electricity losses in Latin America and the Caribbean were 16 percent of total electricity produced in 2012—far higher than the 6 percent lost in OECD countries (Jiménez, Serebrisky, and Mercado, 2014). More particularly, the World Bank's Business Enterprise Survey data show that losses from power outages in Latin America reached $68 billion in 2012.[18] Losses from electrical outages in the region were 3.1 percent of sales—almost 3.5 times higher than in OECD countries, according to the World Bank's 2017 Enterprise Survey. Similar losses resulted from water shortages and interruptions in water supply. In the transport sector, unpaved roads are associated with low quality and inefficient transport services. Road safety is also receiving greater attention as the direct consequence of inadequate services provided by infrastructure assets and poor regulation of traffic rules. The density of the transport infrastructure in Latin America and the Caribbean is low given the region's income level. Its paved road density is similar to Africa's, and about one-quarter of the next-lowest region (World Bank, 2017). Road safety is also weak, with more than 100,000 people a year dying in road accidents. Road accidents are the main cause of death for people 15–29 and cost the region's economy an estimated 1–3 percent of GDP (Serebrisky, 2014).

The World Bank's Logistic Performance Indicators (LPIs) show that the region ranks poorly, close to Sub-Saharan Africa. Logistics costs are higher than in East Asia and South Asia, and it takes longer to export from

[17] Values range from 0 to 100, with the latter being the most efficient value, which belongs to the frontier.

[18] http://www.enterprisesurveys.org/.

Latin America and the Caribbean than from East Asia. Moreover, losses from breakage or deterioration of merchandise during shipping exceeded $70 billion in 2012 (Serebrisky, 2014).

Yet another source of concern is infrastructure maintenance. Once infrastructure is built, policymakers often take for granted that it will continue to provide services at the level of quality observed immediately after construction is completed. But infrastructure deteriorates over time. Adequate maintenance is a necessary condition for infrastructure assets to provide infrastructure services compatible with the standards defined when they were first designed and built. Depreciation of infrastructure assets is nonlinear and is generally not visible until routine maintenance can no longer reverse the damage. At that point, rehabilitation or rebuilding is required, at much higher costs.

Lack of proper maintenance increases costs to infrastructure providers. It also imposes operational costs on infrastructure users. In the case of roads, for example, deteriorated infrastructure is associated with vehicle depreciation, increased travel times, higher gas consumption, and more accidents. In the case of electricity, lack of maintenance increases electricity losses, power tripping, system instability, breakdowns, and fires. Poorly maintained infrastructure sometimes leaves firms with no option but to invest in infrastructure themselves (buying generators, for example) (Rioja, 2013).

There are several reasons for the bias against maintenance. They include limited resources; poor execution capacity; and corruption, favoritism, and rent-seeking opportunities during the bidding process, which create incentives to ignore maintenance. Construction is more politically attractive than maintenance, and citizens seem to value maintenance projects less, while the press focuses on new projects or waits until tragedies occur to call attention to deferred maintenance (Jaffe, 2015). Proper maintenance could help the region make the most of its existing assets. Improving maintenance accountability in national accounts, as well as in utilities' balance sheets, could help shield maintenance costs in times of fiscal constraints.

Paving the Way to a Brighter Future

The state of infrastructure in Latin America and the Caribbean is well below what it should be for a region at its level of development—and the consequences are devastating. Thirty million people in the region lack access to electricity, 34 million lack access to drinking water, and 106 million lack access to improved sanitation (Serebrisky et al., 2017).

This unacceptable state of infrastructure reflects both insufficient and inefficient spending. The region invests about 3.5 percent of its annual GDP in infrastructure—considerably less than what the region should to meet its needs. But increasing infrastructure spending is likely to be difficult given a weaker growth outlook for the region and the need for fiscal consolidation in several Latin American economies. Thus, the focus should be not only on fighting the bias against public investment in government budgets discussed in Chapters 2 and 10, but also on increasing the efficiency of infrastructure investments.

The estimated gains from increasing efficiency are considerable. They come from three main sources: improving project selection and optimizing infrastructure portfolios, streamlining infrastructure delivery by reducing cost overruns and delays, and making the most of existing assets.

Actionable findings from this chapter include the following:

- Cost overruns on projects financed by MDBs in Latin America and the Caribbean average 17–22 percent—less than half the 48 percent estimated for all infrastructure projects in the region. Reducing overruns to this lower level could result in cost savings of more than 0.65 percent of regional GDP. Since cost overruns are endemic to infrastructure construction, several tools have been recently developed to help governments improve costing and delivering projects and now need to be implemented.[19]
- Failing to make disbursements on schedule can add an estimated 10.5 percent to project costs. Eliminating these costs can save as much as 0.5 percent of regional GDP.
- Infrastructure efficiency levels in the region are low across sectors (transport, energy, water, and sanitation). Increasing efficiency requires action on several fronts, including: improving corporate and regulatory governance and providing incentives to earmark and shield maintenance expenditures.

This chapter has provided efficiency gains estimates in public investment that taken together add up to more than 1 percent of GDP. This is a sizable amount, as it represents more than 30 percent of public investment in infrastructure in Latin America and the Caribbean.

[19] An example is a practical guide developed by the IDB in 2016 to generate accurate cost estimates and track them throughout construction. See Monteverde, Pereyra, and Pérez (2016)

To increase the efficiency of public investment in the region the most pressing policy recommendations include the following:

1. Improving institutions and processes to develop a practice of ex ante and ex post project evaluation. The region has made important efforts creating SNIPs. However, not all countries have them in place, and in some countries that do, several projects bypass these institutions. Developed countries like Australia and the United Kingdom recently created institutions to improve cost-benefit analysis, project selection, and project monitoring, an effort that Latin America and the Caribbean would do well to undertake.
2. Countries in Latin America and the Caribbean do not produce comprehensive national infrastructure plans. Plans are usually sector specific and ignore the linkages and interdependencies of infrastructure systems. More worrisome is that the latter tend to be plans produced by each new administration, sometimes ignoring consistency with previous plans. The region needs infrastructure plans that are the outcome of consensus-building exercises.
3. Recognizing that cost overruns are a natural outcome of infrastructure construction, several tools have been recently developed to help governments improve costing and project delivery. The use of these tools should be accompanied by constant efforts to: (i) increase the transparency of procurement processes and (ii) work closely with regulators and competition agencies to foster competition in the design of contracts and bidding processes.
4. Latin America and the Caribbean ranks poorly in terms of the time it takes to complete all permitting and approval procedures for infrastructure projects. Without compromising the need to comply with rigorous social and environmental standards, the region can certainly improve, and one possible action is the creation of a national single window for permit approval.