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TRANSPORTATION SECTOR FRAMEWORK DOCUMENT

TRANSPORTATION DIVISION

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ABBREVIATIONS

BRT	Bus rapid transit
CAF	Development Bank of Latin America
COVID-19	Coronavirus disease 2019
ECLAC	Economic Commission for Latin America and the Caribbean
EIU	Economist Intelligence Unit
ICAO	International Civil Aviation Organization
IHME	Institute for Health Metrics and Evaluation
IRF	International Road Federation
ITF	International Transport Forum
ITS	Intelligent Transportation System
OECD	Organisation for Economic and Co-operation Development
PAHO	Pan American Health Organization
SFD	Sector Framework Document
SISBEN	Colombia's National System of Beneficiaries
UNCTAD	United Nations Conference on Trade and Development
USDOT	United States Department of Transportation
WEF	World Economic Forum
WHO	World Health Organization

EXECUTIVE SUMMARY

Transportation is an essential component of inclusion, quality of life, and sustainable development. Transportation facilitates the movement of people, goods, and services and is the means by which markets and opportunities for work, health, and education are accessed. In the urban context, access to high-quality public transportation can create more inclusive cities by expanding mobility and opportunities for residents, particularly low-income and disadvantaged groups such as women, older adults, people with disabilities, and ethnic minorities. In rural areas, greater connectivity and quality in the road network can help to improve regional integration and the population's standard of living, reducing time frames and costs involved in accessing and distributing goods, public services, and income-generating activities. It can also strengthen productive development and integration into domestic and global value chains. Despite these benefits, transportation is one of the main emitters of gaseous pollutants worldwide, with negative consequences for climate change. For all these reasons, transportation is a key public policy tool that can be used to: (i) coordinate supply and demand for economic and social activities across a country's territory, strengthening regional integration as well; (ii) help to reduce poverty and inequality and improve quality of life and economic productivity; and (iii) combat climate change.

In Latin America and the Caribbean, the performance of the transportation system poses significant challenges, thus limiting its contribution to building a more equitable and inclusive society, as well as a more prosperous and environmentally friendly economy. The region faces challenges in the areas of urban and interurban mobility (infrastructure and services for transporting individuals), logistics (infrastructure and services for transporting goods), institutions and regulations, and technological modernization. Although the Latin American and Caribbean countries have made progress in areas such as infrastructure for both public and active transportation, maritime connectivity, and logistics policies, the gap in sector performance has widened compared with levels in the high-income countries and countries in Central and Southeast Asia and North Africa. In coming years, the main challenges for the countries of the region will be to ensure more socioenvironmentally efficient and inclusive mobility within a limited urban space, transform transportation into a catalyst for regional competitiveness, build sound and transparent institutions, leverage the benefits of new technologies, and strengthen collaboration with the private sector. In light of advancing climate change, Latin America and the Caribbean must promote a transportation system based on the avoid-shift-improve approach, i.e. avoid and manage trips, shift to more sustainable modes, and improve energy efficiency, while fulfilling its role to provide access to economic and social opportunities. In the short term, the region must implement measures that increase the sector's resilience to the impact of the COVID-19 pandemic and mitigate the risk that the pandemic could make existing challenges even more pronounced.

International experience shows that the public sector plays a key role in improving sector operations and ensuring that these contribute to the achievement of welfare objectives and the sustainable development goals. Resolving urban mobility challenges requires deeper integration in the planning of both land use and transportation; infrastructure investments and the prioritization of public and nonmotorized transportation in road use; increased sustainability in urban mobility; substantial improvements to the efficiency and quality of public transportation services; subsidies that target vulnerable segments of the population; implementation of pay-per-use instruments in transportation

infrastructure, support for modal shifts, and increased funding for public transportation improvements; consolidation of transportation systems with operational and fare integration; and the implementation and enforcement of measures to enhance road safety and the inclusion of women, people with disabilities, and low-income populations in the sector. In terms of interurban mobility and logistics, infrastructure development needs to be coordinated with regional development models, production initiatives, and other dimensions for which transportation is a means of coordination. Accordingly, there is a need to increase the coverage, quality, capacity, and connectivity of road, rail, air, and maritime/fluvial infrastructure and to implement technical and economic regulations to improve the quality of services, all from the perspective of sustainability and inter- and multi-modality. “Last mile” logistics should also be addressed as part of a comprehensive approach to transportation and land-use planning, while the development of sustainable infrastructure and transportation services should be promoted and international trade processes simplified. With respect to institutions, Latin America and the Caribbean need to improve the governance of transportation systems, as well as planning and data-driven decisions, competition in service provision, the business environment for greater and more efficient private participation in the sector, and collaboration with other areas of government and the private sector. Lastly, the region needs governments capable of maximizing the benefits of the technology revolution to achieve efficient, inclusive, and sustainable transportation while effectively managing associated risks. In particular, governments should be early adopters of new technologies, facilitators of innovation ecosystems, suppliers of monetary incentives, and regulators to ensure benefits accrue to the whole of society.

A review of lessons learned from the IDB Group’s work in the sector highlights the need to develop comprehensive solutions involving both infrastructure and associated services, as well as the relationship between transportation and a country’s other economic, social, and environmental considerations. Meanwhile, strengthening the institutional framework and adopting a comprehensive approach to managing road assets will be indispensable for ensuring the impact and sustainability of projects financed in the sector. Gender, universal mobility, transportation safety, and climate change resilience should all be incorporated from the early stages of project design, together with associated budgets and indicators for monitoring progress in these areas. Collaboration with the private sector also needs to be strengthened, and actions to design data collection and processing protocols need to be introduced to ensure the consistency and quality of information. Lastly, there is a need to continue gathering knowledge concerning the development effectiveness of sector projects, expanding evidence concerning the impact of these investments in promoting the development of cities and catalyzing reductions in inequality.

Based on the challenges faced by the sector in Latin America and the Caribbean, as well as good practices and lessons learned from both international experience and IDB-supported interventions, **the objective of the Bank’s work in the region will be to support the attainment of efficient, inclusive, and sustainable transportation systems**. To this end, **five lines of action** are proposed that should be adapted to the reality of each country: (i) fostering the efficient, inclusive, sustainable, and high-quality mobility of urban and interurban passengers; (ii) improving logistics performance in Latin America and the Caribbean, promoting the development of efficient and sustainable logistics services; (iii) strengthening sector institutions and regulations; (iv) encouraging technological transformation in the sector; and (v) increasing the availability of information and knowledge regarding the sector.

I. THE TRANSPORTATION SECTOR FRAMEWORK DOCUMENT IN THE CONTEXT OF EXISTING REGULATIONS AND THE INSTITUTIONAL STRATEGY

1.1 The Transportation Sector Framework Document (SFD) guides the IDB Group's work with the countries and governments of Latin America and the Caribbean in the transportation sector. The structure and content of this SFD follows the guidelines established in "Strategies, Policies, Sector Frameworks, and Guidelines at the IDB" (document GN-2670-5). This SFD replaces the Transportation Sector Framework Document approved in December 2016 (document GN-2740-7). It is consistent with the Update to the Institutional Strategy: Development Solutions that Accelerate Growth and Improve Lives (document AB-3190-2), which acknowledges the following structural challenges for development in the region: social exclusion and inequality; low levels of productivity, innovation, and regional integration; and the impact of climate change. This SFD is also related to the Infrastructure Strategy (document GN-2710-5) (Box 1), the objective of which is to guide the Bank's work in that sector with a view to catalyzing competitiveness and fostering regional integration in support of inclusive economic growth.

1.2 This SFD considers transportation to be a system with four components: (i) road, port, airport, and rail infrastructure; (ii) logistics services and road, maritime, fluvial, air, and rail services; (iii) sector institutions and regulations; and (iv) technology (hard and soft, including information and communications). As a system, the overall performance of transportation is determined by the individual performance of its different components. Consistent with the findings of the IDB's "Development in the Americas 2020" report, this necessitates a shift in the vision that has traditionally prevailed in the sector, which focused mainly on improving the supply of infrastructure (IDB, 2020a). Although there are significant weaknesses in transportation infrastructure in Latin America and the Caribbean, poor quality services, an incomplete regulatory framework, and operations based on obsolete technology also have negative consequences for efficient performance in the sector (IDB, 2020a).

1.3 Attainment of the sustainable development goals will require strengthening the sector. Transportation contributes directly to eight of the goals (Table 2) and indirectly to a further nine (Table 3).

1.4 The Transportation SFD is one of 22 SFDs the IDB Group will prepare under the umbrella of the document "Strategies, Policies, Sector Frameworks, and Guidelines in the IDB" (document GN-2670-5), in order to provide a comprehensive view of development challenges in the region. The subject matter of this SFD means that it is complemented by the Integration and Trade SFD (due to the importance of transportation infrastructure and services for regional integration and trade); the Urban Development and Housing SFD (given the required coordination between urban development plans and transportation interventions); the Climate Change SFD (given the need to strengthen the resilience of the sector and reduce its emissions); the Agriculture SFD (due to the sector's importance in connecting rural areas to economic and social opportunities); the Support to SMEs and Financial Access/Supervision SFD (given the high presence of small companies operating in the sector and the need to improve long-term financing in the region); the Innovation, Science and Technology SFD (as technology is one of the pillars of the sector); the

Transparency and Integrity SFD (due to the importance of transparency and integrity in enhancing the effectiveness of public spending in the sector); the Citizen Security and Justice SFD (due to the focus on transportation safety); and the Gender and Diversity SFD (due to the need to improve the inclusion [Table 1] of gender and diversity issues in the sector).

1.5 The rest of the document is organized as follows: Section II describes the status of the transportation sector in the region and identifies the main challenges; Section III reviews evidence regarding the effectiveness of sector policies; Section IV discusses lessons learned from the IDB Group's experience; and Section V proposes a set of strategic lines that will guide the IDB Group's operational, analytical, and dialogue activities in the area.

II. Main Challenges for the Region in the Transportation Sector

2.1 **Transportation is essential for development and economic growth.** Transportation facilitates the movement of people, goods, and services and is the means by which markets and opportunities for work, health care, and education are accessed. This, in turn, helps reduce poverty and inequity and improve quality of life and productivity in the region. There is abundant empirical evidence highlighting the importance of the sector. IDB studies show that mass transit systems (Table 1) increase employment rates and the likelihood of working full-time among populations with access to these systems (in the case of Lima's Bus Rapid Transit system, by around 7% and 8%, respectively, between 2010 and 2017) (Scholl et al., 2018). By reducing travel times, these systems also increase the amount of time riders spent on other activities (e.g. "Mi Teleférico [My Cable Car]" in La Paz, which increased the amount of time spent studying by 120 minutes per day) (Martínez et al., 2018). Moreover, with fewer stops and fewer conflicts with vehicles in mixed traffic, mass transit systems improve operational efficiency, thus helping to reduce emissions of local pollutants (i.e. between 16% and 20% in Mexico City) (Bel and Holst, 2018). With respect to production activities, investments in infrastructure lead to lower transportation costs and times for obtaining inputs and accessing markets, thus expanding productivity and business opportunities (for example, investments in rural roads in Colombia increased productivity by 62% due to access to agricultural inputs, the likelihood of sales by 5%, and the value of production by 15%). They also lead to higher incomes for local populations, helping to reduce poverty (for example, investment in rural roads in Peru generated income opportunities that helped to reduce extreme poverty and unmet needs in neighboring communities by up to 14% and 7%, respectively) (World Bank, 2014; Provias Descentralizado, 2014; Ortega, 2018). Improved infrastructure and logistics services can also lead to substantial increases in economic activity and exports from the region (a 10% reduction in transportation costs can raise exports by 30% and increase employment in exporting companies) (Volpe et al., 2013; IDB, 2018a).

2.2 **In Latin America and the Caribbean, however, the transportation system's weak performance limits its contribution to creating a more equitable and inclusive society and a more prosperous and environmentally friendly economy.** The region's challenges in relation to urban and interurban mobility (infrastructure and services for transporting individuals), logistics (infrastructure

and services for transporting goods), institutions and regulations, and technological modernization are analyzed below. In short, the main challenges for the countries of the region will be to ensure more socioenvironmentally efficient and inclusive mobility within a limited urban space, transform transportation into a catalyst for regional competitiveness, build sound and transparent institutions, and leverage the benefits of new technologies to create an efficient, inclusive, and sustainable transportation system. In light of advancing climate change, Latin America and the Caribbean must promote a transportation system based on the avoid-shift-improve approach, i.e. avoid and manage trips, shift to more sustainable modes, and improve energy efficiency, while fulfilling its role to provide access to economic and social opportunities.

A. Limited efficiency, quality, inclusion, and sustainability of urban and interurban mobility

2.3 Cities are a key driver of development in Latin America and the Caribbean. Around 300 cities generate 75% of regional GDP (McKinsey, 2012). Given transportation's ability to connect people with jobs, health care, education, and training opportunities, it plays a key role in the efficient functioning of cities and the quality of life of their inhabitants. Nonetheless, transportation's ability to fulfill this role is hindered by a series of external structural factors, detailed below, of an infrastructural, operational, and institutional nature. Significantly, cities in Latin America and the Caribbean will face the challenge of providing access to opportunities, balancing the sector's impact on climate change.

2.4 First, a rapid **increase in the rate of urbanization**, combined with a lack of efficient land-use planning, has created substantial structural challenges for urban mobility. From 1950 to 2015, the urban population in Latin America and the Caribbean rose from 41.3% to 80% of the total population and is expected to reach 90% by 2050 (IDB, 2020a). At the same time, the region's cities have undergone a **territorial expansion** process characterized by low population density—the result of a search for lower housing prices and the creation and/or expansion of informal settlements on the urban periphery.[1] This has generally occurred in the absence of integrated planning in land use and transportation provision. As a result, areas in the periphery lack adequate connections to public transportation networks, while their low density means that profits from operating such services are low. All of this has led to the increased use of private vehicles, longer travel distances and times, and higher levels of traffic congestion, road accidents, and pollution.

2.5 Second, the stock of **road infrastructure** in the region's cities and the priority given to its use have favored individual transportation over public and active transportation. According to the latest available data, the 29 largest metropolitan areas in Latin America and the Caribbean have a road network of 277,000 km, of which less than 1% is dedicated exclusively to public transportation and 1.2% to

[1] The annual rate of territorial expansion in cities (4%) is double that of population growth as a whole (1.9%) (IDB, 2016b). Around 25% of the population in Latin America and the Caribbean lives in peripheral neighborhoods with limited access to basic services (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, and Inter-American Development Bank, 2019).

cyclists (Estupiñán et al., 2018).[2] This imbalance in the allocation of road space is even more evident when one considers that public and active transportation account for around 70% of daily trips (Vasconcellos and Mendonça, 2016). Another challenge associated with street furniture in an urban setting is the absence of **universal accessibility** criteria (Table 1) (a lack of sidewalk adaptation, tactile paving, audible traffic signals), affecting people with reduced mobility (Dirección General de Accesibilidad y Desarrollo Tecnológico, 2018).

2.6 Third, recent data show that the **quality of public transportation services** (Table 1) is significantly below that of other regions, leading to lower use of the system. There are deficiencies in terms of the transportation fleet, accessibility, interoperability, reliability, service availability, and passenger safety (Rodríguez et al., 2020). The average age of the public ground transportation fleet is over 15 years, while in some countries it is more than 20 years (compared with 11.4 in Europe); this affects riders' perceived level of comfort and safety while also reducing unit operational efficiency (e.g. increased fuel consumption, emissions, and maintenance) (IDB, 2016a). The **accessibility of transportation**[3] (Table 1) provided by the system is also limited by the territorial expansion phenomenon mentioned above, as well as low population density and a high presence of informal settlements. Accessibility limitations are particularly harmful for low-income individuals living in peripheral areas, who must often resort to informal transportation in order to move around. In Bogota and Mexico City, for example, paratransit (Table 1) increases the accessibility of employment by around 40% (ITF-IDB, 2020). Accessibility limitations also have a disproportionate impact on women, who have different mobility patterns (Figure 1) in that they have higher use of public transportation (Figure 2) and suffer higher rates of harassment. Surveys in Latin America and the Caribbean found that 6 out of 10 women in our cities have experienced some type of sexual violence while using public transportation, in the form of physical or verbal assault (Crotte et al., 2019).

2.7 The interoperability of passenger transportation services is also limited, affecting not only their convenience for riders but also the prospects for improving the urban transportation system's overall efficiency. Poor service availability and reliability leads, in turn, to longer travel times (Figure 3).[4] The average waiting time in the region is 18.7 minutes (above that of Europe and the United States, at 14.3 and 13.3 minutes, respectively), leading to lower user trust in the system (Deloitte, 2019). Similarly, travel times are affected by a higher number of transfers: the proportion of public transportation users making two transfers during a trip averages 52.9% in Latin America and the Caribbean (compared with 47.4% and 42.6% in Europe and

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2 New York, for example, has more than 600 km of bike lanes, ranking it first in the world in this respect (McKinsey, 2018).

3 Accessibility refers to the general ability of individuals to reach desired services and activities (collectively called "opportunities"). In the context of an increasingly deteriorating climate, the additional challenge will be to improve the transportation system's accessibility, while reducing its level of pollutant emissions. "Affordability" refers to the financial cost of travel in relation to users' incomes (Victoria Transport Policy Institute, 2020).

4 Although average trip distances in Latin America and the Caribbean are shorter than those in the advanced economies, travel times are longer (Rivas et al., 2019c). In five of the region's megacities (Bogota, Buenos Aires, Mexico City, Lima, and São Paulo), 28.1 million people travel more than 1.5 hours each day, equivalent to 10 working weeks per year (IDB, 2014).

the United States, respectively) (Moovit, 2019). With respect to safety, the high level of physical or verbal violence toward women using public transportation (more than half of female users) is of concern, affecting 59% of female users in Santiago de Chile, 65% in Mexico City, 67% in Quito, and 80% in Buenos Aires (IDB, 2018b).

2.8 The **affordability** (Table 1) of public transportation is also a significant challenge. Compared to other regions, low-income households allocate more resources to transportation (6.9% for the lowest quintile in Latin America and the Caribbean, compared with 3.9% in Sub-Saharan Africa and 4.7% in East Asia and the Pacific) (Rivas et al., 2018). As a result, they normally sacrifice motorized trips, becoming "captive pedestrians" over long distances. In fact, 45% of trips made by the low-income population consist of walking, compared to 10% to 20% for the high-income group (Rivas et al., 2019a). This, in turn prevents low-income populations in peripheral areas from accessing better job opportunities, which are usually located in the city center. Lastly, lower affordability leads to a high level of fare evasion—close to 10% in Lima, 12% in Buenos Aires, 15% in Bogota, and 28% in Santiago (Troncoso and de Grange, 2017).

2.9 Latin American and Caribbean countries have been pioneers in proposing transportation systems such as Bus Rapid Transit and cable cars (Table 1), thereby improving the quality of public transportation in cities such as Bogota, Buenos Aires, Curitiba, La Paz, and Medellin (see paragraph 3.5). They have also made progress in building and expanding their metro lines (adding 800 km of network in 2015, compared with 1,500 in North America and 2,800 in Europe) and urban railways (Box 2). Nevertheless, significant gaps remain, highlighted by the fact that public transportation is frequently mentioned as one of the main factors affecting quality of life for the region's inhabitants (IDB, 2014). Against this backdrop, it is unsurprising that public transportation use in the region is falling (see paragraph 2.12).

2.10 Fourth, improving service quality would require sizable investments, exceeding even the 1% of GDP that the largest countries (Mexico, Brazil, and Argentina) already invest and the 2% to 3% invested by smaller countries (e.g. Bolivia and Nicaragua) (IDB, 2020a). However, investments are currently limited by **funding and financing challenges** for public transportation (Figure 4). The reasons for these challenges include: (i) rapid growth and urbanization, which demand more funding for infrastructure; (ii) weaknesses in the financial planning framework and a lack of vision surrounding long-term sustainability; (iii) legal barriers and restrictions that affect the amount and type of participation by public entities in the sources of funding and financing; (iv) lower incomes[5] and a dependence on traditional sources of funding that are insufficient to cover operating costs; and (v) inefficiency in fare structures by type of transportation and in the internalization of the costs of transportation externalities such as congestion, pollution, or road accidents (Ariza et al., 2018).

[5] Lower income levels in Latin America and the Caribbean limit the number of people that use public transportation and lead to higher fare evasion. The modal shift from public transportation to private vehicles and motorcycles reduces user numbers, levels of fare revenue, and the availability of funds to improve service quality. Steady cost increases and declining productivity also affect system profitability (Gómez-Lobo and Price, 2020).

2.11 Accordingly, and in response also to rising average incomes in the Latin American and Caribbean countries, the region has experienced an **increase in its motorization rate** (Figure 5). Although the number of vehicles in the region (201 per 1,000 inhabitants) is below that reported in the advanced economies such as Europe and the United States (471 and 805 vehicles per 1,000 inhabitants, respectively), the average annual rate of growth in Latin America and the Caribbean over the last 10 years has been higher than in the advanced economies (4.7% versus 0.5%) (Rivas et al., 2019b). The share of private mobility in the total number of trips has also increased, from 20.6% in the 1990s to 29.1% in the 2010s.[6] This has had a negative effect on the use of public transportation, which saw its share of total trips decline from 50.5% in the 1990s to 35.5% in the 2010s[7] (Rivas et al., 2019b) (Figure 6). The motorcycle fleet, which represents a more affordable option for private mobility, has also expanded (up 153% in the region's 29 main cities between 2007 and 2014, reaching 7.2 million units in circulation [Estupiñán et al., 2018]).

