SLOCAT Partnership | tumi Transformative Urban Mobility Initiative

# Evolving the Economic Appraisals for Land Transport Investments

# About the paper

This paper has been elaborated as a collaboration of SLOCAT and the Transformative Urban Mobility Initiative (TUMI). The objectives of this paper are 1) revealing the structural problems in economic appraisals for transport that prevent investments in public transport, walking and cycling at scale, and 2) enhancing the understanding of solutions to reverse these problems. This policy paper advocates for a shift towards a wider sustainability lens.

Prioritising investments in sustainable, low-carbon land transport based on the social and environmental value for money should be the norm. The overall shift towards sustainable and inclusive societies requires a broader perspective than the traditional cost-benefit analyses of the past. This paper addresses how accounting for social and environmental externalities (both positive and negative) in economic valuation is crucial to overcoming short-termism and one-sided decision making in land transport investments. Accounting for externalities is also crucial to enabling funds to flow to solutions that have the biggest return in terms of social and environmental development – now and for future generations – and the greatest benefit at the lowest cost for society as a whole.

The paper also outlines practical ways to evaluate investments through these lenses. The key focus is on an integrated approach across public transport, walking and cycling by identifying how much economic, social and environmental benefit these sustainable transport modes bring and how they can be scaled up.

**The paper should be cited as:**
SLOCAT (2024), Evolving Economic Appraisals for Land Transport Investments, bit.ly/40ysnLz.

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**Financial support:** This paper has been made possible thanks to financial support from the Transformative Urban Mobility Initiative (TUMI) established and funded by the German Federal Ministry for Economic Cooperation and Development (BMZ).

## Disclaimer



## In collaboration with

# Contents



# Economic appraisals: An important piece of the economics and investments for transforming transport

Despite progress in recent years, the use of standardised, comprehensive sustainability criteria to appraise the economic value of transport investment proposals is yet to become the new normal, as compared to conventional appraisal methods. A more comprehensive and integrated approach is needed, one that values additional impacts and outcomes, as well as the broad economic, social and environmental synergies that are emerging across the integrated implementation of public transport, walking and cycling.

Economic appraisals are only one piece in the big puzzle of prevailing issues in transport economics and investments. However, evolving these appraisals is essential to both redirecting and scaling up investments in sustainable, low-carbon transport solutions. Adequate economic mechanisms and investments are central to a just transition to equitable, healthy, green and resilient transport and mobility systems. But too often, current economic mechanisms work against such a transition. Examples include fossil fuel subsidies, tax-free fuel for high-polluting transport modes, external costs paid by society at large and "free" parking. Additionally, the current investment levels in sustainable, low-carbon transport by international finance institutions, governments and the private sector fall short of what is required to put the transport sector on a pathway to sustainability and decarbonisation. To scale up these investments, improvements are needed across institutional frameworks, project preparation, project financing, implementation and project evaluation.[1]

Within institutional frameworks, accounting for social and environmental impacts (both positive and negative) in the economic appraisals that assess transport investments is crucial to overcoming short-termism and one-sided decision making. Assessing transport investments through these wider lenses will provide the evidence base for political decisions to redirect and enable funds to transport solutions that yield the highest returns in terms of social and environmental development – both now and for future generations – at the lowest cost to society as a

whole. Increasing investment in sustainable, low-carbon transport solutions will in turn enhance infrastructure efficiency and reduce transport costs for all users, improving equity in access to transport and hence to socio-economic opportunities. It will also increase other shared societal benefits, such as improved air quality and environmental indicators. All of this will increase the value for money of public and private investments in sustainable, low-carbon transport.

To pursue the ambitions outlined in this paper, a collaborative approach to transport planning and implementation is needed at all levels of government. Coordinated strategies foster integration among diverse actors, ensuring that local, regional and national entities work together to implement comprehensive transport solutions.

This paper outlines the issues inherent to applying conventional models for appraising the economic value of land transport investment proposals. It also highlights the financial and economic value of public transport, walking, and cycling, and provides guidance to evolve conventional economic appraisals for land transport in support of sustainability and decarbonisation goals. Finally, an appendix compiles an overview of some economic appraisals for sustainable low-carbon transport.

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# Usual issues with conventional economic appraisals for land transport

Economic appraisals for land transport still commonly take a conventional approach, considering only the direct costs and benefits, mainly from saved travel time.[2] In doing so, they tend to favour decisions to invest in private motorisation, large infrastructure and single-mode transport solutions. These decisions tend to work against sustainable, low-carbon transport solutions. As a result, it hinders scaling up investments in activities that promote equitable access to transport and deliver broader societal and environmental benefits.

The issues surrounding conventional economic appraisals for land transport can be summarised in four major groups:

1. Narrow scope of the methods used for the quantitative analysis
2. Disconnect between the investor and beneficiaries
3. Absent or limited economic valuation of so-called intangible benefits
4. Limited systemic vision and integration of knowledge across different stakeholder groups.

