

A Sustainable Asset Valuation of the Mass Rapid Transit System in Bogota, Colombia

SUMMARY OF RESULTS

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Bogota, Colombia's capital and largest city, is home to a rapidly growing population of over 8 million inhabitants. The fast pace of urban population growth in recent decades has placed pressure on the city's public transportation network and left it in need of upgrades. Today, Bogotanos undertake a staggering 13.4 million daily transport trips—and that number climbs to over 16 million trips when all municipalities within the city's metropolitan area are included. Of these trips, public transport accounts for 44.2%, while private modes of transportation, including cars, motorcycles, and taxis, contribute to 25.3%. Active modes of transportation, such as walking and cycling, represent 24% and 6.6% of trips, respectively (Secretariat of Mobility, 2020).

Despite numerous attempts to implement a metro system by various administrations over the past 50 years, the primary form of public transportation in Bogota remains the TransMilenio Bus Rapid Transit (BRT) system. As a result, Bogota has been ranked as one of the most congested cities in the world, with the average person losing 191 hours to traffic each year (WEF, 2020).

To tackle these mobility challenges, Bogota has introduced Metro Line 1 of the Metro de Bogota Mass Rapid Transit (MRT) system, an elevated MRT line that will be fully automatic and driverless. The Metro Line 1 project is the first modern metro system in Colombia. Upon completion, the Bogota MRT will be the main transit line for the public and a major passenger transport system in the city. Bogota Metro Line 1 is expected to accommodate 1.05 million passengers per day—or 72,000 passengers per hour—in each direction, covering a distance of almost 25 km. Each driverless train will be able to carry approximately 1,800 passengers, and there will be MRT stations located within 1 km of 80% of Bogota's population by 2030 (Metro de Bogota, 2022). Construction of the MRT project began in 2020, and it is expected to be operational in 2028. The total investment costs of the MRT system amount to USD 5 billion (Construction Review Online, 2021).

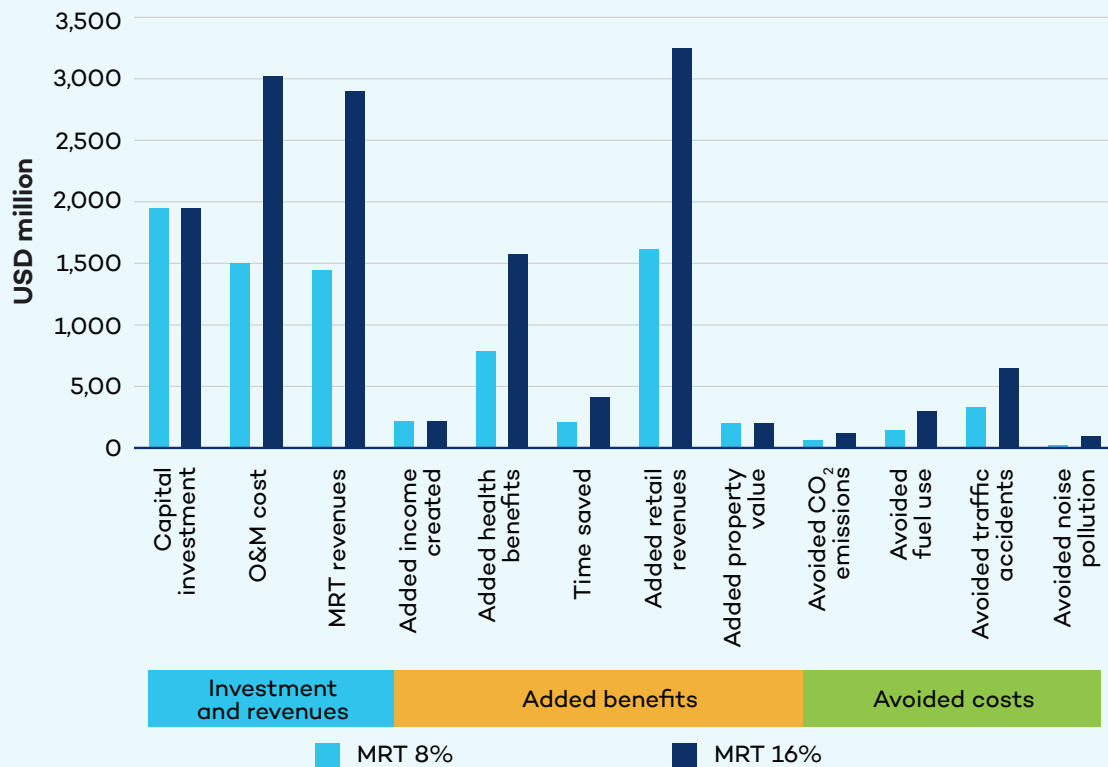
The project will contribute to the economic, social, and environmental development of the city of Bogota through increased productivity, generation of (and improved access to) employment opportunities, reduced traffic congestion, and access to quality transit for public transportation users. The project is expected to encourage a shift from private motorized transport modes to a cleaner public transport network that will be powered by electricity, considerably reducing carbon dioxide (CO₂) emissions. Based on estimates, the MRT will reduce 938,000 tonnes of greenhouse gas emissions by 2049.

This analysis is part of a series of integrated assessments on sustainable transport and mobility projects carried out with the Sustainable Asset Valuation (SAVi) methodology. The SAVi methodology provides policy-makers and investors with a comprehensive analysis of the costs and benefits of their infrastructure projects and policy interventions throughout their life cycles. We consider a wide range of economic, social, and environmental risks and impacts, which are typically overlooked in traditional valuations, looking below the surface for the broader knock-on effects of implementing a transport project.