2.12 This process has been accompanied by an **increase in negative externalities** arising from private mobility, particularly congestion, pollution (with repercussions for climate change), and road accidents. According to INRIX's 2019 Global Traffic Scorecard, four of the 10 most congested cities in the world are in Latin America and the Caribbean: Bogota (191 hours lost per person per year), Rio de Janeiro (190 hours), Mexico City (158 hours), and São Paulo (152 hours). These cities rank first, second, third, and fifth, respectively, out of the 963 included in the ranking. The costs of traffic congestion are estimated at between 5% and 10% of regional GDP (Development Bank of Latin America [CAF], 2018). Urban transportation in Latin America and the Caribbean accounts for 8.6% of total urban emissions worldwide (International Transport Forum (ITF), 2019a) (Figure 7). According to the World Health Organization (WHO), around 100 million people in Latin America and the Caribbean are exposed to the following: air pollution levels in excess of recommendations, with consequences for health (in terms of cardiovascular and respiratory issues); health costs that amount to 1% of GDP in countries such as Colombia, Ecuador, El Salvador, Guatemala, Honduras, and Peru (Low Emission Development Strategies Global Partnership, 2016); and welfare losses of around 2.4% of regional GDP stemming from premature deaths (World Bank, 2016). In this context, cities face the challenge of increasing transportation's accessibility while reducing its impact on the environment. Lastly, approximately 150,000 people die in Latin America and the Caribbean each year as a consequence of road accidents, with estimated costs of up to 3% of regional GDP (Martínez, 2019). These accidents are the main cause of death for children ages 5 to 14: around 50 children die each day on the roads in Latin America and the Caribbean (Pan American Health Organization [PAHO], 2019). Pedestrians are the hardest hit, accounting for more than half of all road accident deaths (Estupiñán et al., 2018). Fatality rates in road accidents involving motorcycles are particularly high, accounting for 23% of total deaths (PAHO, 2019).

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[6] This was the opposite of the trend seen in Europe, where the share of private transportation fell from 37.5% to 29.5% over the same period.

[7] In contrast, the share of public transportation in Europe increased by 0.7% over the same period.

2.13 **Public sector actions have been limited** in this respect, with the authorities facing significant challenges in terms of fulfilling their role of orchestrating urban mobility. Territorial expansion in the cities—now transformed into metropolitan areas that have absorbed other, previously neighboring cities—has increased the complexity of urban transportation planning. Authority over land use and transportation is usually divided across multiple institutions that answer to different political and administrative organizations. This leads to incomplete, fragmented transportation systems that lack integration. To effectively fulfill their role of planning, managing, and supervising urban mobility, sector agencies also face the challenge of continuing to improve their analytical, technical, financial, and technological capabilities, as well as increasing the availability of data and knowledge on—for example—mobility patterns among women (Figure 1) and people with disabilities (around 12% of the region's population) (Economic Commission for Latin America and the Caribbean (ECLAC, 2018a), together with the determinants and management of private mobility.

2.14 **The COVID-19 pandemic**[8] may further exacerbate urban mobility challenges. Containment measures have resulted in declines in public transportation use of between 60% and 85% (Figure 8), which has created significant challenges for the financial sustainability of companies in the sector and consequently for service delivery. Given the importance of public transportation to mobility for middle- and low-income households, this could have a major impact on mobility in cities, with negative socioeconomic consequences for the population. There is also evidence of a loss of confidence in public transportation among the middle classes. Data from China show that since the end of the lockdown period, a significant group of people that had previously used public transportation has shifted to other modes of transportation, mostly private vehicles (ITDP, 2020). In the medium term, the impact of the COVID-19 pandemic could sharpen the downward trends in public transportation use, accessibility, and affordability, as well as the increase in motorization rates and the associated negative externalities for cities (pollution, traffic congestion, and road accidents).

2.15 **Interurban mobility**[9] **is also limited** in terms of its different modes. The **road network**—the predominant means of interurban mobility—**has low coverage, quality, capacity, and connectivity.** Only 23% of the region's roads are paved, compared with 60% to 80% in other regions of the world (with the exception of Sub-Saharan Africa, with 14.5%) (IRF, 2019). However, there is a considerable degree of asymmetry within Latin America and the Caribbean: while around half of the network is paved in countries such as the Dominican Republic and The Bahamas, no more than 15% is in Brazil, Bolivia, Nicaragua, Peru, and Haiti (IRF, 2019). Latin America and the Caribbean also lags behind in terms of the quality of its road network, scoring an average of 36.7/100 in the World Economic Forum's Competitiveness Index for 2018, compared with over 60 points in the case

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[8] Emerging in Wuhan, China, in late 2019, the respiratory disease caused by the SARS-CoV-2 virus was declared a pandemic by the World Health Organization (WHO) on 11 March 2020 (WHO, 2020). The disease has spread rapidly across the globe and is now present in all 26 of the Bank's Latin American and Caribbean member countries, with over 5 million cases and around 203,000 deaths as of August 2020 (IDB, 2020d).

[9] This refers to the extraurban transportation of passengers that links different population centers.

of Eastern Europe and Southeast Asia (WEF, 2018). Regional heterogeneity is also notable in this respect: in countries such as Chile and Mexico, less than 5% of the paved network is in poor condition, while in others, such as Costa Rica and El Salvador, the proportion is above 40% (IDB, 2020a).

2.16 The limited connectivity of the region's road network has a particularly marked impact on rural areas, as well as indigenous and Afro-descendant communities that usually live in more isolated areas where poverty rates are highest (46% of inhabitants—around 20 percentage points higher than levels in urban areas) (ECLAC, 2018b). This increases the isolation of the rural population and affects their living standards due to more restricted access to goods, public services, and income-earning activities. Similarly, deficient roads raise transportation times and costs, curtailing the productive development of rural areas with high agricultural potential and limiting the incorporation of production into the country's export and value chains (Chong and Valdivia, 2018).

2.17 The weaknesses in road infrastructure are the result of a series of factors that include: (i) the limited availability of sector planning tools with a medium- and long-term focus; (ii) low average levels of investment in construction and maintenance in the region (IDB, 2019b);[10] (iii) limited fiscal space for the allocation of public funding (Section II.C.); (iv) low public spending efficiency and weak governance structures for infrastructure[11] (Section II.C.); (v) limited integrated management of infrastructure assets across the entire lifecycle; (vi) a lack of construction industry competitiveness; and (vii) vulnerability to natural disasters and climate change (World Bank, 2017a; IDB, 2020a).

2.18 The construction and operation of transportation infrastructure has also been affected by **the COVID-19 pandemic**. Lockdown measures have included the interruption and/or slowing of infrastructure development and have created problems in the supply of construction materials. This has been coupled with increased occupational risk for workers in the sector and liquidity risk for companies, in light of the sharp drop in demand and interruption of the payment chain. Over the medium term, the economic recession[12] and increased fiscal spending to contain the impact of the pandemic will be important challenges for allocating public funds to investments in the sector (Section II.C).

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[10] In the decade spanning 2008 to 2017, Latin American and Caribbean countries invested an annual average of 2.8% of GDP in infrastructure (2.3% public and 0.5% private), which was below the levels seen in other emerging regions such as East Asia and the Pacific (5.7%) and the Middle East and North Africa. It is estimated that the region needs annual investment of 4% to 7% of GDP to bridge the infrastructure gap (IDB, 2020a).

[11] According to Contreras et al. (2016), one alternative for evaluating efficiency in public investment management is to analyze the public procurement cycle using the Benchmarking Public Procurement report prepared by the World Bank (2017b). The region scores an average of 62/100 in this study, which identifies challenges in the areas of: (i) digitalization of procurement processes, (ii) the existence of effective complaint mechanisms that are integrated into the different stages of the procurement process (both before and after contract adjudication), and (iii) the timely resolution of complaints.

[12] According to various projections from recent studies to estimate the impact of the COVID-19 pandemic on Latin America and the Caribbean, the region's economy could lose 6.3%-14.4% of GDP in the next three years (IDB, 2020e).

2.19 **Road infrastructure in the region has limited sustainability.** That sustainability includes economic and financial, environmental, social, cultural, and institutional factors to be borne in mind throughout the lifecycle of infrastructure, including its planning, design, construction, operation, and maintenance (Bhattacharya et al., 2019). In addition to the issues covered in Section II.C., the environmental safeguards in infrastructure projects tend to be below international good practices. Moreover, the project cycle seldom considers the climate change resilience and adaptation capacity of infrastructure. Climate change may damage or destroy infrastructure, inflicting significant social and economic costs estimated at between 1.5% and 5% of regional GDP (ECLAC, 2014).

2.20 Similarly, despite the efforts made so far (see Section III), the number of traffic accident fatalities remains unacceptably high, at 22.07 deaths per 100,000 inhabitants in 2010, compared with 20.07 in 2017 (IHME, 2017) (in comparison, the European countries recorded 6.3 deaths per 100,000 inhabitants in 2016 [WHO, 2018]) (Figures 9 and 10). Only a small number of countries have implemented good road safety practices. It is particularly concerning that only five countries have implemented good practices—including public education campaigns—in the area of speeding and eight in the area of driving under the influence of alcohol: two of the main causes of fatal accidents (PAHO, 2019). The region is also failing to develop the use of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication (Table 1), while there have been no discussions regarding allocation of the 5.9 GHz spectrum that is used to improve road safety in the developed countries. Against this backdrop, the region failed to meet Sustainable Development Goal 3.6: by 2020, halve the number of global deaths from road traffic accidents compared to 2010 levels (United Nations, 2015; Organisation for Economic Co-operation and Development (OECD)/ITF, 2017; WHO, 2018). Improving transportation safety also entails reducing risk for users and workers in the sector (Table 1), taking into account the health challenges associated with the COVID-19 pandemic, as well as failures and breakdowns in the transportation system and acts of vandalism against it.

2.21 **Passenger air transportation remains nascent**, despite the strategic role that it should play in the countries of the region in terms of internal connectivity (considering, for example, the geography of the Andean and island nations) and regional integration (Fioravanti et al., 2018). The number of passengers in the region has grown in recent years, from 133.7 million in 2008 to 292.8 million in 2018 (World Bank, 2018b). Though the sector has been hit hard by the COVID-19 pandemic, the positive trends observed before the pandemic should continue in the long term, reaching 1.166 billion passengers in 2050 (ITF, 2019a). To accommodate this growth, challenges must be overcome relating to: (i) air transportation policy[13] and sector institutions; (ii) air transportation integration and connectivity to meet growing demand; (iii) energy efficiency and the use of alternative fuels; (iv) service affordability;[14] (v) adoption, implementation, and

[13] Commercial air transportation policies are restrictive in Latin American and Caribbean countries, limiting the availability of routes and flight frequencies and also competition between airlines (Fioravanti et al., 2018).

[14] Passenger demand would be 15% higher if taxes were eliminated and fees lowered to competitive levels—equivalent to 80 million additional passengers annually by 2035 (ECLAC, 2017).

compliance with international civil aviation regulations; (vi) the construction, expansion, and operation of airport infrastructure based on universal accessibility standards; and (vii) airport facilitation. The improvement of air transportation safety is particularly important. The accident rate in the region is above the world average: 2.91 accidents per million departures, compared with 2.51 worldwide (ICAO, 2019). The most significant risks are associated with: (i) runway safety; (ii) a loss of aircraft control; and (iii) airplane crashes.

2.22 Lastly, **maritime passenger transportation** is key for ensuring connectivity in countries such as The Bahamas and Trinidad and Tobago, which are made up of numerous islands, as well as between the various Caribbean countries. However, greater efforts are needed in the regulatory sphere with a view to improving service quality and facilitating domestic and regional integration. The challenges in this subsector are related to: (i) policies for incorporating maritime passenger transportation; (ii) regulations governing the awarding of licenses to ships and passengers; (iii) regulations governing the safety of ships and passengers; (iv) the formalization of routes and timetables; and (v) investment in infrastructure for docks and passenger terminals. Similar challenges exist in relation to fluvial passenger transportation, which is present in the Andean and Southern Cone countries.

B. Poor logistics performance, with consequences for economic competitiveness in the region

2.23 Transportation plays an essential role in the coordination of production activities, which are spread throughout the territory. This is achieved through logistics operations that involve the movement and storage of goods and the associated administrative processes. Logistics affect the costs and time horizons for productive activities, and good logistics performance is thus key for economic competitiveness and stronger regional integration. However, Latin America and the Caribbean **lags far behind** in this area. According to the World Bank's Logistics Performance Index, the region's general logistics performance scored an average of just 2.66 out of 5 in 2018, behind Europe (3.40), East Asia and the Pacific (3.13), and the Middle East and North Africa (2.78) (Figure 11). This was also lower than its score in 2014 (2.79) (World Bank, 2018a). Performance is mixed across the different Latin American and Caribbean countries, however. While Chile and Panama ranked among the top 40 countries in the index in 2018 (positions 34 and 38, respectively), Venezuela and Haiti were among the 20 worst performing ones worldwide (ranking 142 and 153, respectively). Together with the region's distance from its main international markets—which makes logistics even more important—deficiencies in logistics have a **negative impact on the competitiveness** of its economies. Logistics costs in Latin America and the Caribbean stand at between 16% and 26% of regional GDP, compared to 9% in the OECD countries (CAF, 2016). These costs account for a large share of the value of regional exports. In Central America, costs are as high as 40% of the final price of exported goods (World Bank, 2019). In this context, it is not surprising that one in four Latin American and Caribbean companies identify transportation as a crucial obstacle to the development of their activities, with values very close to those in Sub-Saharan Africa (25.8%) (IDB, 2020a).

2.24 International indicators highlight the **gap in logistics infrastructure** in the region. In fact, the infrastructure subcomponent of the Logistics Performance Index is the one in which the region scores worst (2.47/5) when compared with more advanced regions (scores of 3.13 for Europe and Central Asia and 3.01 for Southeast Asia). As a consequence, approximately 40% of the difference in international freight charges between Latin America and the Caribbean and the OECD can be attributed to differences in quality of infrastructure (IDB, 2019b). The weaknesses in road infrastructure highlighted in Section II.A are particularly concerning given the predominance of ground transportation within the modal breakdown for goods transportation. Trucks are responsible for more than 70% of domestic freight movement in the Latin American and Caribbean countries. Similarly, this mode accounts for 30% of intraregional trade in South America and almost all exchanges in Central America. In particular, investment in road infrastructure has failed to keep pace with the increase in road freight transport (e.g. increases of 2.2% in Costa Rica, 5% in Ecuador, and 19.9% in Nicaragua from 2012 to 2016) (IRF, 2019), with negative consequences for the provision of transportation services, resulting in longer time frames and higher costs for users.

2.25 Rail infrastructure is inexistent or of poor quality in most countries. The topography and size of many countries adversely affects the cost-benefit ratio for rail (which is usually competitive with road transportation for distances over 500 km) (Kohon, 2020). Among larger countries, which therefore have greater potential for rail transport, Mexico has the highest rail density (13.6 km per 1,000 km²). This level, however, is far below the averages for Europe (49.2 km per 1,000 km²) and the United States (23.2 km per 1,000 km²), although it is above that of China (7 km per 1,000 km²) (WEF, 2018). According to the Global Competitiveness Report, the quality of rail infrastructure is one third of that in the advanced economies in those countries in the region that have it (WEF, 2019). Combined with high construction costs and the rigidity of this mode compared to the flexibility of road transportation, this means that (with the exception of Mexico and Brazil) rail accounts for only a marginal share in Latin America and the Caribbean (below 3%), in contrast to the advanced economies (Barbero et al., 2020). In the case of port infrastructure (both maritime and fluvial), quality has improved, particularly since the involvement of the private sector in construction and operation.[15] However, a number of challenges still need to be addressed. This includes rethinking the governance of port infrastructure; increasing investment in infrastructure, equipment, and technology to improve port efficiency; and improving intermodal connections—particularly with rail—and with the interior of the country, mainly in port cities. Given that 95% of the region's international trade is moved by sea, overcoming these challenges will be key for improving the competitiveness of economies in Latin America and the Caribbean. Lastly, **inter-modality and multi-modality** are limited. To meet demand stemming from the expected growth in international trade, for example, the region needs to increase the supply of road infrastructure used to access port terminals by 15% by 2030 (ITF, 2017).

[15] The average technical efficiency of ports in the region improved from 52% in 1999 to 64% in 2009 (Serebrisky and Suárez-Alemán, 2019).

2.26 The **weak performance of transportation services** increases logistics costs in the region, with amounts ranging from $0.10-$0.15 per ton-kilometer, compared to $0.05 in Australia and Canada and $0.04 in Spain and the United States (Barbero and Guerrero, 2017). **Road transportation**, which is the dominant mode of goods transportation, faces challenges in several respects. The average age of the fleet is 15.5 years and is as high as 21 years in countries such as Colombia and the Dominican Republic (compared, for example, to 11.5 years in the European Union). This leads to operational and energy efficiency losses and is also associated with low service quality and high levels of emissions. Vehicle usage—measured as distance traveled—is lower in Latin America and the Caribbean than in the advanced countries (around 62,000 km per year on average, compared to more than 110,000 km in France and the United States), while occupancy rates are below 60%, thus reducing productivity. Business organization is segmented: on one hand, there are a high number of microenterprises and individual operators with limited operational and financial capacities, while on the other, a small group of large local and international companies exhibits performance levels similar to those in the advanced countries. There is a high prevalence of informality, ranging between 20% and 40% of operations, and there are persistent regulatory and political economy barriers to greater competition in the market and better-quality services (Barbero et al., 2020). The impact of robberies (as much as 3% of total costs) and informal payments should also be noted (Barbero et al., 2020).

2.27 **Rail freight** accounts for only a small share of the modal matrix and is focused on the transportation of bulk and mining goods in just a few countries in the region (Kohon, 2020). **Air transportation** accounts for just 4% of tonnage transported internationally. While relevant in countries such as Argentina, Brazil, and Paraguay, there is insufficient use of **fluvial transportation** given the wealth of navigable waterways in the region: this mode accounts for less than 1% of tonnage transported in both volume and value terms (Jaimurzina and Wilmsmeier, 2017). **Maritime transportation** yields more positive data, as the region has improved its international connectivity in this segment and, consequently, its ability to reach international markets. Latin America and the Caribbean increased its maritime connectivity by 6% in the 2015-2019 period, although this subsector has not been immune to operational disruptions stemming from labor conflicts and regulatory challenges (for example, in the context of the growing consolidation of the shipping industry) (UNCTAD, 2019).[16] In general, international indicators point to the lower relative quality and competitiveness of **logistics services** in Latin America and the Caribbean. The region scores lower (3.05 out of 5) than Europe and Central Asia (3.65), Southeast Asia (3.49), and the Middle East and North Africa (3.19) (WEF, 2019).[17] Overcoming these barriers is key for the sector, given that its improved performance depends not only on a greater supply of infrastructure, but also the efficiency of service providers (IDB, 2020a).

2.28 Despite recent progress, **institutional and regulatory challenges** persist in the area of logistics. In the last decade, the countries of Latin America and the

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[16] The cases of the Dominican Republic, The Bahamas, and Peru are particularly noteworthy, with connectivity growing in these countries by 41%, 23%, and 22%, respectively (UNCTAD, 2019).

[17] Some countries in the region are better positioned in the world rankings: Chile and Panama are among the 50 top-performing countries (with scores of 3.13 and 3.33, respectively).

Caribbean have undertaken significant institutional and regulatory reforms aimed at improving the planning, implementation, and supervision of logistics policies, as exemplified by Colombia's National Logistics Policy and the National Logistics Plans of Peru, Mexico, Paraguay, Ecuador, the Dominican Republic, and the Central American countries (National Planning Department, 2018; Fioravanti et al., 2019). This has led to significant improvement in logistics performance: indeed, the literature points to a correlation of almost 0.75 between logistics performance and the quality of public and private institutions in any given country (OECD/United Nations and ECLAC/CAF, 2014). Nonetheless, the region still falls far short of the institutional quality levels present in the advanced countries. Of particular concern are the gaps in institutional transparency and the multiplicity of processes and documents requested by government agencies for logistics operations. This is further aggravated by limited coordination between the participating agencies (World Bank, 2019).[18]

2.29 **Scant attention has been paid to urban logistics** in the region. There have been very few cases in which the transportation of goods in cities has been taken into account in land use and transportation planning, while regulatory action, collaboration with the private sector, and knowledge generation in this area has also been sparse. This has led to: (i) the distancing of logistics zones from urban centers, with a consequent increase in distances traveled for goods transportation and an associated impact on logistics times and costs; (ii) congestion in urban centers and areas of high population density; (iii) damage to infrastructure; (iv) a lack of road safety; and (v) environmental and noise pollution (IDB, 2020a). The rapid increase in e-commerce (650% growth between 2020 and 2030) will require effective, comprehensive, and permanent actions in this sphere to avoid even greater pressure on already high levels of congestion, local emissions, and road accidents in Latin America and the Caribbean (IDB, 2020a).

2.30 In general, logistics presents important **social and environmental sustainability challenges**. Goods transportation also affects road safety. For example, 20% of road accidents in Brazil involve trucks. In Peru, the figure is one in every three accidents. In turn, the transportation of goods by road is a key driver of demand for energy, particularly fossil fuels (although well below the level in advanced countries [Figure 12], the region accounts for 12% of global CO_2 emissions from this source), and it is one of the main causes of deteriorating air quality in urban areas (Barbero et al., 2020). This situation is of particular concern given that tonnage transported by road is expected to triple by 2050 (ITF, 2019a). Accordingly, the countries in Latin America and the Caribbean have a particular challenge ahead that is different from the context in which the advanced countries developed: although the region's share of sector emissions is far from that of those countries (Figure 12), the global environmental emergency will require innovative solutions to promote the region's economic growth, with the resulting increase in transportation, while working to mitigate climate change.

2.31 **Technological modernization of the sector** is hindered by a series of factors specific to the region. Recent IDB studies show that supply chains (including

[18] According to the latest available data, informal payments and crime were mentioned as an obstacle to timely goods deliveries by 25% and 7% of logistics professionals, respectively (World Bank, 2018a).

logistics activities) in Latin America and the Caribbean are a decade behind in terms of the digital transformation process seen in the more advanced economies (Calatayud and Katz, 2019). They also show that a two-speed logistics sector is beginning to emerge, with a small number of large companies that are more prepared to face the digital transformation, on one hand, and a large number of small- and medium-sized companies with low levels of knowledge and scant management and financial resources for participating in this transformation, on the other. The main challenges for modernization include: (i) unstable economic and political environments; (ii) low labor costs, which compete with the potential economic benefits of innovation; (iii) a lack of awareness, cultural resistance, and limited local availability of new technologies; (iv) financial and human talent barriers to adopting said technologies; (v) potential adverse impacts on the labor force; and (vi) a lack of coordination between agencies, and with the private sector and academia, in preparing digital transformation programs (Calatayud and Katz, 2019).

