SAVi Sustainable Asset Valuation

Applying a Sustainable Asset Valuation (SAVi) to a Public Bicycle Sharing System in Dwarka, New Delhi, India:

Assessing the environmental, social and economic impacts of non-motorized transport infrastructure

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The Scope of This SAVi Assessment

The Centre for Green Mobility—which is currently developing an implementation program for a Public Bicycle Sharing (PBS) system in New Delhi—asked IISD to apply the Sustainable Asset Valuation (SAVi) methodology to assess the benefits of a well-implemented PBS system. This quantitative evidence is crucial for strengthening the business case for the PBS system as well as encouraging public authorities to invest in providing the necessary bicycle lanes and safety infrastructure. SAVi was customized to estimate and value the environmental, social and economic co-benefits and avoided costs generated by the PBS system.

The SAVi assessment consists of the following elements:

- A valuation of nine externalities resulting from a successfully implemented PBS system.
- A comparison of three demand scenarios and the scale of their valued externalities.
- An integrated cost–benefit analysis of the PBS system, including valued externalities per demand scenario.

Why Use SAVi?

SAVi calculates the environmental, social and economic risks and externalities that impact the financial performance of infrastructure projects. These variables are typically ignored in traditional financial analyses.

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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The assessment demonstrates how and to what extent the PBS system can improve the quality of life in Dwarka, a sub-city of New Delhi. It also shows how the system can contribute to achieving the sustainable mobility targets described in the Delhi Master Plan 2021, a set of policy objectives prepared by the Delhi Development Authority that target issues such as the under-provision of transport infrastructure services and the need for improved environmental conservation.

Moreover, the cost–benefit analysis conducted in this SAVi assessment provides benchmark values of appropriate and optimized investment volumes for sustainable transport infrastructure in Dwarka. This includes bicycle lanes and additional road safety elements to make the use of the PBS system viable and realize the associated benefits. The calculated SAVi net results (Table 3) represent the societal value that the PBS system could deliver in Dwarka if desired demand for the system is realized. These SAVi net results provide a reasonable starting point for public sector decision-makers to determine the maximum monetary amount that infrastructure components could cost over the course of 20 years.

Scenarios

Three potential demand scenarios were considered in this SAVi assessment, reflecting the difficulty of forecasting demand for potentially transformative public transportation projects. Each scenario implies a shift in mobility patterns from other modes of transport to the use of PBS-provided bicycles. The modes of transport that would face reduced demand are buses, cars, motorcycles, auto rickshaws, pedal rickshaws and walking. This table indicates the mobility shifts toward the PBS system for each demand scenario.

Table 1. Mobility shifts towards the PBS system per demand scenario

Scenario	Daily trips shifted to the PBS system	Daily passenger km shifted to the PBS system	Daily vehicle km avoided
Scenario 1: PBS low demand	11,147	39,457	29,700
Scenario 2: PBS medium demand	15,831	56,031	42,176
Scenario 3: PBS high demand	23,993	84,919	63,922

Externalities

Cost of carbon emissions: A shift towards the PBS system reduces CO_2 emissions of the transport sector, valued as reduced social cost of carbon.

Economic value of time saved: Value of improved and less time-intensive mobility resulting from the use of the new PBS system.

Health benefits from physical activity: Value of reduced risk of all-cause mortality due to increased cycling.

Changes in retail revenues: The lower commuting speed and higher flexibility of non-motorized modes of transport are associated with higher retail spending compared to motorized modes.

Changes in property values: Infrastructure that promotes non-motorized transportation has positive impacts on property values as it improves walkability and safety.

Health cost of air pollution: The shift from air-polluting transport modes to the use of a clean PBS system reduces air pollution and the associated health costs.

Health cost of increased exposure to air pollution: High air pollution has worse health effects for cyclists than for other transport users.

Health cost of noise pollution: A shift towards the PBS system reduces noise emissions of the transport sector and reduces associated health costs.

Health cost of accidents: The value of reduced fatal and non-fatal traffic accidents resulting from decreased number of motorized vehicle km.

Results of the SAVi Assessment

The valued externalities that were generated per demand scenario are displayed in the table below. The results are indicated as daily monetary values relative to a baseline scenario that does not involve a PBS system. The externalities are categorized into "added benefits" and "avoided and added costs."

The scale of the monetary value per externality depends on demand for the PBS system and the associated shift away from other transport modes. Higher demand translates to higher net value. In each scenario, the total value of positive externalities clearly outweighs the value of the only negative externality, which is the increased direct exposure to air pollution faced by new cyclists. The largest benefits stem from the economic value of time saved, the increases in retail revenues and property values, and the avoided costs of air pollution.