The SAVi assessment of the MRT system in Bogota shows that the MRT system would provide a more efficient, safe, accessible, and environmentally friendly mode of transportation in the city while also delivering substantial monetary benefits.

In this SAVi assessment, two main MRT scenarios were modelled, including various assumptions on calculating the economic value of the added benefits and avoided costs of the MRT system. More details can be found in the [technical report](#). This summary presents the key findings of the most conservative estimate of two MRT demand scenarios, which assume an 8% and a 16% modal shift from private transport to the MRT system. The MRT 8% scenario amounts to a cumulative net benefit of COP 7,682 billion¹, ² (USD 2,051 million), and the MRT 16% scenario amounts to a cumulative net benefit of COP 23,130 billion (USD 6,177 million) for the city of Bogota over a project period from 2022 to 2058.

Figure 1. The monetary value of investment costs, revenues, added benefits, and avoided costs of the MRT system in Bogota (cumulative discounted values 2022–2058)



Note: O&M = operation and maintenance

Source: Authors' calculations

¹ In this assessment, “billion” corresponds to the short scale, which is equivalent to 10e9 (1,000,000,000), which would correspond to a thousand million for Colombia.

² The exchange rate used is 3,744 COP/USD

The MRT system in Bogota stimulates economic growth, both directly (through MRT revenues and employment creation) and indirectly (through increased retail activity, property value increases, and fuel savings). The most significant economic impact comes in the form of increased retail revenues around MRT stations, which amounts to cumulative discounted values of COP 7,904 billion (USD 1,612 million) in the MRT 8% scenario and COP 15,897 billion (USD 3,243 million) in the 16% MRT scenario. This benefit is achieved through the additional time Bogotanos spend walking to and from MRT stations, which is associated with higher retail spending. Increased retail revenues will be particularly evident in the central areas of the city.

In addition, the MRT system will lead to significant health and environmental benefits through increased physical activity, as well as reduced air pollution and noise pollution from individual transport modes. It will also result in fewer traffic accidents, which will ultimately lead to reduced mortality in the city. These factors lead to health benefits between COP 3,829 billion (USD 781 million) and COP 7,711 billion (USD 1,573 million). The MRT system will be 100% electric. Hence, there won't be additional CO₂ emissions. Given the shift from individual transport modes to MRT, CO₂ emissions will drop even further.

The revenues from the use of the MRT system will also bring considerable economic benefits to the public sector in Bogota, amounting to a cumulative value of COP 7,085 billion (USD 1,445 million) in the MRT 8% scenario and COP 14,217 billion (USD 2,900 million) in the MRT 16% scenario.

Integrated valuations build a fuller picture of the long-term effects that a conventional benefit-cost ratio (BCR) does not consider. A traditional BCR for this project considers only the tangible impacts (e.g., capital costs, operational and maintenance costs, and MRT revenues) and amounts to 0.4 BCR in the MRT 8% scenario and 0.6 in the MRT 16% scenario. However, a sustainable BCR (S-BCR)—which draws on the full range of economic, social, and environmental added benefits and avoided costs—is higher, amounting to 1.5 BCR in the MRT 8% scenario and 1.9 BCR in the MRT 16% scenario.

Table 1. Net results of value-added benefits and avoided costs

		MRT 8%	MRT 16%
Cumulative net benefits (undiscounted)	COP billion	56,060	122,691
Cumulative net benefits (discounted)	COP billion	7,682	23,130
Cumulative net benefits (discounted)	USD million	2,051	6,177
BCR		0.4	0.6
S-BCR		1.5	1.9

Source: Authors' calculations

In other words, when the sustainability impacts of the MRT are considered, the benefits are approximately four times higher in both demand scenarios. This shows that advancing sustainable transport investment options, such as the MRT system in Bogota, requires identifying, assessing, and valuing these societal benefits and avoided costs so that city planners and project developers can advocate for their implementation and financing.

The long-term value of the MRT system will also be enhanced by the growth of other public transport systems in the city, including the TransMilenio BRT system and the non-motorized transport system. By promoting sustainable intermodal transportation, it is possible to improve the efficiency of travel in Bogota and increase the economic benefits of all three public transport systems. An analysis that factors in these other transport interventions is the focus of a complementary SAVi assessment of the Sustainable Transport Strategy in Bogota.

It is crucial that policy-makers design and implement processes that enable the recognition and accounting of the wider benefits of sustainable mobility infrastructure so that decisions are made in favour of transport investments that provide the greatest benefits to society while minimizing the environmental impacts.

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SAVi is a simulation tool that is customized to individual infrastructure projects. It is built on project finance and systems dynamics simulation.

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About SAVi

SAVi is a simulation service that helps governments and investors value the risks and externalities that affect the performance of infrastructure projects.

The distinctive features of SAVi are:

- **Valuation:** SAVi values, in financial terms, the material environmental, social, and economic risks and externalities of infrastructure projects. These variables are ignored in traditional financial analyses.
- **Simulation:** SAVi combines the results of systems thinking and system dynamics simulation with project finance modelling. We engage with asset owners to identify the risks material to their infrastructure projects and then design appropriate simulation scenarios.
- **Customization:** SAVi is customized to individual infrastructure projects.

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