2.32 Although the countries have made progress in terms of trade facilitation, administrative processes and a lack of adequate infrastructure at **border crossings continue to cause delays, driving up logistics costs** for international trade and diminishing the benefits of the economic integration of the region. The average score attained by Latin America and the Caribbean for the Doing Business cross-border trade indicator is 69/100 (compared to 94.3 for the OECD countries). El Salvador and Panama are the top-ranked countries (positions 46 and 59 out of 188, respectively), while Guyana and The Bahamas occupy the lowest positions (151 and 161, respectively) (World Bank, 2019). This situation underlines the delayed implementation in the region of explicit commitments in the World Trade Organization's Trade Facilitation Agreement relating to key areas such as risk management, single windows for foreign trade, authorized economic operators, and cooperation in customs and between other relevant agencies (IDB, 2019a).

2.33 **The COVID-19 pandemic** has presented major challenges to the logistics sector. In the short term, there have been challenges with respect to occupational safety for drivers and a lack of rest and wash stops. Measures taken by local authorities have also hindered or even prevented drivers from transiting. The decline in economic activity has impacted the financial sustainability of companies in the sector, with consequences for the continuity of service delivery (Sánchez et al., 2020). Meanwhile, the increase in e-commerce has not only led to a reconfiguration of logistics operations but also traffic from greater volumes of goods at the urban level. Over the medium term, the aftermath of the pandemic could potentially impact the level of competition in the sector, investments to improve logistics performance, the movement of goods in cities, and the participation of companies from the region in global supply chains due to their potential reconfiguration, among other effects.

C. Institutional and regulatory challenges in the sector

2.34 **Institutional weakness and fragmentation** is one of the most widespread problems in the Latin American and Caribbean countries. On average, the region's performance in this sphere is below that of the Asian and North African countries, surpassing only that of the Sub-Saharan African countries (IDB, 2020a). These weaknesses have negative consequences for the prioritization and effective allocation of resources; the introduction of adequate regulatory frameworks; the

ability to catalyze private sector participation; transparency and integrity;[19] and the planning, execution, and management of investments and policy actions in the sector. Recent studies demonstrate the relationship between weak institutions and the low quality of infrastructure in Latin America and the Caribbean, finding that if institutional capacity were to improve, the supply of infrastructure could double without any increase in investment funding over existing levels (IDB, 2020a). Corruption also has high socioeconomic costs (Engel et al., 2018). Annual losses due to corruption in the transportation sectors of developing countries are estimated at US$18 billion (Paterson and Chaudhuri, 2007).

2.35 Institutions in the region face high staff turnover; inadequate budgetary, human capital, and technological resources; gender gaps in the sector labor market (Figure 13); fragmentation in decision-making (normally in silos based on the mode of transportation, with no comprehensive vision of the investment cycle and the overall territory); and excessive bureaucracy. The sector also has to contend with gaps in relation to transparency,[20] which have a negative impact on investment and service delivery[21] (Engel et al., 2018; IDB, 2020b). There is a widespread, pressing need to strengthen planning, prioritization, evaluation, and preinvestment capabilities for infrastructure projects. Bidding, works supervision, and contract administration processes should be guided by policies and practices that foster competition, ensure transparency, and reduce the risk of both cost overruns (double the world average in Latin America and the Caribbean [Flyvbjerg, 2014]) and extensions to execution periods.[22] This is key to reducing inefficiencies in public investment, which stand at 0.65% of regional GDP (IDB, 2020a). Assets should also be managed using a comprehensive approach, with particular emphasis on prioritizing infrastructure maintenance actions. Investment in new projects must be balanced against the need to ensure levels of service provided by those projects already completed.

2.36 **Technical and economic regulatory frameworks for the sector are weak** across all modes and at all levels of government, compared to international good practices. In general, greater clarity is needed on the rights and obligations of operators, consumers, and the public sector, as well as on efficiency and quality levels for infrastructure and services to be provided by operators in the sector that also ensure service affordability. There is little promotion of the regularization of informal companies involved in the transportation of passengers and goods to foster competition and improve service quality and road safety, (ITF-IDB, 2020). This results, in part, from scant interagency coordination, given that multiple

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[19] In the World Economic Forum's Global Competitiveness Report 2018-2019, Latin America and the Caribbean scored below other regions with regard to the diversion of public funds, favoritism in decision-making by public officials, and the wastefulness of government spending. Between 10% and 25% of the value of all public contracts (not only the transportation sector) is lost to corruption (IDB, 2018a).

[20] Data for the sector in the OECD countries (2014) indicate losses of 4% in construction and 16% in transportation as a proportion of total transaction value.

[21] Studies conducted by the OECD and the World Bank found that corruption in the infrastructure and extractive sectors leads to inadequate budget allocations and affects the quality and quantity of services provided (OECD, 2015).

[22] For example, compared to the OECD countries, it takes one month longer to obtain construction permits and approvals in Latin America and the Caribbean (McKinsey, 2017).

agencies are involved in regulating the transportation sector—some of them external to the sector. Such coordination is key to establishing clear rules that encourage private sector participation, competition, transparency, and equitable access to infrastructure services.

2.37 Institutions in Latin America and the Caribbean are not playing the active role required to **ensure that infrastructure and associated services help to reduce environmental degradation**. The Paris Agreement, which seeks to limit global temperature rises to between 1.5ºC and 2ºC above preindustrial levels, has been ratified by every country in the region. These targets require a reduction in net carbon dioxide emissions to zero by 2050 and significant reductions by 2030. In this context, the countries in Latin America and the Caribbean have a particular challenge ahead that is different from the context in which the advanced countries developed: although the region's share of sector emissions is far from that of those countries, the global environmental emergency will require innovative solutions to promote the region's economic and social growth, with the resulting increase in transportation, while working to mitigate climate change. Moreover, a key challenge will be for the institutions, policies, regulations, processes, and practices that determine where, how, and what infrastructure will be planned and designed to incorporate the concept of resilience into transportation infrastructure, starting from the investment feasibility analysis stage.

2.38 In light of current and future fiscal constraints, especially as the COVID-19 pandemic unfolds, and in the face of a possible decline in funding from traditional sources for the sector, such as fuel taxes[23] (see Section III), one key challenge for Latin America and the Caribbean will be to **improve spending quality and seek out new sources of funding and financing from the public and private sectors** (see paragraph 3.29). In general, there is a lack of project portfolios with sound analyses of demand and cost (including environmental and social impacts), and of project structuring mechanisms and facilities with private sector participation (e.g. fleet renewal programs), including projects carried out through public-private partnerships (Box 3) (EIU, 2019). Weaknesses in project business models and risk management and allocation between the public and private sector (IDB, 2019b), among other factors, restrict private funding for projects. In addition, in most countries of the region, there are constraints on commercial banking, and the participation of institutional investors is still limited (IDB, 2020a).

2.39 In general, collaboration with the private sector is limited. The private sector is also a critical actor in transportation sector operations. For example, it is responsible for almost all goods transportation, and for the operation of 18 of the 20 largest port terminals and 15 of the 20 main airports in the region (IDB, 2020a). It also plays an important role in technology adoption and transfer in the sector (ITF, 2019c). Improving both dialogue with the sector and the business environment in Latin America and the Caribbean will therefore be key, including overcoming challenges related to lack of transparency, the fiscal burden, legal uncertainty, limited access to finance, the complexity of procedural matters, macroeconomic

[23] In Latin America and the Caribbean, fuel taxes as a share of overall tax revenue range from 2% in countries such as Ecuador to a maximum of 11% in countries such as Nicaragua and Costa Rica.

instability, lack of human talent, all with a view to laying the groundwork for more efficient private sector actions.

2.40 Lastly, the **weak availability of data** on the sector and its users remains a problem in the region (for example, data disaggregated by gender and/or other population groups). Where data is available, it is usually spread across different sources that are out of date, incomplete, and of low quality compared to the standards in advanced countries. This diminishes effective regulation, planning, and supervision by the authorities, adversely affects transparency, prevents optimization of the use of available infrastructure, discourages private sector investment, and hinders enhanced management of operations and assets (in both public transportation and logistics).

D. Challenges and opportunities of new technologies

2.41 New trends and technologies applied to transportation are leading to **an unprecedented speed of change**. The main advances—in addition to traditional Intelligent Transportation System (ITS) solutions—can be summarized as Autonomous, Connected, Electric, and Shared (ACES) transportation (Table 1). The benefits of these technologies would have a transformational impact on the sector, helping to achieve more efficient, inclusive, and sustainable transportation. Table 4 summarizes these **benefits**. These changes are not **risk**-free for economies and societies, however, as summarized in Table 5. In this context, **the public sector must play a key role** in maximizing benefits and managing risks effectively. Without this, the Latin America and Caribbean countries could miss out on a historic opportunity to reverse current trends in the sector.[24]

2.42 The speed with which these technologies are being deployed in the region, especially with the push for digitalization in the context of the COVID-19 pandemic, requires governments to focus simultaneously on the more traditional problems in the sector (such as the quality of transportation infrastructure) and also on the challenges arising from the new technological context. **Shared transportation** is not a new phenomenon in Latin America and the Caribbean, where it is common for coworkers and neighbors to share rides to school or work. The novelty stems from the entrance of transportation network companies into the market. In 2018, for example, Uber was present in 230 cities across 15 countries, with 30 million users and 1 million drivers (surpassing the numbers in North America) (Statista, 2019). The emergence of these companies has not been without conflict, with street protests by taxi drivers opposed to them. Recent studies—while in their early stages—also seem to indicate a modest modal shift away from public transportation.[25] Other studies highlight the potential of these companies as service providers for populations with more limited access to public transportation (see Section III). Further data, research, and policy actions are required to understand the impact of these companies and ensure that they are better integrated with each other and with public and active transportation.

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[24] See the section on the future of transportation in IDB (2020a), which presents four scenarios for the region based on public sector actions and the impact of new technologies.

[25] Studies for Santiago and Bogota estimate that approximately one third of people using the services would otherwise have used public transportation (Tirachini and Gómez-Lobo, 2017; Granada et al., 2018).

2.43 Micromobility (including bicycles and scooters) is also gaining in popularity in the region. However, many cities have not yet succeeded in efficiently incorporating these services from a comprehensive urban mobility perspective. Accordingly, for different reasons—including the use of public space, road safety, and the transfer of data and information on users and enterprises—the transition has created tensions between the authorities, citizens, and operators of micromobility systems. Cities have taken different approaches to regulating micromobility, using a variety of price, control, and information management mechanisms with varying levels of success (see Section III).

2.44 With respect to **e-mobility**, different Latin American and Caribbean countries are developing strategies to promote this technology (see Section III). Despite this, the region has lagged behind Europe, the United States, and China with respect to its adoption. According to 2018 data, sales of electric vehicles accounted for less than 0.02% of total sales in Mexico, 0.05% in Chile, and 0.15% in Colombia. Moreover, one in every two people in the region has indicated that they have no desire to purchase an electric vehicle (Latinobarómetro, 2017). Reversing this trend will be key if the Latin American and Caribbean countries are to achieve targets for reductions in pollutant emissions by 2030 and decarbonization with zero net emissions by 2050.

2.45 **Digital connectivity** in the region is also below that of the advanced countries, starting with the gap in rolling out broadband (only 43% of households have a fixed broadband connection,[26] while individual access to mobile internet is just over 50%) and followed by the adoption of sensors, programs for analyzing information, and digital management platforms for transportation and associated infrastructure (ECLAC, 2016; GSM Association, 2019). This prevents countries from receiving the benefits associated with the implementation of this technology, including the optimization of transportation and infrastructure use, traceability of goods, risk management, and traffic accident forecasting. Despite this deficit, available estimates indicate that the regional market for the Internet of Things will grow at an annual rate of 35% between 2018 and 2023, with transportation and logistics the main segments for adoption (IDB, 2020c).

2.46 With regard to **automation**, while research, testing, and public debate surrounding the commercial deployment of autonomous vehicles has expanded rapidly in the advanced countries, the countries of Latin America and the Caribbean lag behind in all of these areas. On social media, the level of discussion regarding autonomous vehicles is 18 times lower in the region than worldwide. Although there is still no consensus regarding when this technology will achieve a 50% share of the vehicle market in the advanced countries (ranging from 2030 to 2050), available analyses for Latin America and the Caribbean suggest that the region is likely to achieve this level one or two decades later (Benitez, et al., 2020). It is therefore encouraging that initiatives are emerging to test this technology in the region, such as those promoted by the Governments of Chile and Colombia (see Section III). The objective is to expand knowledge of the technology and explore

[26] From a gender perspective, an additional challenge is the gap between men and women in the use of technologies. Women have lower usage of digital devices and the internet, particularly where digital payments are concerned (Agüero et al., 2020).

the nuances and benefits of its use in the Latin American and Caribbean context (Table 4). The rapid spread of unmanned aerial vehicles (or drones) shows that the adoption of this technology may accelerate in response to technological advances and declining costs, and the Latin American and Caribbean countries need to be prepared for this eventuality.

2.47 In general, compared with the actions that countries in other latitudes are taking (see Section III), the **gap in knowledge and attention paid by the public sector to the new technological context** is of concern. Sector plans make scant mention of technological factors, while institutional capabilities (in terms of both human and monetary resources) are limited compared to the actions that need to be taken to modernize sector institutions and initiatives. This affects the ability to update sector regulations to adapt them to technological changes, creating regulatory vacuums or frameworks that are too rigid to stimulate innovation while also mitigating the risks thereof (e.g. the impact on the sector labor force). Interagency cooperation is also scant, even taking into account the fact that certain regulatory issues exceed the prerogatives of the transportation sector—for example, data protection and cybersecurity matters. The same situation exists between the public sector, the private sector, and academia. The latter two are the main sources for the identification and generation of skills for the future workforce, as well as innovation and data for understanding and monitoring the impact of new technologies. Lastly, the exchange of good practices and the harmonization of regulations at the regional and international levels is nascent, especially in relation to issues such as drones and cybersecurity, in which strong coordination between countries is needed to improve management of the associated risks.

III. International Evidence Regarding the Effectiveness of Transportation Sector Policies and Programs

3.1 In light of the impact of the transportation sector on economic and social well-being (see paragraph 2.1), governments play an important role in ensuring that sector operations contribute to policy objectives such as improving quality of life, inclusion, productivity, economic growth, and sustainability. According to Berg et al. (2017), transportation policies may be divided into three main categories: (i) infrastructure investments to improve transportation services (construction, rehabilitation, and/or maintenance of infrastructure); (ii) price-based instruments that influence modal choices and user behavior (e.g. subsidies for specific groups, fuel taxes, parking fees); and (iii) technical and economic regulations to address market failures (e.g. social externalities) and establish standards for service provision (e.g. quality and performance standards). This section presents a review of the literature regarding the effectiveness of different policies, responding to each of the four major challenges analyzed in the section above. Although this section describes a variety of literature on transportation, there is limited evidence available on Latin America and the Caribbean, and there are significant knowledge gaps in the region.

A. Policies and programs to promote efficient, inclusive, sustainable, and quality mobility for urban and interurban passengers

1. Measures to promote the integrated planning of land use and the provision of transportation services

3.2 The integrated planning of transportation systems and land use is a key factor in controlling the rapid expansion of urban sprawl (Suzuki and Roberts, 2014). In this sense, a policy that has been little used in the region is that of **transit-oriented development**, which prioritizes the planning and development of cities around public transportation hubs (motorized and nonmotorized) (Martínez Salgado, 2018). Existing experiences (Table 6) have demonstrated that this type of policy helps to achieve dense, compact, multimodal cities, resulting in greater numbers of passengers using the public transportation system, opportunities for the joint development of infrastructure by the public and private sectors, and higher numbers of affordable houses, land values, and returns on real estate (Medina and Veloz, 2013).

3.3 Another measure to facilitate comprehensive planning involves the drafting and implementation of **urban mobility master plans**. These instruments establish a long-term vision for the development of sustainable transportation systems. To that end, they generally include actions to achieve the more efficient use of road space, prioritizing public transportation as a means of traveling swiftly, reliably, and safely (Arsenio et al., 2016; Harkness et al., 2019), while also fostering coordination between transportation and land-use policies. The experience in European cities shows that these instruments are correlated with modal shifts toward the greater use of public and active transportation (Bueno and Vassallo, 2019). Additional studies highlight the need to include a social component in planning instruments, acknowledging the implicit social, cultural, and economic differences between different groups of users (Guzmán et al., 2019).

2. Measures to improve the quality of urban transportation services

3.4 Improving the quality of public transportation requires actions in a variety of areas—service availability, universal and transport accessibility, information, travel times, customer service, comfort, safety, and environmental impact (Rodríguez et al., 2020)—as well as acknowledging differences in mobility patterns as a function of user gender (Sánchez de Madariaga, 2013) and travel conditions that are different to those of the typical user (e.g. people with reduced mobility) (Olivares et al., 2019). For example, the development of mass transit systems, such as **Bus Rapid Transit or urban railways (including metro systems)**, has been shown to improve the quality of transportation services by reducing travel times (Rodríguez et al., 2017; Martínez et al., 2020), with positive effects on access to employment opportunities (Gómez-Lobo and Micco, 2020; Martínez et al., 2020), reduced emissions (Chen and Whalley, 2012; Goel and Gupta, 2017; Gramsch et al., 2013; Bel and Holst, 2018), and fewer traffic accidents (Box 4). Nonetheless, these mass transit solutions are applicable only to large and medium-sized cities in the region. In small cities, the main policies for improving urban and interurban mobility (apart from promoting nonmotorized transportation) center on developing demand-driven transportation services, either within the cities and/or to connect them with other urban and/or rural areas.

3.5 **Cable car** systems represent an innovative solution for addressing urban inequalities in public transportation provision, as they generally serve population segments living in remote and complicated topographies. The systems in La Paz (the largest in the world, with 32 km of network and 11 lines) and Medellin, for example, have shown that this type of intervention improves integration of the low-income population in areas on the outskirts of cities, while also helping to modernize neighborhoods (Brand and Dávila, 2011; Goodship, 2015), increase access to employment opportunities (Bocarejo et al., 2014), improve safety (Canavire-Bacarreza et al., 2016), and reduce perceived pollution levels (Martínez et al., 2018). In La Paz, travel times dropped by 22% on average following implementation of the first three "Mi Teleférico [My Cable Car]" lines, when compared to traditional transportation services (Suárez-Alemán and Serebrisky, 2017). There was also a modal shift away from private cars to public transportation (Martínez et al., 2018).

3.6 Facilitating **access to information** on the part of users can also positively affect transportation systems. The development of mobile apps that allow public transportation passengers to find routes and/or check expected vehicle arrival times helps to improve the user experience and facilitate trip planning. For example, an evaluation of the effects of real-time information provided via web-enabled and mobile devices in New York showed an increase of approximately 1.7% in the number of passengers per route per weekday (Brakewood et al., 2015). This is particularly key for people with reduced mobility (Guzmán et al., 2019). An evaluation of the implementation of Transport for London's open data policy shows that this yields annual economic benefits of as much as US$175 million for users, the city, and the institution itself (Deloitte, 2017).

3.7 The literature also shows that fixed urban transportation prices have a significant impact in terms of social inclusion, particularly with regard to the low-income population (captive users) for whom the financial burden of transportation costs can limit access to services and employment (see paragraph 2.8). Transportation policies face a trade-off between the objectives of efficiency and equity, i.e. high-quality services with efficient prices versus pricing with equity considerations. Efficient fare structures are not necessarily favorable for the poor (Gwillian, 2017) and subsidies therefore have an essential social function. The region has gained experience in implementing **demand** and supply-side **subsidies** aimed at improving access to transportation services. The evidence shows that supply-side subsidies may be justified only in a small number of cases (Gwilliam, 2017).[27] In contrast, demand subsidies are generally more effective (Serebrisky et al., 2009) as they allow transfers to be better targeted toward specific groups of beneficiaries (e.g. older adults, people with disabilities).

3.8 One successful case in the region is that of the subsidy arrangements implemented in Bogota starting in 2014, in which the approach has been similar to the one used in direct cash transfer programs (Guzmán et al., 2017). The

[27] While subsidies for vehicle purchases, fuel, or labor can provide short-term financial relief to operators, they almost always create serious distortions in both the use of resources and operational incentives over the long term. Input subsidies should only be used where there is a clear, well justified objective, such as accelerating technological change.

arrangement, which is based on the National System of Beneficiaries (SISBEN), targets subsidies on those members of households earning below the poverty line, through the use of individually issued smart cards. The cards provide riders with up to 30 trips each month at an average fare of US$0.30,[28] compared to an overall average fare of US$0.55 (Gwilliam, 2017). This subsidy has increased monthly trips by beneficiaries by 56% (Rodríguez Hernández and Peralta-Quirós, 2016) and has raised the hourly earnings of informal workers (Rodríguez et al., 2016), with a positive impact on access to transportation and equity for beneficiaries (Guzmán et al., 2017). This confirms that in addition to universal measures to reduce base fares on public transportation, policies are needed to reduce the number of suppressed trips by members of low-income households (Falavigna and Hernández, 2016).