Table 2. Summary table of valued externalities per PBS demand scenario (in INR, low-value estimates, undiscounted)

Costs and benefits	Unit	PBS low demand	PBS medium demand	PBS high demand
Added benefits				
Benefits from physical activity	INR/day	38,550	54,744	78,104
Value of time saved	INR/day	168,910	239,865	363,532
Increases in retail revenues	INR/day	101,049	143,498	217,481
Increase in property values	INR/day	487,397	487,397	487,397
Total added benefits	**INR/day**	**795,906**	**925,504**	**1,146,514**
Avoided and added costs				
Avoided cost of air pollution	INR/ day	33,415	47,452	71,917
Cost of increased exposure to air pollution	INR/ day	(54,181)	(76,941)	(116,610)
Avoided social cost of carbon	INR/ day	2,003	2,845	4,311
Avoided cost of accidents	INR/ day	1,891	2,685	4,070
Avoided cost of noise pollution	INR/ day	15,100	21,443	32,498
Total avoided costs	**INR/day**	**(1,772)**	**(2,516)**	**(3,814)**
Net results of valued externalities				
Total net value per day	**INR/day**	**794,134**	**922,988**	**1,142,700**
Total net value per year	**INR million/ year**	**289.9**	**336.9**	**417.1**

This table displays only the lower-end estimates for the monetary valuation of externalities. The detailed project report provides higher-end estimates as well.

SAVi's Integrated Cost-Benefit Analysis

The table below displays the results of an integrated cost–benefit analysis conducted for the PBS system. The conventional net results indicate that the PBS system falls short on financial performance under all demand scenarios. However, if the environmental, social and economic co-benefits and avoided costs valued by SAVi are integrated, the picture changes significantly. The SAVi net results demonstrate that each demand scenario yields a positive net value. The higher the demand for using the PBS system, the higher the positive net result.

Even when assuming conservative demand numbers and lower-end estimates for the valuation of externalities, discounted net benefits over 20 years amount to more than INR 3.14 billion (~USD 44.4 million). The more optimistic high-demand scenario would yield a net result of INR 4.82 billion (~USD 68.2 million). These SAVi net results also indicate benchmark values for making public investment decisions for providing bicycle lanes and additional road safety elements to make the use of the PBS system in Dwarka viable.

Table 3. Integrated CBA, daily values per PBS scenario (in INR, low-value estimates) based on a project period of 20 years. Discount factors: 8 per cent for conventional costs and revenues, 6 per cent for valued externalities

		PBS low demand	PBS medium demand	PBS high demand
Costs and benefits	**Unit**	**Low-valuation estimate**	**Low-valuation estimate**	**Low-valuation estimate**
Conventional costs & revenues				
Total costs	INR/day	121,270	121,270	121,270
Total revenues	INR/day	30,138	42,801	64,869
Conventional net results	**INR/day**	**(91,132)**	**(78,468)**	**(56,401)**
Valued externalities				
Total added benefits	INR/day	795,906	925,504	1,146,514
Total avoided costs	INR/day	(1,772)	(2,516)	(3,814)
Added benefits + avoided costs	**INR/day**	**794,134**	**922,988**	**1,142,700**
SAVi net results				
SAVi net results per day	**INR/day**	**703,002**	**844,520**	**1,086,299**
Total SAVi results over 20 years	**INR million**	**5,131.9**	**6,165.0**	**7,930.0**
Total SAVi results over 20 years (discounted*)	**INR million**	**3,143.6**	**3,764.5**	**4,824.9**

Conclusion

The SAVi assessment results provide clear evidence that the PBS system is a worthwhile investment. It advances the realization of sustainable mobility targets in Dwarka, improves quality of life and helps deliver on transport policy objectives defined in the Delhi Master Plan 2021. Positive implications of the PBS system include its contribution for convenient and affordable access to public transport, along with related facilitation of multi-modal transport use, enhanced transport efficiency, reduction of carbon emissions, positive health effects (resulting from reduced air and noise pollution), and more road space for cyclists with associated benefits for retail spending and property values.

The SAVi assessment strengthens the business case for the PBS system and encourages public authorities to invest in providing bicycle lanes and traffic safety infrastructure in Dwarka. This SAVi assessment also showcases the importance of systemic and integrative assessments for demonstrating the real value of sustainable mobility projects and for allocating public investments accordingly.

The Centre for Green Mobility is making use of the SAVi assessment results in conversations with public authorities in India, including the Delhi Development Authority, to promote the implementation of this and other PBS systems in India. IISD is pleased to support the deployment of sustainable mobility projects and looks forward to providing advice and conducting further analyses on the sustainability value and financial viability of transport infrastructure projects in India.

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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