3.9 In addition to the social function of transportation, subsidies can also be used to pursue efficiency objectives: (i) as a tool for promoting a modal shift away from private cars, thus reducing the externalities associated with the use of such vehicles; and (ii) as a tool for increasing trip volumes, which—by leveraging economies of scale in the sector—leads to higher frequencies and a reduction in waiting and access costs for all users. The latter is also known as the Mohring effect (van Goeverden et al., 2005; Rivas et al., 2019a). This relates to other studies that conclude that fare reductions are insufficient to reverse a decline in passenger numbers. The literature suggests that relative travel times and the quality of service are more important determinants of modal choices than public transportation fares, particularly in the case of high-income users (Gwilliam, 2017). Analyses of revealed and/or stated preferences indicate users have a greater willingness to pay for improvements to service quality attributes (Eboli and Mazzulla, 2008; Pujiati et al., 2019). However, no specific evidence for the region was found. On the contrary, public transportation fare increases have prompted social protests (Kemmer, 2020).

3.10 To improve the quality and affordability of transportation services, **stable funding structures** are needed to cover both operational and investment expenditure. The Latin American and Caribbean countries finance their public transportation systems using fare revenue and other supplementary sources such as fuel taxes, vehicle ownership taxes, betterment levies, and subsidies. However, the region has experienced greater difficulty in developing alternative sources such as tools for capturing land values or user fees for infrastructure, which—in addition to being a source of revenue—facilitate the internalization of externalities associated with the use of private vehicles (Ariza et al., 2018). International best practices suggest that good financial planning for transportation systems requires four components: quantifiable long-term objectives, funding mechanisms that are aligned with strategic mobility principles, institutional control and monitoring mechanisms to estimate funding gaps, and resource management that ensures long-term resource flows (Ariza et al., 2018). These elements are aligned with the strategic planning exercises mentioned in paragraph 3.2.

[28] The following changes were introduced to the policy in March 2017: (i) eligibility was restricted to individuals with a SISBEN score of 0 to 30.56 points (previously 0 to 40 points); and (ii) the benefit was reduced to 30 trips per month (previously 40) (Veeduría Distrital Bogota, 2017).

3.11 Lastly, the adoption of **congestion charges** (Table 7) to internalize private transportation externalities may contribute additional resources for improving the quality of public transportation. Available information on international experiences shows that the implementation of these arrangements leads to reduced rates of congestion and pollution, higher incomes and economic productivity, and effects on equity. In Singapore, traffic volumes and emissions levels fell by 15%, while average speeds rose from 30-35 km/h to 40-45 km/h, thus generating annual earnings of US$100 million. In Stockholm, traffic volumes dropped by 20%, traffic delays by 30% to 50%, and CO_2 emissions by 14%, generating US$155 million in revenue per year. The London Congestion Charge Zone has also been successful in reducing congestion (30% drop), improving air quality and public health (decline of 16% in CO_2 emissions and 15.5% in PM10), and creating a long-term source of financing for future transportation improvements (net annual revenue of US$182.1 million).

3.12 Although the potential benefits of congestion charges have been widely signaled in the literature, worldwide rates of adoption are low. Some authors indicate that implementation challenges and the low acceptability of this policy are the result of concerns surrounding user privacy, equity, and the complexity of executing this type of policy, as well as uncertainty regarding the effects of the measures and the use of revenue generated (Gu et al., 2018; López Ghio et al., 2018). The gradual implementation of this type of policy may help to improve public acceptance, as was the case in Stockholm, where the measure was first piloted in 2006. In addition, congestion charges should be seen as just one component of a broader transportation policy (supply and demand instruments) that should include, first and foremost, actions to improve the quality and accessibility of public transportation services. Transparency and accountability in the use of revenue has also been highlighted as a key element in the success of the London case, while income redistribution is critical if gains for higher-income groups and losses for lower-income ones are to be avoided (Else, 1986; Cohen, 1987; Transportation Research Board, 2003).

3. Measures to improve the environmental and social sustainability of passenger transportation services

3.13 From the standpoint of the avoid-shift-improve approach, avoiding unnecessary trips, particularly in private automobiles, while also promoting more sustainable modes of transportation and improving the environmental performance of vehicles, can help reduce transportation's environmental footprint (Table 1). In particular, with the aim of reducing urban traffic and associated local transportation emissions, cities in the region have frequently imposed **restrictions on vehicles** in urban areas in certain locations and at certain times. The effectiveness of these policies varies from city to city. In Mexico City, the implementation of a policy prohibiting vehicle use based on a rotation system (last digit of the vehicle license plate) led to an increase in the total number of vehicles in circulation and a shift toward vehicles with higher emissions (Davis, 2017). In the case of Santiago, permanent restrictions on vehicles without catalytic converters failed to lead to any reduction in traffic. Similarly, when an additional restriction was introduced to prohibit the use of vehicles with catalytic converters on days declared to be "environmental pre-emergencies," a reduction of only 5.5% was observed in car use (De Grange and Troncoso, 2011). The regressive nature of these policies is

evident, as low-income households tend to have older, more polluting vehicles and are unable to buy another vehicle (Montero et al., 2018).

3.14 One traditionally used instrument is fuel taxes, which account for approximately 60% to 70% of environmental tax revenues (United Nations Development Programme, 2016). However, the literature questions the efficiency of these instruments, as inelastic demand for fuel in the short term means that the resulting reductions in fuel consumption (the base for the tax) are not particularly large. These taxes are also far from commensurate with the environmental damage[29] generated by fuel consumption (Miller and Vela, 2013). A number of countries are beginning to experiment with the alternative instrument of **distance-based fees**, with dynamic elements that allow higher charges during peak travel times and/or depending on the type of vehicle. Internationally, programs are also being implemented to promote electric mobility (see paragraph 3.47).

3.15 Complementary policies exist to improve the environmental sustainability of the sector; these focus on promoting both **active transportation** (cycling and walking) and public transportation, with a view to reducing congestion and pollution. International evidence shows that programs to develop bicycle-sharing systems increase the frequency of personal or shared bicycle use (Ricci, 2015). The literature also shows that this type of system promotes modal shifts (Fishman et al., 2014): for example, bicycle-sharing systems reduced car usage by approximately 90,000 km per year in Melbourne and Minneapolis/St. Paul and by 243,291 km in Washington, D.C. (Fishman et al., 2014).

3.16 In addition to the foregoing, **reducing road accidents** is a public health priority for most countries in Latin America and the Caribbean. One policy commonly used by governments is to introduce stricter regulations on driving under the influence. Chile, for example, enacted a law in 2012 to reduce blood alcohol limits from 0.5 to 0.3, with severe fines and the revocation of licenses for drivers under the influence. An evaluation of this measure concluded that the law reduced the number of alcohol-related road accidents by 18% to 25% (Otero and Rau, 2017). Other policies that have had positive results in reducing the number of deaths and injuries from road accidents are as follows: (i) the strengthening of institutional and regulatory frameworks that ensure care for victims while reinforcing alcohol testing,[30] the use of motorcycle helmets,[31] child restraint and seat belt systems, mandatory vehicle insurance, speed reductions in urban (residential) areas,[32] and road safety education programs; (ii) the creation of institutional frameworks with specialized agencies for coordinating speeding inspections, control, and

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29 The tax rate charged varies by fuel type and, in some countries (e.g. Central America), the tax is lower for diesel than gasoline (O'Brien and Vourc'h, 2001).

30 An evaluation of the Target Zero Teams project from Washington state demonstrated that the deployment of nighttime police patrols responsible for carrying out alcohol testing reduced the involvement of drunk drivers in fatal accidents by 24.8% and also reduced the number of accidents (Thomas et al., 2015).

31 Blanco et al. (2018) found that this measure increased helmet use in one of Uruguay's municipios from less than 10% to more than 90% in just one month. The evidence also suggests that laws mandating the use of helmets reduce the likelihood of fatalities or serious injuries by 8.7 percentage points (a reduction of 57% compared to the control group).

32 The probability that a pedestrian struck by a vehicle will suffer fatal injuries increases dramatically at speeds of over 30 km/h (Bunn et al., 2003).

sanctions; (iii) data collection and analysis for guiding decision-making (road safety observatories); (iv) road safety audits and inspections;[33] (v) the adoption of international safety standards for vehicles sold in the Latin American and Caribbean region; and (vi) the application of tools from behavioral economics (Gaviria Fajardo et al., 2019).

3.17 **The elimination of barriers to mobility for different groups of users (including women, people with disabilities, older adults, and indigenous peoples) is essential if the objectives of reducing poverty and social inequality are to be achieved.** Although the literature on effectiveness in this area is limited, the following good practices have been identified (Allen, 2018; ITF, 2019b): (i) implementing access audits that offer specific recommendations for infrastructure design (priority seats, raised platforms for wheelchairs, ramps, spaces for shopping bags) and operational improvements (specific services for people with reduced mobility), ensuring that transportation facilities and services are designed to serve all users equitably (Litman and Rickert, 2005) from a universal accessibility standpoint (Olivares Medina et al., 2019; Duryea et al., 2019); (ii) institutionalizing the collection of mobility data disaggregated by gender to guide the planning and operation of transportation systems; and (iii) adopting measures to prevent and mitigate sexual harassment in public transportation,[34] including the use of technology to support the effective reporting of violent incidents and the implementation of protocols for handling reports of sexual harassment (investigation, follow-up, and punishment).

3.18 Promoting labor participation by women and people with disabilities in positions at different technical, operational, and management levels in the sector also has a positive impact in terms of social inclusion. For example, an analysis of the implementation of measures to facilitate the inclusion of women drivers in Santiago's public transportation system has shown positive effects in terms of economic independence (75% of female drivers indicated that their income had increased after being recruited by Transantiago), self-esteem, working conditions, and corporate performance (women have a lower rate of accidents than men, and accidents involving women are less serious) (Granada et al., 2019).

4. Measures to improve interurban passenger mobility

3.19 **Investments to improve the quality and connectivity of transportation infrastructure** have positive effects in terms of inclusion and local development. One evaluation from Peru concluded that a rural roads maintenance program reduced travel times and increased primary school enrollment among girls by 7% and boys' secondary school attendance by 10% (McSweeney and Remy, 2008), thus indicating that inclusion of the community at the different stages of the project increased the sense of ownership and facilitated the efficient management of road assets. A study of the impact of new bridge construction in rural areas of Nicaragua showed that the bridges improved the beneficiary population's access to labor

[33] The audits are assessments of the risk of traffic accidents on the designs of a future road, while the inspections are systematic reviews of risks on existing roads (Alves et al., 2018).

[34] A qualitative evaluation prepared by Plural Consultora (2019) showed that one year after the "Bájale al acoso [Put a stop to harassment]" campaign was implemented in Quito, the number of women reporting sexual violence while using public transportation had fallen 34.5%.

markets outside the area of intervention and led to a 39% increase in labor income (Donovan and Brooks, 2017). In addition to improving access to nonagricultural labor markets, road investments also facilitate access to markets for inputs and products, reducing production and marketing costs and boosting agriculture sector productivity (Ortega, 2018).

3.20 Investing in **infrastructure maintenance** is critical to ensuring that assets can perform their functions without failure or interruption (Pastor, 2019) and for ensuring the sustainability of investments. In the case of road infrastructure, a good practice in the sector is the use of service-level road maintenance contracts, which integrate construction with maintenance. An analysis of service-level Rehabilitation and Maintenance Contracts (CREMA) in Uruguay shows that these contracts are more efficient (as measured by pavement quality) than traditional administered contracts that separate construction and maintenance (Pérez, 2020). They ensure that planned road rehabilitation is done when needed based on the structural condition of the pavement, in contrast to the typical pattern in administration contracts, where delays in rehabilitation lead to more extensive and costly work.

3.21 The literature identifies a variety of impacts associated with improvements in air connectivity in remote regions: (i) economic impacts in communities resulting from reductions in a number of barriers to the movement of passengers and goods, thus stimulating growth in the beneficiary regions; (ii) economic impacts on industry, with new, profitable routes for airlines; and (iii) social impacts from improving the population's access to public services such as health and education (Fageda et al., 2018). **Route-based policies** (e.g. the introduction of specific routes or traffic distribution rules) help to reduce fares and increase frequencies, but these should focus on remote areas rather than dense routes (Fioravanti et al., 2018) (see details in Table 8).

3.22 Studies conducted by Jaimurzina and Wilmsmeier (2017) highlight the need to improve the capacity and quality of fluvial infrastructure and associated services, incorporating navigable routes, ports, and docks into a **consolidated fluvial navigation network** based on a process of river classification. The fluvial transportation system should also be integrated with the country's other transportation systems, and minimum quality standards should be regulated to address the different dimensions of environmental sustainability, efficiency, and safety in the operation of rivers and fluvial services.

B. Policies and programs to improve logistics performance in Latin America and the Caribbean

1. Measures to promote comprehensive planning of logistics infrastructure as part of national economic and social development strategies

3.23 One of the determinants of improvements in logistics performance is the level of public sector management and the institutional context. As in the case of urban transit systems, the planning of logistics infrastructure also requires robust coordination mechanisms between the main actors and institutions involved in the different stages of planning, execution, and monitoring of the infrastructure cycle, including the private sector. The development and implementation of **national and regional logistics plans or policies** helps to coordinate infrastructure

investments with the requirements of national production chains. These types of instruments have a positive effect on countries' productivity and competitiveness.[35] For example, as part of the implementation of Colombia's National Logistics Policy, trade facilitation measures were introduced that reduced export times by 10 days and import times by 5 days, resulting in improvements to international logistics performance indicators (Cipoletta Tomassian et al., 2010) and thereby helping to strengthen the country's economic integration into world trade.

2. Measures to improve the quality of logistics infrastructure and services

3.24 **Investments in physical infrastructure** to improve the extensive (size) and intensive (quality) margins of transportation assets help to reduce logistics costs (Table 1) between production centers and foreign trade hubs such as ports, airports, and border crossings (Hugot and Umaña-Dajud, 2015; De Soyres et al., 2018; Mesquita Moreira, 2008), with a positive impact on growth in foreign trade and insertion in regional and global value chains, thereby strengthening regional integration (IDB, 2019a). Improvements in logistics infrastructure also help to reduce international transportation costs (Hugot and Umaña-Dajud, 2015; De Soyres et al., 2018). A 1% reduction in domestic transportation costs in Chile, Peru, Colombia, and Mexico would increase total exports by 1.3% to 4.5% and the number of products exported by 0.5% to 3.1% (Molina et al., 2016). The positive impact of road network improvements is also on display at the enterprise level (IDB, 2019a). For example, the construction of new rural roads in Peru between 2003 and 2010 reduced transportation costs for exports by Peruvian companies; as a result, exports by these companies and the numbers they employed grew at a faster pace (Volpe Martincus, 2016). In addition to these positive effects, infrastructure development can also have an undesirable impact on the environment, both directly (through the use of land) and indirectly (by bringing economic activity to areas that were previously protected by distance).[36]

3.25 With regard to the **technical regulation** of motorized freight transportation, measures adopted by the countries focus on the issues of vehicle weights and dimensions, loading methods, power-to-weight ratios, maximum vehicle age, and limits on emissions (Barbero and Guerrero, 2017). Other, complementary measures include operational weigh stations and rest areas for truck drivers. In addition to existing inspections and systems for fines, other alternatives include the implementation of nonfinancial sanctions such as penalty points applied to drivers' licenses. Other good practices for improving the safety of freight transportation include the use of global positioning systems (GPS) in truck fleets and/or radio-frequency identification (RFID) antennae along highways to ensure obligatory rest breaks and limits on driving time, as well as cargo traceability.

3. Measures to enhance the efficiency of urban goods distribution

3.26 The literature divides measures to improve the efficiency and sustainability of urban goods distribution into the following categories: (i) cooperation and

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[35] Effective implementation of the National Logistics Strategy in Panama will have a direct impact in the form of a cost reduction estimated at between 9% and 13% (SPIM-ABECEB-Briher, 2019).

[36] For this reason, it is essential that environmental and social plans be prepared and implemented to mitigate/prevent these impacts and/or compensate affected individuals.

collaboration; (ii) regulatory; (iii) market instruments; (iv) integrated land use; and (v) cleaner infrastructure and vehicles (Cárdenas et al., 2017). **Cooperation and collaboration measures** include consolidating shipments with a single distributor, time windows for deliveries to a single street, and arranging for suppliers to use vehicles belonging to other companies instead of their own. **Regulatory** measures include restrictions on cargo vehicle movement at certain times or along certain roads based on vehicle size or weight, as well as the implementation of low-emission corridors and areas (Cuevas et al., 2013). However, the evidence suggests that prohibiting large trucks in congested areas, while beneficial to those areas, may have undesirable effects on other geographic areas (Cárdenas et al., 2017).

3.27 Several cities have implemented programs to encourage **off-peak goods delivery** to reduce urban congestion. Studies in New York and São Paulo show that depending on the magnitude of the change in delivery times these types of measures are effective in reducing environmental pollution, with reductions of 45% to 67% (Holguín-Veras et al., 2016). Other economic benefits arising from these measures include lower operating costs and parking fines, smaller inventory levels (due to more frequent deliveries), and lower stress and shorter working hours for drivers (Holguín-Veras et al., 2018).

3.28 From an integrated land-use perspective, facilities for loading and unloading goods can also help to improve the efficiency of urban logistics. Available evidence shows that urban consolidation centers improve vehicle load factors by 15% to 100% and reduce total distances traveled in urban areas by 60% to 80% (Browne et al., 2007). Designating **special loading and unloading areas** is a low-cost, easily implemented infrastructure solution for facilitating logistics operations (Merchán and Blanco, 2016). These measures help to avoid double parking and other parking infringements that hinder the mobility of pedestrians and other road users (McLeod and Cherrett, 2011), which has a positive impact on traffic flows and the efficiency of urban logistics (Iwan et al., 2018; Miranda-Moreno et al., 2020). For example, a study in Oslo concluded that the implementation of cargo bays reduced carbon monoxide emissions by 5%, hydrocarbons by 3%, and nitrogen oxide emissions by 4% (Iwan et al., 2018). Pilot programs in Querétaro, Mexico demonstrated that delivery vehicle travel and parking times could be reduced by 30% through the improved use of loading/unloading areas (Fransoo, 2019). The literature suggests that the main limitation of loading and unloading bays is that the parking area must be set aside and also enforced to ensure that maximum parking times are not exceeded and the reserved space is not used by other vehicles. Artificial intelligence and video tools can help to improve enforcement (Miranda-Moreno et al., 2020).

3.29 Market-based tools such as **congestion and/or parking fees**, accompanied by technological innovations to improve efficiency in the use of urban space (sidewalks, parking lots etc.), have proven successful in reducing urban congestion. A pilot program in Washington, D.C. to evaluate the effectiveness of dynamic parking prices in commercial cargo zones led to a drop in the time taken to find a parking space, reductions in congestion and pollution, and improvements to safety. Other examples of the “intelligent” management of public space have been seen in Amsterdam, Barcelona, and Helsinki, with reservation systems that offer real-time information on parking spaces (IDB, 2020a).

3.30 The use of **electric vehicles and freight bicycles** is a relatively new measure within the spectrum of policies to improve the sustainability of urban logistics. Analyses financed by the European Union found that freight bicycles could be used for 25% of all goods and 50% of all small deliveries in consolidated urban environments and historical centers. The evidence shows that the efficiency of this type of transportation varies depending on delivery windows, type of bicycle (electric or nonelectric), proximity to distribution centers, delivery volumes, and residential density (Sheth et al., 2019). Simulations conducted for the case of Portugal conclude that CO_2 emissions would be reduced by 3% to 4% if 10% of delivery vans were replaced by electric freight bicycles (Melo et al., 2014). Moreover, pilot programs in Rio de Janeiro using electric vehicles for "last mile" delivery showed cost reductions of 28% by delivery route (De Mello et al., 2019).

4. Measures to improve the environmental and social sustainability of logistics infrastructure and services

3.31 Incorporating disaster risk management from the planning stage onwards offers high returns, with each dollar invested in this area reducing losses by four dollars (Michel-Kerjan et al., 2013). **Including climate change criteria as part of the design, construction, and operation** of transportation infrastructure requires strengthening the planning and preinvestment systems by: (i) including adaptation parameters such as the adoption of resilient construction methods and materials; (ii) evaluating extreme climate vulnerability (Blue Spot Analysis) for asset management and the identification and prioritization of interventions to ensure the resilience of the transportation network; and (iii) updating national infrastructure design guidelines and adopting technical standards that ensure climate change resilient transportation infrastructure (SLOCAT-PPMC, 2017; Martínez Salgado, 2018).

3.32 In terms of the sustainability of transportation services, several countries have promoted **fleet renewal** programs to encourage the incorporation of more efficient, safe, and clean vehicles, while also withdrawing older vehicles from the market. Although empirical evidence on the effectiveness of these programs is limited, the example of Mexico is worth noting, where different financial mechanisms benefiting small-scale operators were implemented (Barbero et al., 2020). Between 2005 and 2011, the proportion of vehicles complying with the Euro 5 standard rose from less than 1% to 70% of the total fleet (Robles Linares, 2020). Other countries such as Germany and New Zealand have responded to the environmental challenges of the sector by implementing commercial truck fees based on vehicle type and distance traveled. Vehicles with lower emissions pay significantly less than those with higher ones. In Germany, this policy helped to alter the composition of the truck fleet.

5. Measures to improve trade facilitation

3.33 In addition to the need to improve the quality, connectivity, and capacity of logistics infrastructure (hardware), it is also critical that regulatory challenges in the sector (software) be addressed. For example, studies in the region show that **simplifying and expediting customs procedures** at border crossings—combined with adopting risk management systems to reduce physical inspections (Volpe Martincus et al., 2015; Carballo et al., 2019), introducing expedited procedures for international transportation, harmonizing border controls, and implementing

authorized economic operator programs (Carballo et al., 2016; Volpe Martincus, 2016)—yields positive effects in terms of reducing processing times, with a significant impact on exports and the strengthening of regional integration processes (IDB, 2019a).

C. Institutional and regulatory strengthening policies and programs

1. Measures to improve the governance of transportation systems

3.34 Improving sector governance requires actions in the following areas: (i) sound institutions and regulatory frameworks, (ii) long-term planning, (iii) sector coordination, (iv) accountability and transparency, and (v) user participation and prioritization (Jaimurzina, 2018). Institutions are acknowledged to be a critical determinant of public expenditure efficiency and, thus, of the quantity and quality of infrastructure services provided to the population (Serebrisky, 2014; IDB, 2015; IDB, 2020a). Together with regulatory frameworks that link different modes of transport, clear, sound institutional structures support the satisfactory administration of infrastructure, the regulation of quality standards in transportation services, and the management of fare policies (IDB, 2020a).

3.35 **Long-term sector planning** is a critical instrument for ensuring integrated transportation policies. As previously mentioned, transportation sector objectives should be aligned and coordinated with other economic sectors (housing, industry, etc.) and respond to a national and/or regional vision. They should also be based on the coordinated planning and execution of actions between the public and private sectors (Jaimurzina et al., 2016). To that end, the different elements of transportation systems must be taken into account: infrastructure, services, institutions, and technology. In terms of short- and medium-term planning, the implementation of national public investment systems is a good practice for optimizing the use of public funding for investment and boosting the economic and social impacts of these investments (Ardanaz et al., 2019). Nonetheless, there are opportunities for improving the preinvestment stage of these systems, including: (i) coordination of local and sector investments with national development goals; (ii) institutional capacity for implementing project appraisal methodologies and/or prompt evaluations; and (iii) flexibility for projects of different sizes (Alberti, 2015).

3.36 The literature also highlights the importance of **basing infrastructure policies on data and empirical evidence** (OECD, 2017). To this end, it is essential that the public sector implement systems for gathering key indicators, the analysis of which allows effective monitoring of the performance of infrastructure assets and their associated services. Initiatives to establish data observatories at the national or regional level are helping to eliminate information gaps for the transportation sector.

3.37 Lastly, in relation to the transparency dimension, the Integrity Framework for Public Investment developed by the (OECD, 2016) identifies the following **measures to combat corruption** in the different stages of infrastructure projects: (i) developing and implementing codes of conduct for public officials responsible for the processes; (ii) ensuring that the selection and adjudication of public investment projects does not favor any particular interest group or individual over the public interest; (iii) ensuring the objectivity and credibility of social, economic, and environmental feasibility studies; (iv) preventing bid rigging, collusion, or

agreements to share the market or future contracts for a public investment; (v) implementing effective internal control systems and financial reports to monitor and identify irregularities; (vi) ensuring the independence of audit institutions; and (vii) ensuring that public investment decisions are based on national, regional, or sector objectives. Also important are systemic reforms that address the supply and demand for acts of corruption consistent with international treaties, principles, and standards on transparency and integrity, all from a perspective of the modernization of infrastructure sector governance (IDB, 2020b). In this context, institutional reforms to reduce corruption could generate around US$1 billion in fiscal revenue each year across the world.

2. Measures to improve competition in service delivery

3.38 The evidence from developing countries concludes that greater competition in goods transportation leads to more competitive prices, thus supporting growth in international trade (Begazo Gómez et al., 2018). For example, **eliminating freight tables and limits on the number of vehicles** in the Rwandan and Mexican markets reduced prices by 75% and 23%, respectively, in real terms (Teravaninthorn and Raballand, 2008). Similarly, **eliminating quotas for cross-border transportation licenses** between Thailand and Laos translated into a reduction in freight costs of 20% to 30%.

3.39 In the airline sector, reforms to increase competition in service provision have also yielded some positive effects. Evaluations of the impact of **open skies agreements** with the United States show that these agreements have generated at least US$4 billion in annual gains for travelers (as measured in fare reductions of almost 15%) (Winston and Yan, 2015). Studies in Brazil confirm that liberalization of the international air transportation market was a determining factor in the positive performance of the market over the last 15 years (Ayres Padilha et al., 2017). Meanwhile, open skies agreements negotiated between 1990 and 2003 led to a 9% drop in the cost of shipping goods by air (Micco and Serebrisky, 2006).

3.40 With regard to the port sector, available evidence shows a positive correlation between the operational and economic performance of ports, on one hand, and **private sector participation, the promotion of competition, and suitable port governance and regulation**, on the other (Suárez-Alemán et al., 2019). Good practices in port reform include participation in concession processes by the responsible body, promoting intraport competition,[37] rules that restrict the number of terminals per concessionaire, and rules governing horizontal and vertical concentration.

3. Measures to promote private sector participation in transportation

3.41 Internationally, different alternatives have been explored and implemented to involve the private sector in the construction and maintenance of infrastructure, as well as the provision of transportation services. From the perspective of infrastructure assets, arguments in favor of private participation relate to increases in spending efficiency and service quality, the introduction of new technologies and

[37] Intraport competition promotes specialization, flexible adaptation, and innovation, in addition to avoiding a situation of excessive market power by providers of port services (de Langen and Pallis, 2006).

operational arrangements, and improvements to project management and execution. For example, the asset lifecycle approach used by the private sector facilitates the optimization of timelines and programming of works, thus helping to reduce total road transportation costs (administrative and user) by 5% to 30% (Talvitie, 1996). Nonetheless, an evaluation of the British public-private partnership program[38] indicates that evidence regarding the benefits of this modality remain insufficient (National Audit Office, 2018).

3.42 In the Latin American and Caribbean region, the concessions model has yielded mixed results in terms of attracting private investment. In Brazil, for example, airport concessions are the most attractive investment segment in transportation, and there is considerable interest in the ports subsegment. In the case of the rail subsector, however, there are major challenges in attracting investments through concessions, including disputes over rights-of-way, permits, and third-party freight (Fitch Solutions, 2019). Meanwhile, the road concession program that began in Chile in the 1990s is one of the most attractive in the region, due to an environment of low country risk, successful operating precedents, and the participation of several international companies (Fitch Solutions, 2019). In the case of public transportation, experiences of concession contracts operating in Santiago, Lima, Bogota, and Bucaramanga show that payments to operators must be linked to operational variables, while also transferring part of the demand risk to operators (Gómez-Lobo and Briones, 2013).

3.43 The positive impact of private sector participation in infrastructure development and service operation depends substantially on the public sector's ability to plan, regulate, execute, and supervise policies, programs, and contract management (De Michele et al., 2018). Some studies have concluded that in order for private participation to generate expected benefits, **sound institutional frameworks and clear regulations** are needed that cover the possible risks to companies created as part of the projects to be developed (Moore et al., 2013). In this context, national infrastructure plans perform the additional function of creating a framework for efficient investments with long-term sustainability that allows projects to be prioritized in a systematic, transparent, and objective manner (Serebrisky et al., 2017).

D. Policies and programs to promote technological transformation in the sector

1. Measures to promote Autonomous, Connected, Electric, and Shared (ACES) transportation and mitigate its risks

3.44 Transformation of the traditional mobility ecosystem, with new technological trends, changes in user behavior, and the appearance of new services has given rise to the concept of **Mobility as a Service (MaaS)** (Voege, 2019). The main idea behind this concept is the integration of different transportation modes to provide an efficient, flexible, and personalized service based on the mobility needs of users. Although few cities have implemented pilot projects in this area so far,

[38] The Private Finance Initiative currently has more than 700 economic and social infrastructure projects in operation, with an equity value of around £60 billion.

meaning that the evidence is still limited, Mobility as a Service is expected to improve users' travel experience and encourage more sustainable mobility.

3.45 **Shared mobility** (Table 1) has been the subject of numerous analyses and policy actions at the international level. Despite this, evidence regarding the effectiveness of the policies implemented is limited. The following measures—identified by the United States Federal Highway Administration (2018)—have been acknowledged as international good practices: (i) incorporating shared mobility as a component in transportation planning and regulation; (ii) promoting the physical and fare integration of shared mobility services and public transportation systems; (iii) determining standards and definitions for shared mobility; (iv) introducing regulations to ensure accessibility and equity for transportation users; (v) obtaining data for transportation planning and evaluation of the operational, economic, and social impacts of services; and (vi) protecting users' physical safety and privacy.

3.46 In terms of transportation network companies, a number of cities have established regulations to incorporate these into transportation systems, including: (i) requirements that these companies observe regulations for taxis, including insurance policies and social security contributions; (ii) the creation of different regulatory frameworks for these companies (e.g. for those operating in the luxury services segment); and (iii) fare-setting mechanisms (Table 1) aimed at offsetting the impact in cities, including charges levied per vehicle and per kilometer traveled, and the use of curbstones or entrances to a specific area (Mexico City and São Paulo have implemented these mechanisms). Of particular interest is the partnership these companies created with small- and medium-sized cities in the United States, aimed at providing first- and last-mile services for access to public transportation, services for people with disabilities, and—in certain cases—replacing public transportation routes with low demand.

3.47 The transition to **electric mobility** requires public sector actions to ensure the optimal, reliable, and affordable operation of this type of vehicle. Policy options in the area of e-mobility can be broken down into the following categories: (i) vehicle and energy standards; (ii) circulation and reliability; (iii) expanding supply and facilitating user purchase; (iv) creating environments that promote e-mobility; and (v) regulating distributed generation and differentiated fares based on time (Pérez et al., 2018). For example, Costa Rica's National Decarbonization Plan and Chile's e-mobility strategy both use these policy options to promote e-mobility.

3.48 A review of the literature on the effectiveness of financial incentives for the purchase of electric vehicles finds that the most effective actions involve tax exemptions for the purchase of plug-in electric vehicles. The authors also indicate that priority should be given to incentives applied at the time of purchase, and that design of the incentives should differentiate between the type of electric vehicle and between high-end, mid-level, and low-end vehicles (Hardman et al., 2017). Another study that analyzes a combination of financial and nonfinancial incentives in 20 countries worldwide concluded that installation of a charging network on freeways is an absolute necessity, regardless of the average mileage driven per

day (Lieven, 2015).[39] Also of interest are measures to increase consumer awareness with a view to supporting growth in the nascent market for electric vehicles (Jin and Slowik, 2017).

3.49 Policies relating to **automation** technology are recent and as a result there have not yet been any evaluations of their effectiveness. Nonetheless, governments have initiated at least four types of actions relating to this technology: (i) the development of **guiding principles** for certification and testing of autonomous vehicles, establishing the responsible authorities, requirements for testing the technology and the mechanism for registering vehicles, among other things; (ii) identification of requirements for operational safety, insurance policies and the apportioning of responsibility in the event of accidents, cybersecurity, data protection, sharing data with public bodies, and consumer education; (iii) partnerships with the private sector and academia and **regulatory sandboxes** (Table 1); and (iv) evaluation of the status of infrastructure and improvements in the connectivity and digitalization of that infrastructure in preparation for vehicle-to-infrastructure (V2I) communication in autonomous operation (USDOT, 2019).

3.50 Lastly, increasing **connectivity** requires that measures be implemented both within the transportation sector and beyond it. First, government agencies in the sector have been implementing **Intelligent Transportation Systems (ITS)** for several decades now, with the aim of improving the urban management, operational efficiency, revenue collection, and transportation service quality. The literature is consistent in highlighting the positive impacts of ITS: for example, adaptive traffic management systems can reduce travel times by up to one third, while the installation of electronic toll systems helps to reduce congestion and greenhouse gas emissions (Crotte et al., 2017). Second, governments have developed **digital strategies** and national plans for expanding coverage and access to broadband networks (key for ITS operations), regulatory frameworks for promoting long-term investment in digital infrastructure, increased competition in the telecommunications sector, the strengthening of public agencies, incentives to improve connectivity in remote areas and for vulnerable populations, and financial inclusion programs based on electronic payments (OECD/IDB, 2016b).

2. Measures to give the public sector a catalytic role in the sector's technological transformation

3.51 The **digitalization of processes** in the public sector can help to improve the quality of services offered (Corydon et al., 2016), as it allows governments to be more efficient and effective in performing their roles while also responding to the demands of citizens and enterprises with greater transparency (OECD/IDB, 2016a). Accordingly, international experiences suggest that government agencies in the transportation sector should work in two main areas. First, they should make changes to the methods, processes, and tools used to interact with users (citizens). Second, they should update their organizational strategy to include the

[39] This is consistent with evidence from Europe, where countries with more intensive use of electric vehicles have financed charging stations to facilitate e-mobility (Cansino et al., 2018). The literature also examines the technical and economic impacts of growing the electric vehicle fleet on the power distribution system (Deb et al., 2019), highlighting the role of technology in balancing demand peaks and the multisectoral nature of these interventions.

issue of innovation and technology as a crosscutting theme, fostering investments in technology and communications infrastructure and incorporating digital talent. Following the examples of Transport for London and the Hamburg Port Authority, including specialized teams in the organizational chart with dedicated budgets for innovation and technology can yield positive results in moving towards greater digitalization (IDB, 2020a). There is also preliminary evidence showing that digital government reforms and the use of information technologies for administrative streamlining have a positive impact on transparency and integrity by reducing the opportunities for rent-seeking (IDB, 2020b).

3.52 The use of artificial intelligence to **generate and analyze sector data in real time** has been identified as a key measure for improving the efficiency of transportation services. Singapore, for example, has improved the efficacy of its congestion charge system by using dynamic pricing adjustments based on real-time traffic data (Lehe, 2019). Another interesting case is that of the European Union's INFRALERT project, which uses machine learning tools to gather and process data on transportation infrastructure performance, thus facilitating the identification of maintenance needs and planning of interventions (Pastor, 2019). Globally, several countries have established specific strategies to foster the use and development of artificial intelligence, with specific considerations for priority sectors such as transportation.

IV. Lessons Learned from the IDB Group's Experience in the Transportation Sector

4.1 The lessons learned that are highlighted in this section are the result of an analysis of 12 sovereign-guaranteed operations (Table 9) and seven operations with the private sector (non-sovereign guaranteed) (Table 10). This analysis was based on a review of related documentation, as well as interviews with project team leaders. The main lessons learned from these operations are summarized below, broken down into categories based on sector challenges.

4.2 Traditionally, actions in the transportation sector have been focused on infrastructure. However, a crosscutting lesson learned from all of the projects is that institutional and regulatory frameworks need to be strengthened based on the specific features of each mode of transportation, with greater emphasis on the management and operation of services. Similarly, there is a need to continue gathering knowledge of the development effectiveness of transportation projects, expanding evidence of the impact that soft investments for improving service quality have on logistics costs, the competitiveness of foreign trade, access to health care, education and jobs, poverty reduction, and improving quality of life.

A. Lessons aligned with the challenge of providing efficient, inclusive, sustainable, and quality mobility for urban and interurban passengers

4.3 The IDB Group's technical and financial support for the construction of BRT systems, metros, and airports, and for the reorganization of public transportation systems. Operational experience demonstrates that comprehensive solutions need to be developed that not only improve infrastructure but also take into account the operation of associated services, as well as the relationship between mobility and other institutional, economic, social, cultural, and environmental factors in a territory.

In certain cases, a limited regulatory institutional framework for public transportation systems has adversely affected the implementation of system reforms and the execution of transportation projects. Particular attention should be paid to the factors determining passenger demand for public transportation, such as service quality and affordability (AR-L1158, Abad et al., 2019), the financial sustainability of those systems, and the fare structure (EC-L1111, EC-L1124), as well as the impact of the industry's organization on regulatory changes being promoted (HO-L1061 and ES-L1050).

4.4 In mainstreaming gender and social inclusion perspectives, specific actions to address the mobility needs of different users need to be included starting from the design stage. The Quito Metro project (EC-L1111, EC-L1124), for example, used "universal design" (Table 1) for both the interiors of stations and their surroundings. IDB Group actions also show the opportunities transportation projects have to continue diversifying the sector labor force. The third phase of the Espíritu Santo operation, for example, included the creation of a permanent gender and inclusion commission responsible for spearheading implementation of training for women in nontraditional transportation sector activities, and the implementation of gender-based violence and discrimination prevention campaigns linked to the transportation sector (BR-L1263).

4.5 Past experience also highlights the importance of institutionalizing road safety actions to ensure consistent, sustainable outcomes in the long term. Those strategies require a comprehensive approach that: (i) prioritizes data generation and analysis for assessing, monitoring, and evaluating interventions to improve decision-making (JA-L1027); (ii) promote training workshops and road safety campaigns to build awareness and educate different road users (AR-L1158); and (iii) allocate annual funding in the general budget for those strategies (ES-L1061).

B. Lessons aligned with the challenge of logistics performance in Latin America and the Caribbean

4.6 Logistics operations should adopt a holistic approach that helps to coordinate sector strategy with productive development goals of each country. Past experience underlines the importance of cross-sector planning and coordination with a view to simultaneously stimulating the different economic sectors, addressing both the first mile challenges and the challenges of long-haul transportation, the last mile, and foreign trade logistics. For example, Brazil's Road Master Plan and the National Logistics Plan (PNLog) are good examples of a planning instrument that was agreed with the different productive sectors, establishing investment priorities to reduce logistics bottlenecks. IDB Group support has been key in developing these instruments (BR-L1263 and PN-L1151) (see paragraph 4.9).

4.7 High-level leadership is required for the implementation of transportation and logistics reforms, to coordinate the different actors involved (transportation, customs, agriculture, private sector, and others) and achieve satisfactory results. Cooperation between agencies and between the public sector, private sector, academia, and civil society should be constant with a view to designing and implementing effective, inclusive, and sustainable sector policies and projects. For example, Panama's National Logistics Plan (PNLog) was prepared using participatory methodologies (PN-L1151). In Panama and Peru, the national government's leadership and

commitment was also key in legitimizing decision-making processes in projects to improve logistics performance (PN-L1151 and PE-L1003).

4.8 From the standpoint of the sustainability of infrastructure investments, a road asset management approach needs to be adopted, ensuring the periodic and routine maintenance of the infrastructure that has been built. Accordingly, governments should plan for ensuring the continuity of maintenance activities after the projects have been completed, assigning specific resources for this purpose, thereby ensuring the sustainability of the works. Such is the case of Jamaica, where the government decided to use a routine maintenance strategy with performance-based contracts to avoid incurring higher maintenance costs over the long term (JA-L1207) (see paragraph 3.20). In contrast, in the case of Suriname (SU-L1006), maintenance activities were limited to cutting the grass alongside the highway and superficial fixes for cracks due to the lack of a maintenance strategy and a specific budget.

4.9 Private investors see the technical advice from the IDB Group for mitigating social and environmental risks associated with transportation projects as a source of value added. The IDB Group's participation also ensures that the highest standards of integrity are adopted. In some of the non-sovereign guaranteed projects analyzed, the IDB Group performed an important role in reviewing and mitigating concerns surrounding possible integrity issues both during and after the award of concessions, reinforcing the importance of adequate due diligence.

C. Lessons aligned with the challenge of sector institutions and regulations

4.10 The introduction of institutional strengthening components focused on implementing project monitoring and evaluation arrangements helps improve execution of operations and manage the risk of cost overruns in works (BR-L1263). In addition, the activities focused on improving planning, prioritization, and structuring of transportation projects help make sector investment more efficient. For example, institutional strengthening components have facilitated the development of robust technical and economic studies, which are key to determining project viability. In the context of infrastructure implemented with the private sector, institutional weaknesses have resulted in poorly developed socioenvironmental impact studies, uncertainty regarding how concessions are awarded, problems associated with the bankability of contracts, and challenges for the execution of works due to delays in removing site restrictions, among other challenges. In addition, the lack of stability and predictability in countries' legal and regulatory frameworks has brought projects to a standstill or jeopardized their financial viability. Boosting transparency and getting the private sector involved in the project preparation cycle could increase project bankability and enhance the competitiveness of bidding processes for public-private partnership projects, potentially reducing costs for governments and users and avoiding delays in implementing projects or cancellations.

4.11 Infrastructure works and sector reform processes require lengthy execution periods, and transition strategies therefore need to be coordinated with new administrations and the political economy of decision-making processes in the sector need to be analyzed to ensure program continuity. An analysis of the main institutional processes is recommended in the design phase, and institutional strengthening activities should be included where necessary to support technical demands that arise during project execution. In the case of the Quito metro, for example, the

activities for building executing agency capacity, were focused on compliance with environmental and social safeguards (EC-L1111, EC-L1124).

4.12 Policy-based loans are helpful in developing a long-term approach to planning. They can generate benefits in all transportation subsectors (logistics, airport infrastructure, road infrastructure, etc.), yielding regulatory, institutional, and operational reform outcomes that help to improve sector planning and resource allocation while promoting improvements in the management of transportation services (see paragraph 4.7). They have also provided opportunities for including crosscutting issues such as support for private sector participation in infrastructure development and road safety (CO-L1111).

D. Lessons aligned with the challenge of sector technological transformation

4.13 Pilot projects to promote technological transformation in the sector allow any resistance to be anticipated, while also building trust in the technologies and ensuring that new technological tools enjoy the necessary internal support. Operational experience indicates that the Bank can play the role of honest broker in the process of innovation. Knowledge generation and dissemination, through platforms such as the Regional Policy Dialogues, helps to identify specific demand in the countries for technology applied to the sector and to the design of gradual strategies for organizational change, identifying the best intervention mechanism, and adjusting institutional design accordingly.

4.14 Technology incorporation is an opportunity to improve transportation projects since it helps to expedite works and also opens up opportunities for the digital transformation of the sector. For example, in Bolivia (BO-L1076), a system was implemented to allow the remote monitoring of progress in works, reducing the number of project visits required. In the case of Panama, a Trade and Logistics Integration Technology Platform (PTILC) was implemented, providing information for the monitoring and analysis of commercial activities. In the case of Kingston Freeport Terminal Limited (KFTL) in Jamaica, private sector financing made it possible to incorporate IT systems for logistics management and electronic billing.

V. Lines of Action for IDB Group Work in the Transportation Sector

5.1 This Sector Framework Document proposes that IDB Group work in transportation assist in achieving an efficient, inclusive, and sustainable transportation system in the Latin American and Caribbean countries. Based on the diagnostic assessment presented in Section II, literature review in Section III, and lessons set out in Section IV, five lines of action are proposed to guide the IDB Group's work; these lines of action and their sequencing will subsequently need to be customized for each country.

A. Line of action 1: Promote efficient, inclusive, sustainable, and quality mobility for urban and interurban passengers

5.2 **Cities in Latin America and the Caribbean should strengthen integration between mobility and land-use interventions from a comprehensive urban**

planning perspective, encompassing urban[40] and economic development policies, housing, education, and health. The aim is to optimize the use of urban space and public transportation systems while also enhancing their resilience to natural disaster and climate[41] risks, reducing emissions of local pollutants and greenhouse gases, and promoting more inclusive and sustainable mobility. Sector projects should be integrated with cities as part of planned, sustainable territorial development, facilitating greater access to transportation among population groups that are marginalized from labor opportunities and health and education services.

5.3 **The region must pursue the development of urban mobility systems.** With this objective in mind, investments in public transportation infrastructure and services are required, as well as policy actions that improve the efficiency, quality, accessibility, and affordability of these services, all from a perspective of inclusion, sustainability (social, financial, and environmental), transparency, and safety. This should be accompanied by actions to promote active and nonmotorized mobility, as well as demand management measures for transportation infrastructure—including the use of technology—aimed at discouraging the inefficient use of private vehicles. In the short term, there is a need to evaluate policy actions that mitigate the COVID-19 pandemic's impact on the financial sustainability of the sector.

5.4 **Latin America and the Caribbean should expand the coverage, capacity, and quality of interurban passenger transportation networks (road, air, fluvial, maritime, and rail) and promote multimodality, efficiency, and sustainability in services.** This includes continuing to develop and implement mechanisms to prioritize, manage, and supervise investments; building, rehabilitating, and maintaining sustainable and culturally relevant transportation infrastructure, particularly in areas with limited access; and introducing technology to improve the entire project cycle. Technical and economic regulation of the sector also needs to be improved with a view to ensuring competition, efficiency, inclusion, and sustainability in interurban transportation services.

5.5 **The region needs to foster the sector's sustainability with a view to mitigating its negative effects on climate change and the safety of the population.** There is a need to promote decarbonization and reductions in local emissions from urban and interurban mobility, based on actions to encourage greater energy efficiency in vehicles and transportation operations, the use of clean technologies, and the promotion of active mobility, among other things. At the same time, the planning, construction, and operation of infrastructure should include mitigation and adaptation components to boost infrastructure resilience.[42] The inclusion of transportation safety components should be strengthened throughout the project cycle and across the different modes of transportation. As the COVID-19 pandemic unfolds, one key action will be to develop protocols and tools, especially technological ones, to make workers and users of public transportation and of transportation infrastructure in general safer.

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[40] In keeping with the guidelines established in the Urban Development and Housing SFD (document GN-2732-6).

[41] In keeping with the guidelines established in the Climate Change SFD (document GN-2835-8).

[42] Ibid.

5.6 **Transportation should be bolstered as a part of a strategy for social and economic inclusion.** Sector and cross-sector actions need to be identified that help to reduce poverty and inequality from a perspective of comprehensive, participatory socioeconomic planning. These should include measures such as improvements in the coverage, quality, and affordability of public and nonmotorized transportation in vulnerable urban areas, as well as the enhanced coverage and quality of infrastructure in nonurban areas. The inclusion of women, people with disabilities, and marginalized groups such as indigenous peoples and Afro-descendants should also be promoted in urban and interurban transportation systems, both as users and as part of the sector's labor force.[43]

B. Line of action 2: Improve logistics performance in Latin America and the Caribbean, promoting the development of efficient, sustainable logistics services

5.7 **The countries of Latin America and the Caribbean should develop policies to strengthen logistics using a comprehensive approach,** including the components of infrastructure, services, institutions, and technology. This requires improving logistics planning and management capacities, as well as promoting cooperation both within and between agencies (at the local, national, and regional levels), facilitating dialogue with the private sector, and promoting comprehensive logistics, mobility and land-use planning.

5.8 **Improving the region's logistics performance will require investment in sustainable infrastructure and fostering greater efficiency and quality in services.** Connectivity needs to be improved between production zones, centers of consumption, and external trade hubs, increasing the capacity, quality, and coverage of transportation networks, and promoting inter- and multi-modality and regional integration. This should be supplemented by reforms to strengthen regional integration, facilitate trade,[44] modernize logistics services, digitally transform supply chains, and formalize, professionalize, and digitalize logistics service providers. During the COVID-19 crisis, fiscal and financial measures to alleviate the pandemic's economic impact on the sector will be needed.

5.9 **Latin American and Caribbean cities must improve the planning of urban goods distribution, integrating this with land use and transportation plans.** There is a need to better understand the dynamics of urban logistics, especially in light of the changes brought about by the COVID-19 pandemic, and to promote greater efficiency and sustainability in the latter by incorporating good operating practices and arrangements that favor public-private coordination.

5.10 **Improving logistics performance in Latin America and the Caribbean should also entail greater sustainability of the sector.** In addition to the issues mentioned in paragraph 5.5, actions are required to mitigate the negative impact of logistics on climate change and the safety of the population, with incentives to promote energy efficiency, the modernization of transportation fleets, and reductions in accident rates.

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[43] In keeping with the guidelines established in the Gender and Diversity SFD (document GN-2800-8).

[44] In keeping with the guidelines established in the Integration and Trade SFD (document GN-2715-11).

C. Line of action 3: Strengthen sector institutions and regulations

5.11 **The countries of the region need to promote innovation and institutional arrangements tailored to the needs and context of each country.** There is a need to improve the formulation and implementation of transportation policies and projects, including those that involve private-sector participation. There is also a need to promote coordination between the four institutional functions in the sector (policy-making, regulating technical issues, operating infrastructure, and investigating accidents and incidents) and interagency coordination; promote practices that increase the transparency and efficiency of institutions and public spending; include climate criteria in decision-making; and improve the regulatory capacities of transportation sector institutions to improve infrastructure supply and service delivery by the public and private sectors. The region also needs to promote transparency and integrity across the different stages of the project cycle, fostering the adoption of clear rules to avoid the abuse of authority, increasing access to information for collective action, and ensuring the effectiveness of control entities. All of this should be consistent with the international standards on transparency and integrity suggested in the Transparency and Integrity SFD and the Report of the Advisory Group on Anti-Corruption, Transparency, and Integrity in Latin America and the Caribbean commissioned by the Office of the President of the IDB Group.

5.12 **Latin America and the Caribbean need to promote innovative arrangements for financing infrastructure and associated services.** The region needs to improve the business environment to promote greater collaboration with and participation by the private sector and also strengthen institutional capabilities in identifying, structuring, managing, and supervising contracts with private sector participation with a long-term view. It is also important to develop innovative financing instruments, including access to capital markets, to mobilize resources and diversify the profile of investors in the sector (IDB, 2019c; IDB Invest, 2019d). At the same time, there is a need to implement alternative sources of payment for projects, such as value capture mechanisms. As the COVID-19 pandemic unfolds, this will be key to ensuring investment in infrastructure that helps spur economic recovery, generate employment, and create the conditions necessary for sustainable long-term development.

5.13 **Sector institutions and regulations in the region should encourage inclusion and sustainability in transportation.** Sector plans, regulatory frameworks and/or strategies are needed to support climate change mitigation and adaptation, as well as promoting sustainability criteria in the different stages of transportation infrastructure projects. Support is also required for sector policies aimed at achieving greater inclusion through transportation infrastructure and services, with special emphasis on women, people with disabilities, and other population groups, both as users and as part of the sector labor force.

D. Line of action 4: Promote technological transformation in the sector

5.14 **Latin America and the Caribbean should encourage the adoption of technologies in the transportation sector as a strategy for improving productivity, competitiveness, safety, and sustainability.** To that end, regulatory sandboxes and pilot projects need to be developed to test new technologies, while technologies with proven benefits for the sector need to be disseminated, including those that reduce greenhouse gas emissions and foster greater resilience to climate

impacts. Strengthening institutional and technological capacities in the sector, promoting interagency coordination, and incentivizing their adoption by the private sector are key. Cooperation should also be fostered between the public sector, private sector, and academia to advance the research, development, testing, and implementation of new technologies.

E. Line of action 5: Increase the availability of sector information and knowledge

5.15 **Increasing available information and knowledge regarding the sector in the region will be key.** Given the scant availability of information and limited knowledge regarding the sector in Latin America and the Caribbean, there is a need to promote the generation, consolidation, and analysis of information, sector data, and knowledge regarding all modes and levels of transportation (urban, interurban, and international), as well as information disaggregated by gender and/or other population groups. This will allow transportation policies to be developed on the basis of data analysis and empirical evidence. These efforts should leverage new technologies that allow data to be generated, analyzed, and shared in areas and volumes and at speeds that were hitherto difficult to obtain. Based on the exhaustive review performed of the availability of knowledge in the region and the challenges presented in Section I, particular emphasis should be placed on generating knowledge and empirical evidence for Latin America and the Caribbean regarding urban mobility patterns, industrial organization and interurban transportation costs, transportation informality and the relationship of this to efficiency and inclusion, logistics costs and their causes, social inclusion and transportation, transportation funding and financing, transportation safety, transparency, climate risks and their impact on infrastructure, and the impacts of new technologies.

ANNEX I. TABLES, FIGURES, AND BOXES

Table 1. Definitions

Term	Definition
Transportation accessibility	Transportation accessibility refers to the ability to reach destinations using a given transport mode. The ITF report (2019a) mentions the term "absolute accessibility" as the total number of destinations that can be reached by driving, cycling, walking, or taking public transport. It captures all the opportunities that are available to a resident and that are determined both by the size and density of the city and the neighborhood where someone lives, as well as the transport network that connects the area to the rest of the city.
Universal accessibility	Universal accessibility is a condition that must be met by the environment, processes, goods, products, and services, as well as the objects, instruments, tools, and devices, to be understandable, usable, and practicable by all people, especially those with disabilities or reduced mobility, in safe, comfortable conditions and in the most autonomous and natural way possible (Borau et al., 2019). In the specific case of transportation, systems should be designed to allow people with disabilities to physically access the service independently (e.g. inclusion of ramps, tactile signage in Braille, visual or audible signage, etc.) (see definition of universal design).
Affordability	Affordability captures the relationship between the cost of transportation services and the user's income. Users are considered to have the ability to make necessary journeys for work, school, health care, and other social services and make visits to other family members or urgent other journeys without having to curtail other essential activities (Rivas et al., 2018).
BRT	Bus Rapid Transit is an enhanced bus service that offers faster speeds, shorter travel times, and improved services for customers. BRT performance is facilitated by operational and physical features such as the use of exclusive lanes (SamTrans, 2020).
Quality of public transportation services	The definition of service quality includes eight features: (i) service availability; (ii) accessibility; (iii) information provision; (iv) travel times; (v) customer service; (vi) comfort; (vii) safety during travel; and (viii) environmental impact (Rodríguez et al., 2020).
Logistics costs	Total logistics costs are the sum of transportation, inventory, storage, and administrative and supply costs (Montañez et al., 2015).
Universal design	Universal design is a strategy aimed at developing accessible services for all users, eliminating barriers to participation in society.
Avoid-shift-improve approach	The avoid-shift-improve approach proposes addressing the environmental impacts of transportation with measures aimed at: (i) avoiding or reducing trips by car, through integrated urban planning, demand management measures, and electronic communication options (use of mobile telephones, teleworking, etc.); (ii) shifting or promoting more efficient modes of transportation, such as public transportation or nonmotorized transportation; and (iii) improving the environmental performance of transportation through more energy-efficient vehicles and less carbon-intensive fuels (Dalkman and Branningan, 2007).
Inclusion	The term "inclusion" involves an active, intentional, and ongoing commitment to diversity in the social, cultural, economic, and political spheres. Accordingly, it is the process that attempts to ensure equality of opportunity—i.e. for all people, irrespective of their background, to fulfill their potential throughout their lives. These efforts include policies and measures that promote equality of access to services (public) and allow citizens to participate in the decision-making processes that affect their lives (United Nations, 2019).

Term	Definition
Shared mobility	This refers to shared use or ownership. There are different business models in this category, including: (i) shared vehicles, bicycles, or scooters, managed by a company that owns the fleet that provides the service; and (ii) transportation network companies, which connect the drivers of private vehicles to people wishing to make a trip (Shaheen et al., 2018). In both cases, the technological component is key, given that users access the services using an IT platform or app.
Interurban mobility	This refers to the extraurban transportation of passengers linking different population centers.
Paratransit	Paratransit is an urban passenger transportation service, usually involving highway vehicles operated on public streets and highways with mixed traffic. It is provided by private or public operators, and it is available to certain groups of users or to the general public, but it is adaptable in its routing and scheduling to the individual user's desires in varying degrees (Vuchic, 1981). The concept differs between developed and developing countries. In developed countries, paratransit refers to demand-driven systems. In developing countries, it refers to different types of informal services (motorized and nonmotorized) that provide frequent, flexible services generally in locations where there are no other low-fare services available (Shimazaki and Rahman, 1995).
Regulatory sandboxes	A space (technical, physical, legal) for experimentation aimed at promoting innovation within a safe environment, subject to careful monitoring by the sector regulator.
Transportation safety	This refers to the measures required to mitigate risks associated with the transportation of people and goods, both for service and infrastructure users and for workers in the sector. This includes safety risks caused by the impact of natural disasters as well as threats caused by people (e.g., violence, piracy, sabotage, hijackings, terrorist attacks, and cyberattacks).
Road pricing	This refers to a broad spectrum of charges for the direct use of road infrastructure. These increase the cost of travel by private car with the aim of reducing negative externalities. The literature identifies three main kinds: (i) variable toll lanes, which include express toll lanes (in which all vehicles pay a toll) or high-occupancy toll lanes (in which low-occupancy vehicles pay tolls and high occupancy vehicles, such as public buses or emergency vehicles, use the lanes free of charge or at low cost); (ii) road and bridge tolls, which may include variable tolls during peak times or new tolls for previously free infrastructure; and (iii) congestion charges based on zones (areas, cordons, corridors) or distance-based schemes. It is important to note that, while inter-city tolls are aimed at funding infrastructure, tolls or charges on urban roads are aimed at internalizing externalities.
Cable cars	A means of transportation that uses cables or traction and carrying cables without any terrestrial rolling surface (DEJ, 2019). Different urban specialists have begun to consider cable cars—traditionally associated with ski resorts—as an alternative to traditional modes of urban transit, designed to address the challenges of growth and mobility. In the last decade, many cities around the world have built cable car networks, including Portland and Roosevelt Island (United States), Medellin and Bogota (Colombia), Caracas (Venezuela), Hong Kong (China), Lagos (Nigeria), Constantine (Algeria), Rio de Janeiro (Brazil), Koblenz (Germany), Maokong (Taiwan), and La Paz-El Alto (Bolivia) (Suárez-Alemán and Serebrisky, 2017).
Autonomous transportation	In autonomous transportation, the role of the crew of an automobile, airplane, ship, truck, etc. is performed by artificial intelligence algorithms, with varying degrees of human intervention.
Connected transportation	This refers to the use of information and communication technologies to generate and transmit data between vehicles, infrastructure, and other elements of the transportation system (e.g. traffic lights and signals). These may take the form of V2V, V2I, or V2X (see below).
Shared transportation	This involves the shared use or ownership of cars, bicycles, scooters, or cargo vehicles.

Term	Definition
Electric transportation	Also known as e-mobility, this refers to the use of electrically propelled vehicles.
Mass public transit	The movement of people within urban areas using group travel technologies such as buses and trains. The essential characteristic of mass transit is that many people are transported in the same vehicle (e.g. buses) or in a collection of adjoining vehicles (trains) (Schofer, 2018).
V2I	Data transmission between vehicles and infrastructure.
V2V	Data transmission between vehicles.
V2X	Data transmission between vehicles and any element of the transportation system.

Table 2. Direct contribution to the Sustainable Development Goals

Target	Goals
3.6	Halve the number of global deaths and injuries from road traffic accidents.
3.9	Reduce the number of deaths and illnesses from air pollution.
7.3	Double the global rate of improvement in energy efficiency.
9.1	Develop quality, reliable, sustainable, and resilient infrastructure.
11.2	Provide access to safe, affordable, accessible, and sustainable transport systems for all and improve road safety.
12.c	Rationalize inefficient fossil fuel subsidies that encourage wasteful consumption.
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters.
13.2	Integrate climate change measures into national policies, strategies, and planning.

Table 3. Indirect contribution to the Sustainable Development Goals

Target	Goals
1.1	Eradicate extreme poverty for all people everywhere, currently measured as people living on less than US$1.25 a day.
1.2	Reduce at least by half the proportion of men, women, and children of all ages living in poverty in all its dimensions according to national definitions.
2.3	Double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land.
5.2	Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.
5.4	Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies, and the promotion of shared responsibility within the household and the family as nationally appropriate.
5.c	Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.
6.1	Achieve universal and equitable access to safe and affordable drinking water for all.
11.6	Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and other aspects.

Table 3. Indirect contribution to the Sustainable Development Goals

Target	Goals
12.3	Halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains.

Source: United Nations, 2015.

Table 4. Potential benefits of Autonomous, Connected, Electric, and Shared (ACES) transportation in the sector

	Autonomous	Connected	Electric	Shared
Efficiency	• Greater personal comfort and productivity during travel, with people able to perform other tasks (e.g. sleeping, working). • Improved traffic management and urban planning using big data produced by autonomous vehicles. • Lower logistics and mobility costs resulting from lower labor costs and better route planning, facilitated by big data from autonomous vehicles.	• Improved use of infrastructure (e.g. intelligent traffic lights that send traffic information to vehicles and public agencies for real-time decision-making). • Improved enforcement of the use of segregated infrastructure (e.g. exclusive lanes for buses and bicycles and low-emission zones). • Shorter safe distances required between vehicles, increasing the capacity of infrastructure. • New revenue sources arising from technology (e.g. dynamic congestion charges).	• Lower operating costs due to greater energy efficiency and lower maintenance needs than for internal combustion vehicles. • Greater passenger comfort due to quieter and more fluid operation. • Batteries may be used as an additional store of energy.	• Fewer single occupant journeys and higher rates of vehicle occupancy, reducing the number of vehicles on the road. • Improved access to public transportation (e.g. providing first and last mile services and solutions tailored to individual needs). • Greater compatibility between supply and demand for logistics assets, reducing the number of empty transportation vehicles. • Greater efficiency in public transportation when integrated with shared autonomous vehicles.
Inclusion	• Increased mobility for older adults, people with disabilities, and nondrivers.	• Improved public transportation planning through the use of sensors and big data, allowing on-demand transportation connecting lower density areas.		• Improved convenience of public transportation, as mentioned above.
Sustainability	• Improved road safety due to less human intervention, which is responsible for 90% of accidents. • Greater driving efficiency, reducing energy consumption. • Less need for parking, freeing up urban spaces for the development of social spaces.	• Improved road safety through accident alerts (an alert three seconds before a potential impact can reduce collisions by 70%).	• Lower emissions and noise pollution, improving quality of life and reducing the impact of the sector on climate change.	• Fewer single occupant journeys and higher rates of vehicle occupancy, reducing the number of vehicles on the road. • Greater active mobility through shared bicycle programs.

Source: IDB (2020a).

Table 5. Risks of the new transportation technologies

Autonomous	• Higher congestion: vehicles travel more (up to 60% increase in mileage) as occupants can now use their travel time more productively, cost per mile is lower, and many vehicles travel empty to pick up passengers and after dropping them. • A shift away from public transportation and active modes of travel in favor of increasingly affordable private vehicles, worsening congestion and sedentary lifestyles. • An acceleration of urban expansion, as people become less reluctant to make long daily trips. • New accident scenarios as conventional vehicles coexist with autonomous vehicles. • Greater vulnerability of road users as a result of a lack of standards, unsafe autonomous vehicle operations, cyberattacks, and uncertainty regarding responsibility. • Social conflict: workers displaced by automation may experience difficulty in finding alternative employment.
Connected	• Cybercrime and consumer data vulnerabilities. • A lack of standards and interoperability, as well as an unwillingness on the part of the private sector to share information.
Electric	• Concern over range and a lack of comprehensive charging infrastructure for vehicles (the two main concerns mentioned by drivers in relation to electric vehicles). • Inconsistent vehicle charging technology and standards. • A lack of financial resources for replacing the fleet. • Retreat by car manufacturers concerned over investment in new production facilities. • Road safety risks resulting from silent vehicles. • Reductions in fuel tax revenue, creating budget gaps for maintaining transportation infrastructure and services.
Shared	• Involuntary shift away from public transportation and active modes of travel in favor of single occupancy passenger transportation, worsening congestion and sedentary lifestyles. • Induced traffic. • Specific resistance in the sector and effects on the labor market (e.g. among bus and taxi drivers). • Rejection by car manufacturers concerned about lower car sales resulting from the less frequent use of private cars. • Greater road safety risks as micromobility rises. • Resistance to shared mobility services due to safety and privacy concerns and to cars being considered symbols of status, independence, and flexibility.

Source: IDB (2020a).

Table 6. Transportation-oriented development policies

City	Actions	Results achieved
Curitiba, Brazil	Curitiba (Brazil) developed a master plan integrating land use with transportation, prioritizing development of the city along five designated corridors (promoting high-density industrial and residential development),[45] building pedestrian thoroughfares, and achieving partial reductions in vehicle traffic in the city center.	Reduced traffic congestion, improved air quality, an expansion of green spaces, improvements in walkability and habitability, and reduced criminality (Suzuki et al., 2010).
Hong Kong	Hong Kong has developed a model of urban train systems accompanied by real estate in the areas surrounding the stations; this has created highly accessible transportation hubs with varying uses and attractions in which the capture of value from the real estate developments has paid for construction of the infrastructure.	The city has a high population density— 6,480 inhabitants per square kilometer—in proximity to public transportation. Seventy-five percent of the population live within 1 km of a metro station, while 43% live even closer, within 500 m (or less) of a station. Ninety percent of motorized trips are taken using public transportation.
Denver	Denver's Metro Vision plan placed limits on growth in the urban footprint and provided for an expansion of the transportation system. The city also made important zoning changes aimed at increasing permitted densities in transportation corridors. Building heights of 67 m are permitted in mixed-use transit areas (previously only 42 m) and occupancy ratios of 5. Parking requirements were also reduced by 25%, and the creation of public spaces was encouraged around stations.	The city has built more than 25,000 residential units and 12.8 million square meters of office space around stations, as well as spaces for cultural, educational, government, and medical activities. Eighteen percent of new offices and 8% of new multifamily units were built within half a mile of Union Station. In 2015, people in the Denver metropolitan region spent an average of 47% of their incomes on housing and transportation costs, while people living close to transit stations spent 39%.

Source: Adapted from Medina and Veloz (2013).

Table 7. Taxonomy of congestion pricing systems

Type	Description	Examples
Cordon charges	This refers to congestion fees paid by all vehicles entering or crossing the area within a cordon. Fees may vary by the number of trips, time of day, day of the week, type of vehicle, and direction of travel.	Singapore, Rome, Stockholm, Oslo, Florence.
Zone charges	This involves a daily congestion fee charged for driving into or within a defined area, but without additional charges for crossing the cordon more than once. Fees may vary by distanced traveled, time of day, day of the week, and type of vehicle.	London.

[45] This concept goes beyond average demographic densities and promotes articulated densities—i.e. densities that are strategically distributed in relation to public transportation trunk lines (Suzuki and Robert, 2014).

Type	Description	Examples
Corridor charges	Refers to a congestion fee charged to all vehicles traveling along a corridor in a city—for example, vehicles using a toll road, bridge, or tunnel.	United Kingdom, France, Greece, Italy, Portugal, and Spain.
Road network charges	Vehicles pay to use a road network. Fees may vary by the type of vehicle, emissions, the roads used, distances traveled, and time/duration of each trip.	Germany.

Source: Adapted from Broaddus et al. (2009) and ITF (2018).

Table 8. Classification of policies for providing air connectivity to remote areas

Type of policy	Description	Examples
Route-based policies	This involves short-term contracts (2-3 years) between the government and airline companies aimed at offering low-cost, regular air services on specific routes, or traffic distribution rules, to serve isolated communities with limited ground or air access. These contracts may specify service levels, flight frequencies, the type of airplane, programming, and the fares to be offered on each route.	Peru's Promotion and Development program, which subsidizes 14 routes in the Amazon, and Chile's Public Transportation Subsidies Law, which subsidizes routes for the Magallanes region and the Chilean Antarctic.
Passenger-based policies	These establish discounts for residents of remote communities, through either specific fixed or maximum fares, or calculated as a percentage of market fares.	Residents of the Galapagos Islands enjoy a fixed fare for domestic destinations, while additional discounts are offered for children, senior citizens, people with disabilities, and residents with special travel needs (medical care).
Airline-based policies	This refers to social services provided by state-run airline companies, which operate exclusively in remote areas and depend on government subsidies for their operations. Some state-run companies may be created with the explicit intention of supporting air services in remote regions, while in other cases, they may not have this as an explicit objective, yet in practice some of their routes cover flights to these areas.	Satena (Colombia) offers both loss-making air services with social objectives and commercial services on profitable routes. Tame Amazonia operates flights within the Amazon region, while Boliviana de Aviación Regional (Bolivia) provides air services to mid-sized cities in the country that are not necessarily located in remote regions.
Airport-based policies	These include incentives to airline companies aimed at leveraging the launch of new routes, such as discounted airport fees, bonus payments, guaranteed growth in passenger numbers, and joint marketing activities. They also include airport subsidies for expanding or improving infrastructure capacity. These programs are not specifically directed at remote regions, and small and large airports alike may avail of them.	Under Brazil's Federal Airport Assistance Program, the federal government cofinances projects to upgrade or expand capacity in small and/or loss-making airports (managed by states/municipios).

Source: Definitions taken from Fioravanti et al., (2018).

Table 9. Sovereign-guaranteed operations analyzed for lessons learned

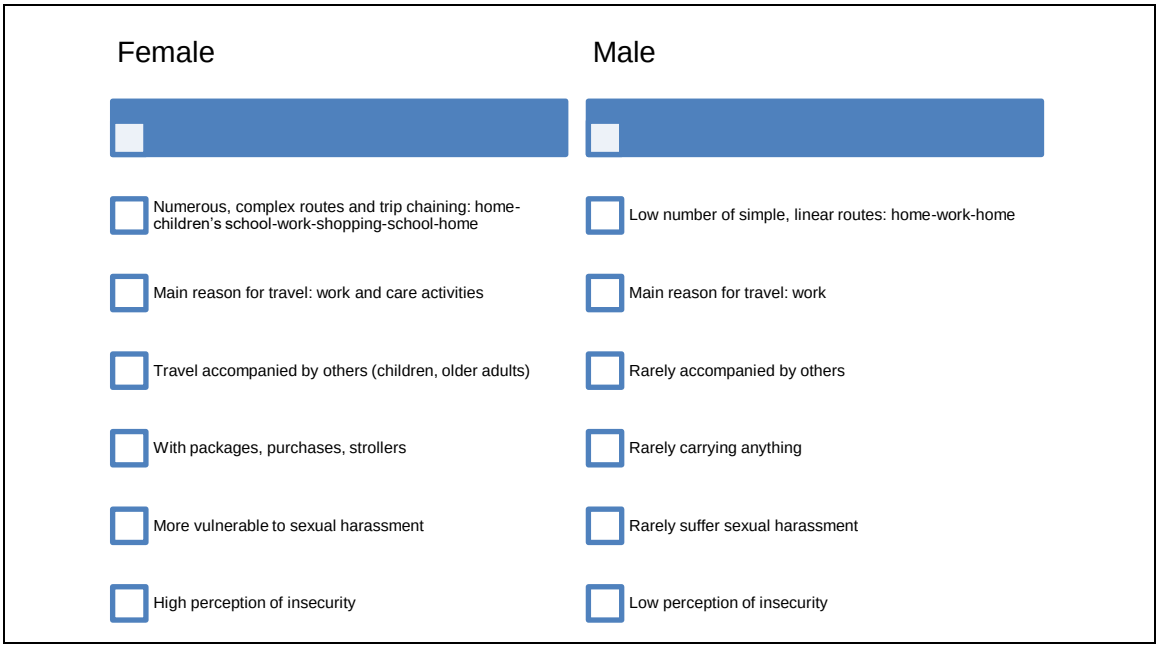
Project name	Operation number
Support for Panama's Transport and Logistics Sector Reform Program, I, II, and III	PN-L1151, PN-L1119, and PN-L1110
Airport Infrastructure Program. Phase I	BO-L1076
Quito Metropolitan Urban Transportation System	EC-L1111 and EC-L1124
Comprehensive Improvement Project for the General Roca Railroad: Plaza Constitución – La Plata Branch Line	AR-L1158
Central District Public Transportation Project (Tegucigalpa-Comayagüela)	HO-L1061
Meerzorg-Albina Road Rehabilitation Project	SU-L1006
Road Improvement Program	JA-L1027
Espírito Santo Road Program III and Espírito Santo Logistics Efficiency Program	BR-L1263 and BR-L1524
Border crossings	PE-L1003
Transportation Program for the San Salvador Metropolitan Area	ES-L1050
Support for Implementation of the National Road Safety Policy	CO-L1111
Atlantic Coast Road Connectivity	NI-L1087

Note: To determine lessons learned from sovereign-guaranteed operations, the team reviewed project completion reports and loan proposals, in addition to technical notes such as: *Infraestructura para el Desarrollo - Vol 3, No 1: Cómo modernizar el sistema ferroviario en Buenos Aires* [Infrastructure for development - Vol 3, No 1: How to modernize the rail system in Buenos Aires], Infrastructure for Development - Vol 3, No. 2: How to improve the road network in Jamaica and Road Safety Strategy.

Table 10. Non-sovereign guaranteed operations analyzed for lessons learned

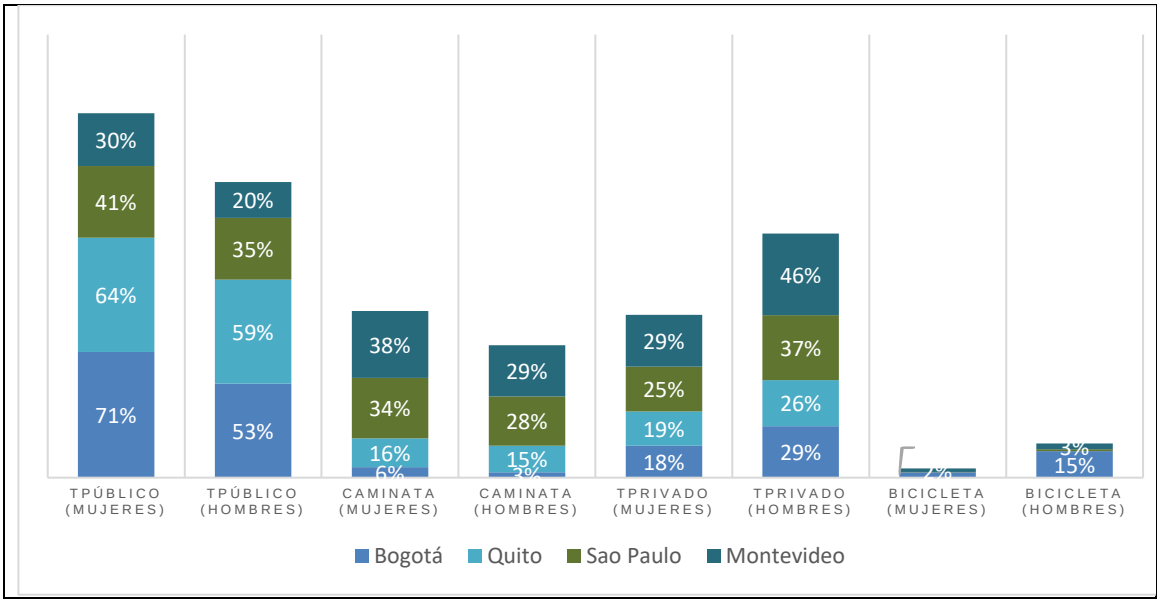
Project name	Operation number
Posorja Port, Ecuador	12177-01
Routes 2 and 7, Paraguay road program	11895-03
Itapoá Container Terminal, Brazil	12216-01
Kingston Container Terminal Project, Jamaica	JA-L1054
Arawak Port Expansion and Energy Efficiency Program, The Bahamas	12081-01
Perimetral Oriental de Bogotá Public Private Partnership	CO-L1159
Autopista al Mar 1, Colombia	11895-05

Figure 1. Mobility patterns by gender



Source: IDB (2020).

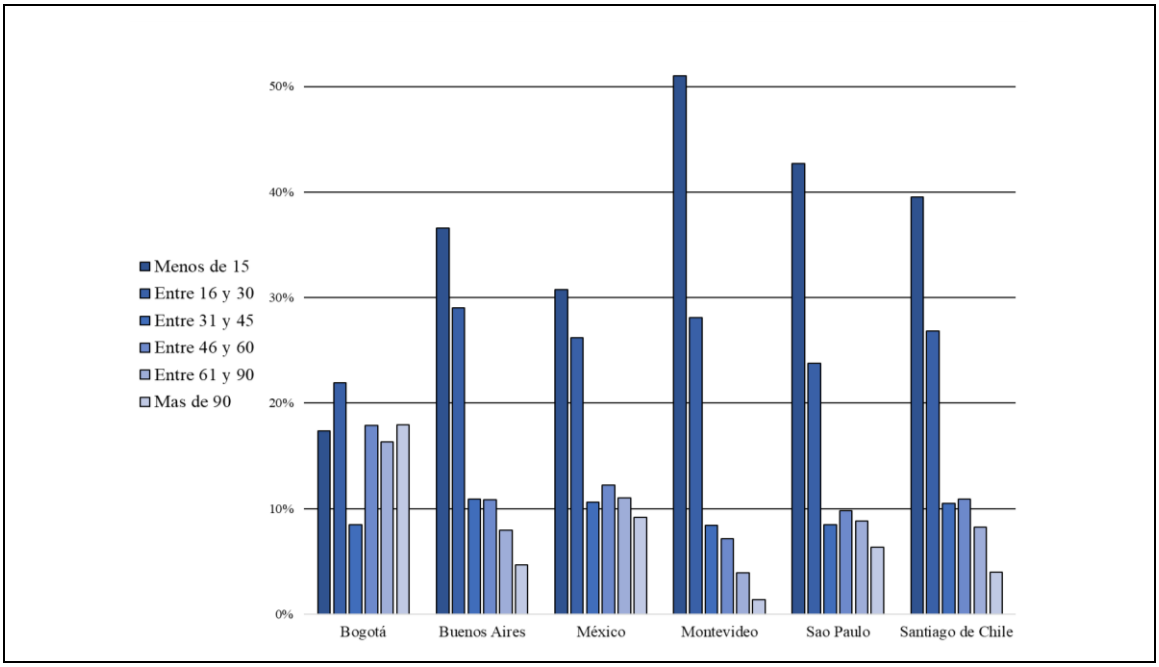
Figure 2. Modal distribution disaggregated by gender



Note: Women make less use of motorized modes (cars, bicycles, and motorcycles), relying more on public transportation and walking. On average, women account for 50% of public transportation system riders in the region (Granada et al., 2016).

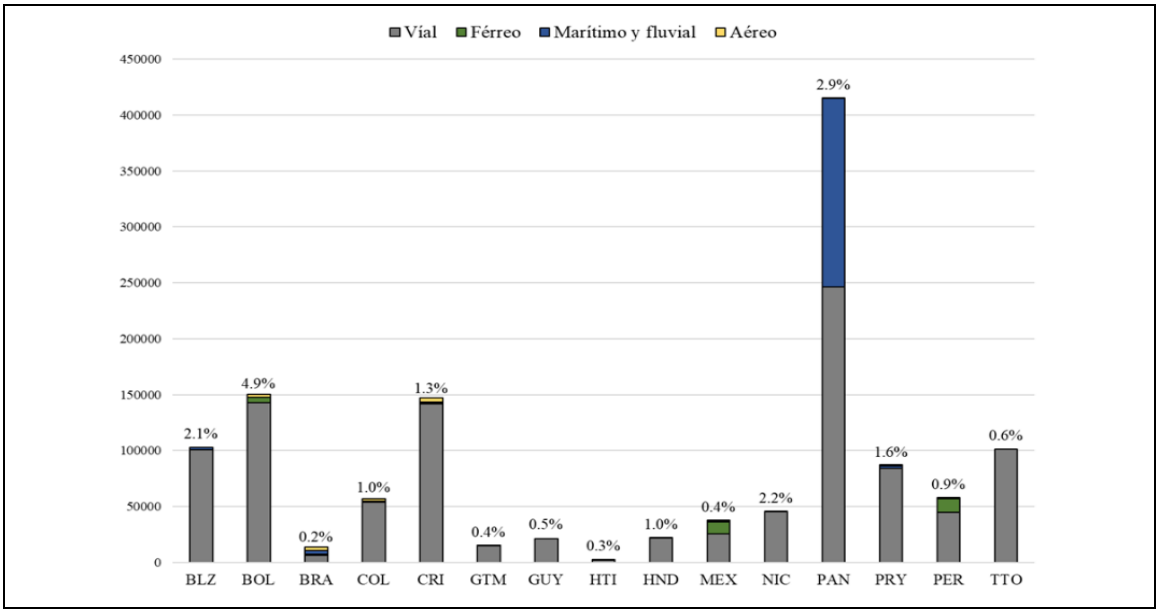
Source: Rivas et al., 2019b.

Figure 3. Distribution of travel times in selected cities (minutes)



Source: Bogota City Hall (2015); Government of the City of Buenos Aires (2010); Mexico's National Institute of Statistics and Geography (INEGI) (2017); Government of the City of Montevideo (2016); Government of the State of São Paulo (2017); and the Chilean Ministry of Transportation and Telecommunications (2012).

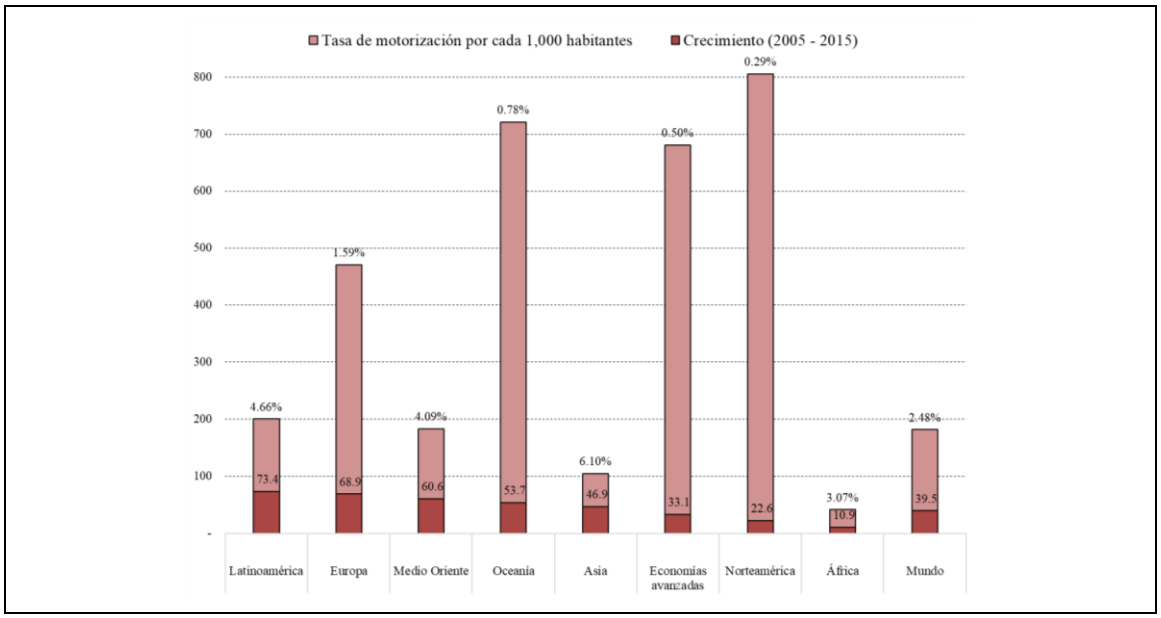
Figure 4. Public investment in the transportation sector (US$ per 1,000 inhabitants) (2016)



Note: The bars represent the value of public investment in physical infrastructure per 1,000 inhabitants, broken down by mode of transportation. The percentage represents this investment as a proportion of national GDP.

Source: Infralatam (2017).

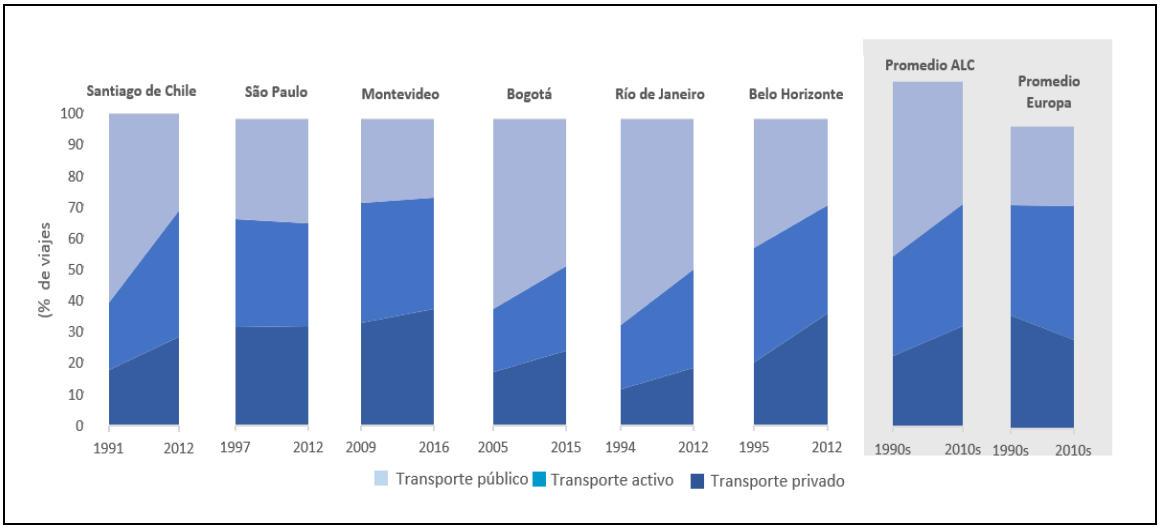
Figure 5. Motorization rate per 1,000 inhabitants and growth in the motorization rate (2005-2015)



Note: The dark red bar represents absolute growth in the motorization rate between 2000 and 2015. The percentage value, above the lighter bar, is the annual rate of growth in the motorization rate (average growth over the previous 10 years).

Source: Rivas et al., 2019b.

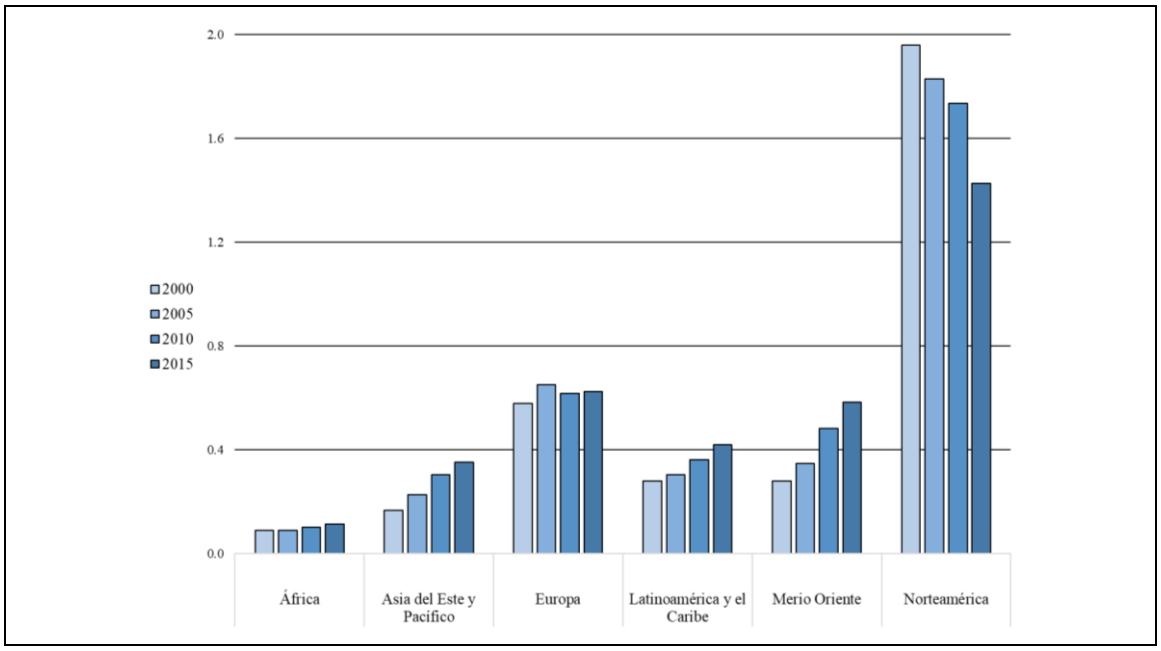
Figure 6. Percentage of trips by mode of transportation (selected cities)



Note: Comparisons between cities are constrained by methodological differences and the timing of surveys. Private transportation includes cars and motorcycles. The cities included in the European average are Stockholm, Hamburg, London, Munich, Berlin, Vienna, Copenhagen, Zürich, Amsterdam, and Paris.

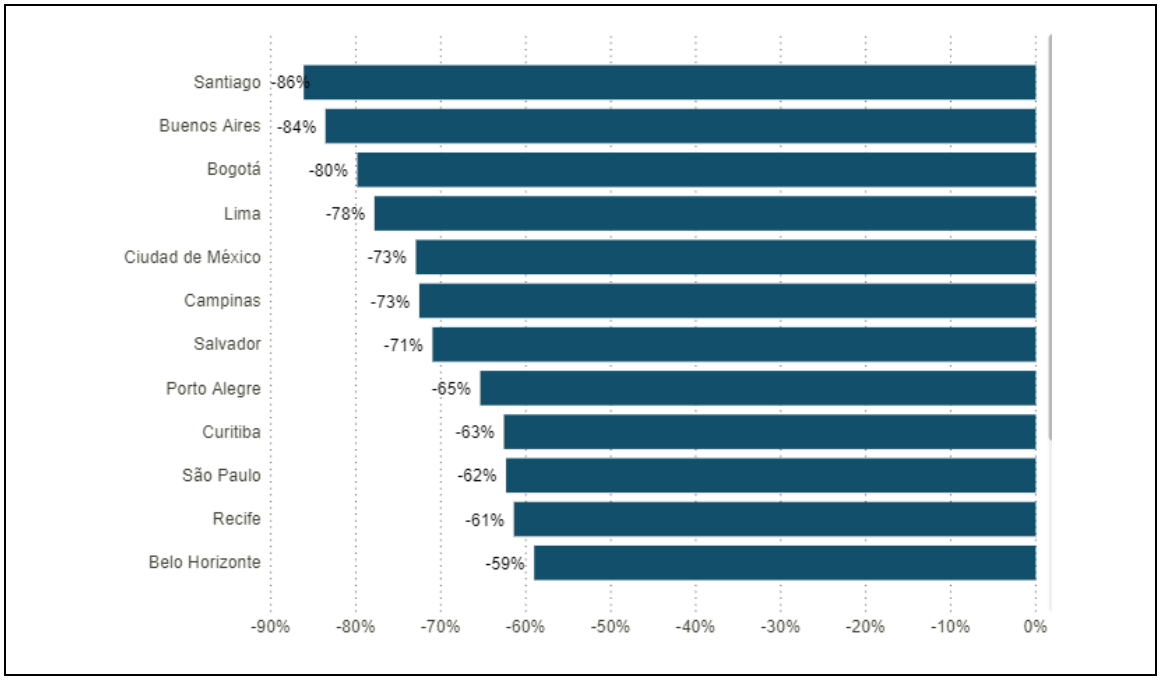
Source: Rivas et al., 2019b.

Figure 7. Kilograms of CO2 emitted from road transportation per 1,000 inhabitants (2000-2015)



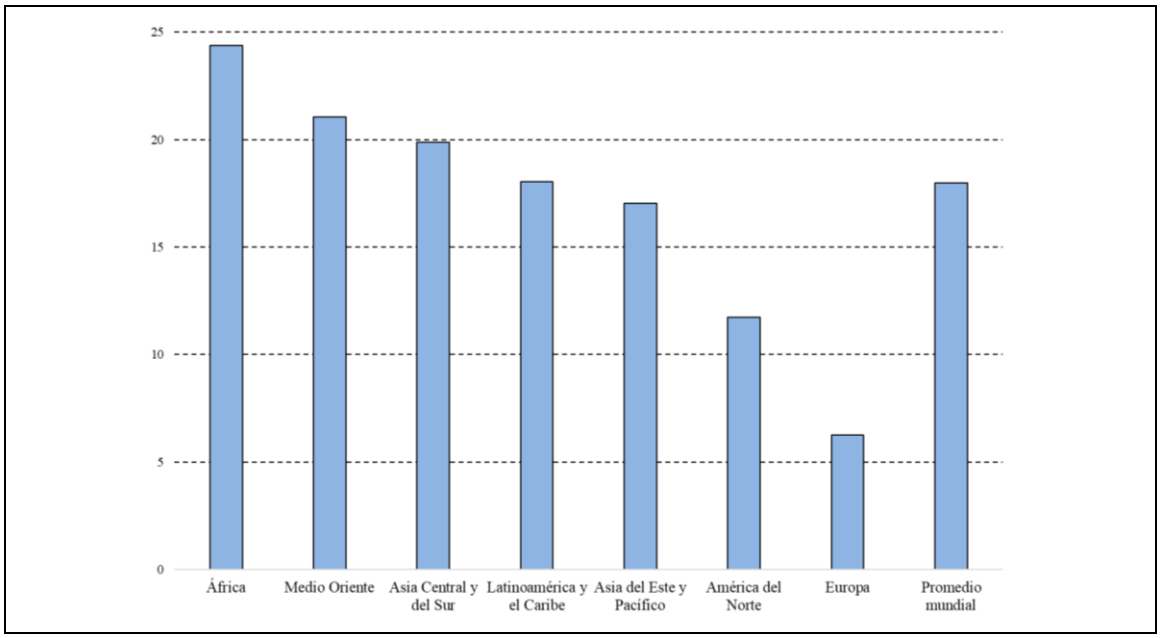
Source: International Council on Clean Transportation (2016).

Figure 8. Percentage change in the number of passengers using public transportation as of 1 July (compared to the week of 2-8 March 2020)



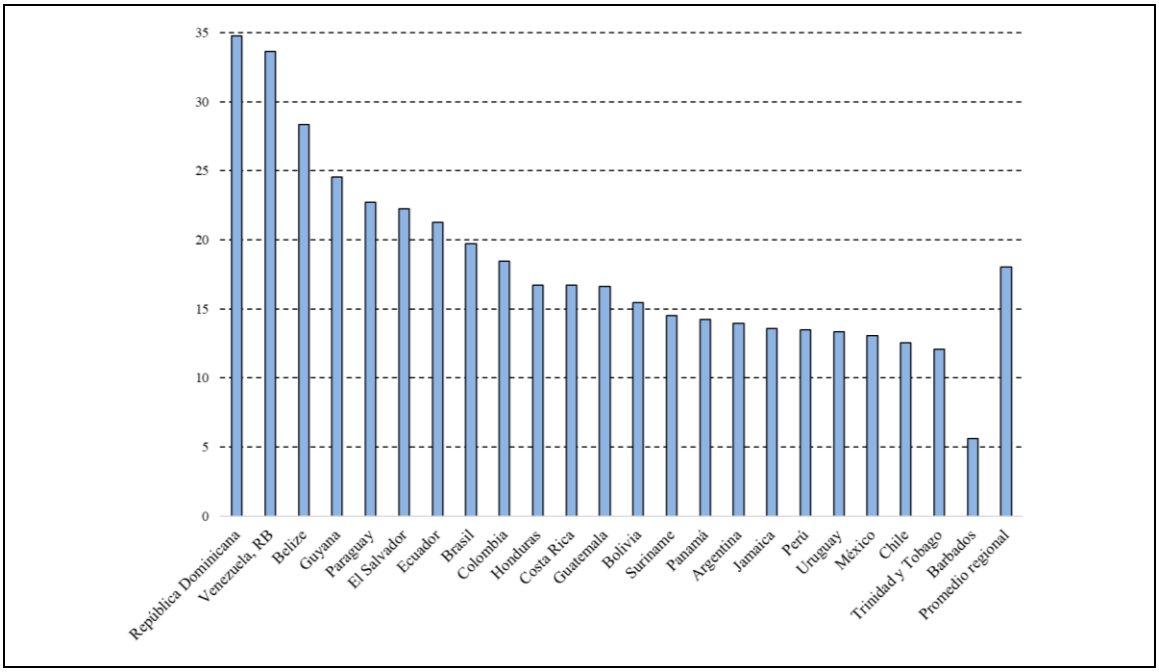
Source: IDB (2020d).

Figure 9. Road accident fatalities per 1,000 inhabitants (2016)



Source: World Health Organization (2018).

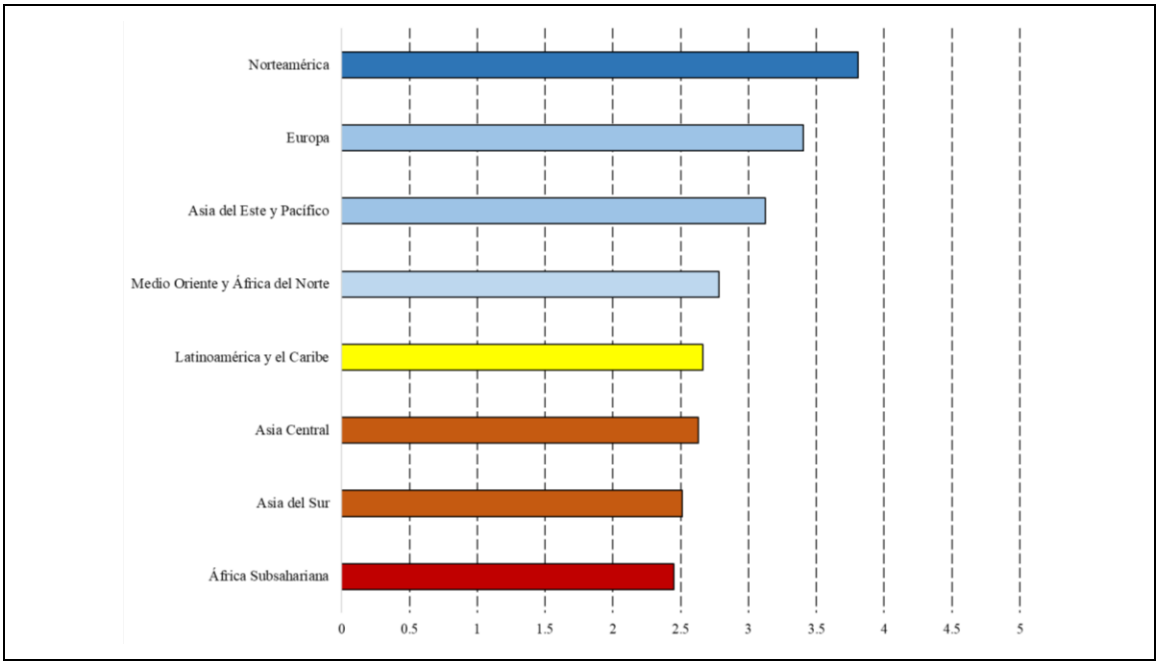
Figure 10. Road accident fatalities in Latin America and the Caribbean per 1,000 inhabitants (2016)



Note: The number used is the weighted average by population—i.e. the total number of deaths in Latin America and the Caribbean divided by the total population of the region.

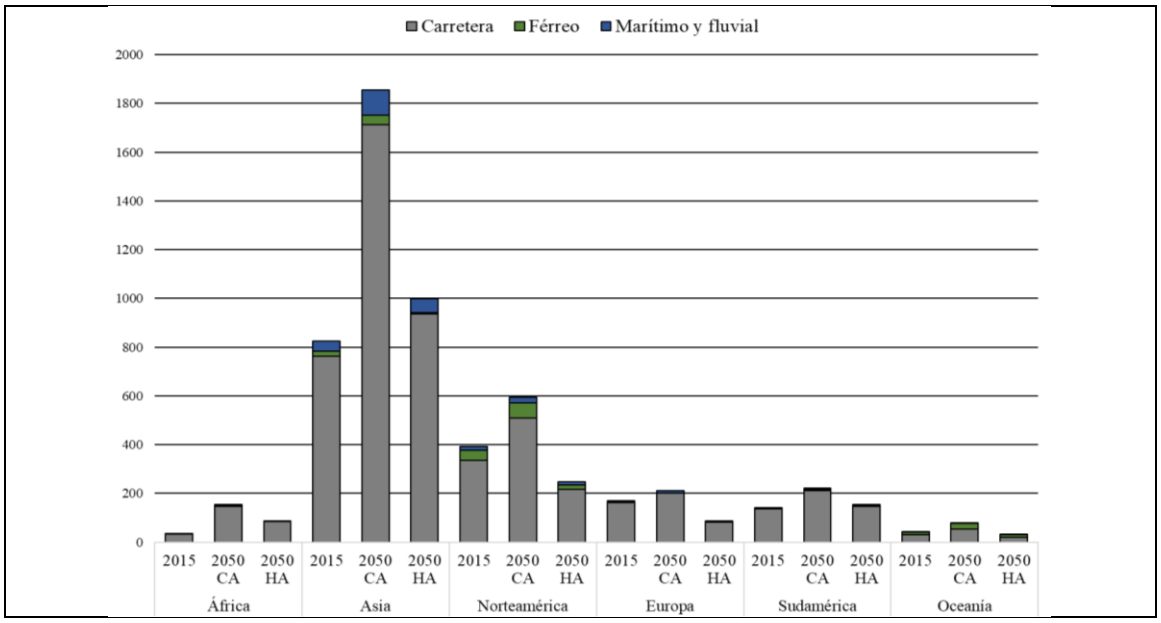
Source: World Health Organization (2018).

Figure 11. Logistics Performance Index (regional average, 2018)



Source: World Bank (2018a).

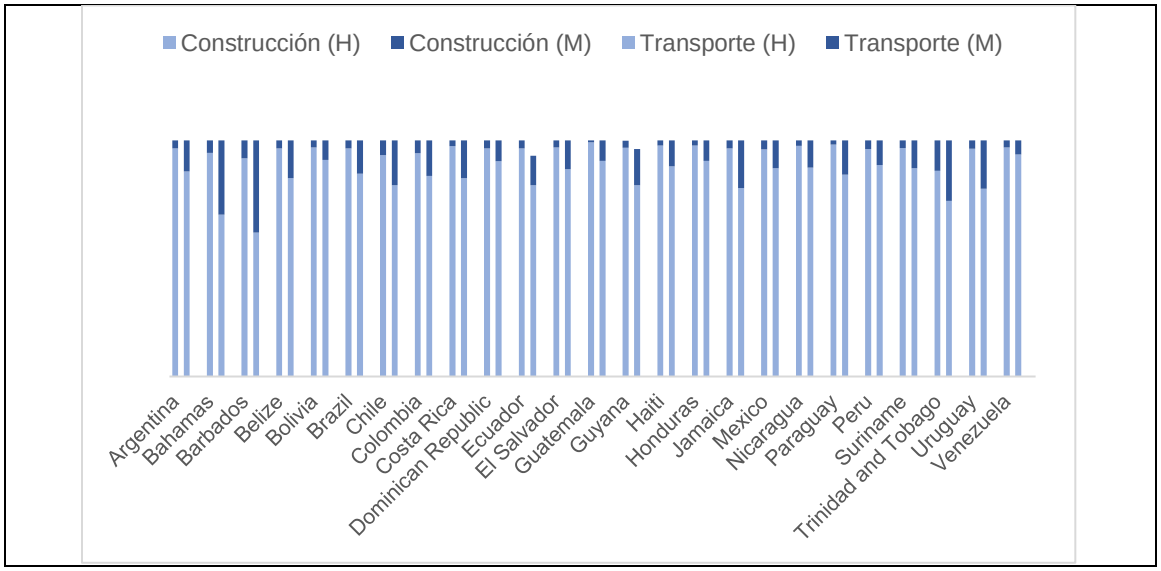
Figure 12. Millions of tons of CO2 emitted by the freight transportation sector (2015-2050)



Note: "CA" and "HA" refer to expected growth in emissions by 2050 based on current trends (Current Ambition) and expectations based on structural reforms (High Ambition), respectively.

Source: ITF (2019).

Figure 13. Total employment in each sector disaggregated by gender



Note: Women account for between 1% and 13% of employment in the construction sector and between 6% and 39% in the transportation sector. It should be noted, however, that the latter includes the communications sector.

Source: International Labor Organization estimates for 2019.

Box 1. The Transportation Sector Framework and the Infrastructure Strategy

The objective of the Infrastructure Strategy (document GN-2710-5) is to guide future Bank support for the countries of the region toward their adoption of a new vision for the sector. According to this vision, infrastructure is planned, built, and maintained in order to support the provision of adequate quality services that promote sustainable and inclusive growth. This new vision of infrastructure rests on the key pillars of environmental, social, and fiscal sustainability, and it recognizes the need to expand multisector approaches that allow the synergies among infrastructure sectors to be exploited. The priority areas for action are as follows: (i) promote access to infrastructure services; (ii) support infrastructure for regional and global integration; (iii) foster financing mechanisms and leverage the participation of the private sector in infrastructure; (iv) adopt and promote a multisector agenda; (v) support the construction and maintenance of an environmentally and socially sustainable infrastructure; and (vi) support the construction and maintenance of an environmentally and socially sustainable infrastructure

The Transportation Sector Framework is aligned with the Institutional Strategy as it considers transportation to be a system in which—in addition to infrastructure—services, institutions, and technology are key elements for performance. It also seeks to boost the role of the transportation system as a catalyst for competitiveness and inclusive, sustainable growth in the region. As shown in this document, the objective of the Bank's work in the region will be to support the attainment of efficient, inclusive, and sustainable transportation systems, addressing the key areas for action mentioned in the Infrastructure Strategy: access to quality transportation services, the search for improved sector funding and financing, improvements in logistics for regional competitiveness and integration, sustainability of the transportation system, and improvements in the institutional framework.

Box 2. Metro systems in Latin America and the Caribbean

Faced with growing demand for high-capacity public transportation systems, coupled with high rates of motorization and pollution and poor levels of service in conventional bus systems, some cities in the region have opted for metro systems.

While there are some very recent projects, metro lines have been present in Latin America and the Caribbean for a long time. Twenty-two cities have functioning metro systems, inaugurated between 1913 and 2014. The Buenos Aires metro is the oldest, while the Panama City metro is the most recent. In terms of length, the Mexico City metro is the most extensive, with 226.49 km distributed across 12 lines, transporting an average of 6 million passengers each day. The San Juan Metro is the smallest, with a single 17.2 km line that transports 14,000 passengers per day on average. There are several projects aimed at extending existing metro systems—including Panama City, Lima, Santiago, Buenos Aires, and Mexico City (Asociación Latino-Americana de Metros y Subterráneos, 2017)—and at building new ones (Bogota and Quito).

The IDB has actively participated in some of these flagship projects. It recently financed the Line 2 project in Lima and is currently the lead organization for coordination of the multilateral development banks in Bogota and Quito. The latter project, for example, involved an initial investment of US$2.009 billion, including US$450 million in IDB financing. This line will be 22 km long, with the number of passengers per hour projected at 27,000 on average.

Box 3. Transportation infrastructure as an asset class

One alternative pursued by the G20 and the multilateral banks to increase investment in infrastructure (particularly in the transportation sector) has been to transform the risk-return profile of cash flows for such works into a specific asset class ("infrastructure as an asset class"). An asset class is a group of negotiable investments or securities (financial assets) that share similar characteristics in terms of their risk-reward ratio and react in a similar (positive) way to certain external shocks that contrasts with other assets, be they bonds (fixed income), shares (variable income), real estate, or commodities.

Infrastructure assets usually share the following characteristics that make them a desirable investment: (i) cash flows that are generally stable throughout the business cycle; (ii) protection against inflation; (iii) long-lasting assets; and (iv) diversification dividends due to their low correlation with returns on other asset classes. The opportunity to transform cash flows from infrastructure works into a negotiable asset class brings with it substantial benefits, as it channels available savings from institutional investors (pension funds, insurance companies, sovereign funds, and fund administrators).

To this end, infrastructure investment needs to be divided into several standardized financial instruments that are easy to buy and sell and provide an attractive source of earnings to institutional investors currently holding shares, bonds, investment funds, and other instruments. The main challenge is to achieve a risk-return profile that is advantageous in comparison to other market instruments and asset classes. The challenge lies in adequately selecting this group of transportation infrastructure works, as the nature of these investments means that they are subject to different degrees of risk and are often unprofitable.

Box 4. Benefits of Bus Rapid Transit in Lima

According to impact evaluations of the BRT system and Metro Line 1 in Lima, average travel times on the trunk line fell from 55 minutes to 35 minutes after its construction. Employment rates for people living 1.5 km from the BRT trunk line rose by 6.7 percentage points and the probability of working full-time by 8.2% between 2010 and 2017 (Scholl et al., 2018). The probability of finding employment for women living in the corridor's area of influence grew by 7.6% after the BRT system was implemented (2012-2014) and by 10 percentage points following the implementation of both systems (Martínez et al., 2020). Annual CO_2 emissions fell by 78,600 tons between 2011 and 2014 (AENOR, 2015), while traffic accidents in the BRT corridor dropped by 65% in the first year of system operation (Scholl and Celse L'Hoste, 2015).

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