## Issue 1 Narrow scope of the methods used for the quantitative analysis

Investments in sustainable, low-carbon land transport infrastructure offer people improved connectivity and access to services. From this, several other benefits emerge, including indirect and induced benefits such as income creation from better employment opportunities.[3]

The approaches to implement sustainable, low-carbon transport and the derived outcomes are very comprehensive and integrated; however, the methods and models currently used to inform investment decisions for transport infrastructure often remain narrowly focused. They primarily consider i) capital and operations and maintenance costs, and ii) performance indicators of the transport infrastructure (e.g. ridership, revenue generation).[4] To better reflect the comprehensive

nature of the **direct, indirect and induced benefits of sustainable, low-carbon transport**, additional indicators should be considered.[5] This broader approach will enhance the appreciation of the societal contributions derived from investments in sustainable, low-carbon transport, including their **economic value**.[6]

## Issue 2 **Disconnect between the investor and beneficiaries**

Investments in infrastructure (especially public infrastructure) are typically centralised and made by a single organisation or entity. However, the benefits of sustainable infrastructure, including for transport, are often shared among many beneficiaries.[7] As a result, sustainable infrastructure often does not generate enough benefits for a single investor, although it generates considerable **benefits for society as a whole**.[8]

The challenge is to develop planning and financing strategies that involve **multiple actors** who are also the beneficiaries of the investment. In this regard, **coordinated action and cross-sectoral performance indicators** at the policy level may be required, in order to embed more benefits into the performance reporting and to allow multiple actors to realise monetised benefits **(see Box 1)**.

### **BOX 1.** Consideration of different beneficiaries in project appraisals: net zero transport strategy in Indonesia

The Sustainable Asset Valuation (SAVi) methodology, developed by the International Institute for Sustainable Development (IISD), was applied to a national net zero transport strategy in Indonesia. Interventions such as investing in public transport, electrifying private vehicles, teleworking and decarbonising the electricity supply were identified and compared from the perspectives of different groups of beneficiaries.

The resulting benefit-cost ratios* (BCRs) aimed to demonstrate the value for money for all groups. The analysis indicated that households and citizens benefit from reduced air pollution, lower energy costs, and fewer accidents; businesses benefit from reduced time of travel and employment creation; and the government benefits from increased tax revenues and avoided investments in conventional transport infrastructure.[9]

The SAVi methodology takes into account social and environmental impacts that are often overlooked in a conventional valuation and provides a more holistic understanding of the value of sustainable transport infrastructure.[10]

* The benefit-cost ratio (or cost-benefit ratio) is a systematic approach used to assess the value for money of an activity by dividing the value of its benefits by the costs incurred. Source: K.S.U. Jayaratne (2013), "Learn how to analyze cost-benefits of extension programming", https://evaluation.ces.ncsu.edu/wp-content/uploads/2013/04/Learn_How_to_Analyze_Cost_Benefits.pdf.

This means that transport planning departments and investors should both look beyond the direct transport beneficiaries and involve other stakeholders that may benefit from sustainable transport investment (Table 1). For instance, establishing joint planning and more coordinated responsibility for health, equity, job creation and land transport in public administrations and investors (for example, through a high-level strategy or framework) will result in accounting for the health, equity or job creation benefits from land transport in the overall assessment.

**TABLE 1.** **Selected impacts of sustainable transport investment and their relevance across local actors**

| Investment | Impacts | Actors benefiting | | | Examples |
|---|---|---|---|---|---|
| | | Government | Private sector | Households | |
| Active mobility | Physical activity and related health benefits | ✓ | ✓ | ✓ | **Private sector:** reduced sick leave of employees |
| | Reduced air pollution and related health costs | ✓ | ✓ | ✓ | **Governments:** reduced costs for public health |
| | Reduced fuel use and related carbon dioxide ($CO_2$) emissions | | ✓ | ✓ | **Households:** reduced expenditure on transport |
| | Increased property price and retail revenues | ✓ | ✓ | (✓) | **Private sector:** increased revenue Households: benefits for property owners; might have negative impact on people renting |
| | Reduced travel time | | ✓ | ✓ | **Households:** more time for other activities |
| | Reduced traffic crashes | ✓ | | ✓ | **Governments:** reduced health burden |
| Bus rapid transit and mass rapid transit systems | Reduced air pollution and related health costs | ✓ | ✓ | ✓ | **Households:** improved health |
| | Increased property price and retail revenues | ✓ | ✓ | ✓ | **Private sector:** more customers leading to more revenue |
| | Reduced fuel use and related $CO_2$ emissions | | ✓ | ✓ | **Households:** reduced expenditure on transport |
| | Reduced travel time | | ✓ | ✓ | **Private sector:** higher accessibility by more employees or customers |
| | Reduced traffic crashes | ✓ | | ✓ | **Households:** reduced potential financial burden |
| | Employment creation | ✓ | ✓ | ✓ | **All:** higher employment resulting in more disposable income and higher spending levels |
| | Revenues from bus rapid transit use | ✓ | | | **Governments:** higher revenue |
| Transport electrification | Reduced air pollution and related health costs | ✓ | ✓ | ✓ | **Households:** improved health |
| | Reduced fuel use and related $CO_2$ emissions | | ✓ | ✓ | **Private sector:** reduced costs for transport of goods or services |

## Issue 3 **Absent or limited economic valuation of so-called intangible benefits**

Often, some benefits are considered "intangible" simply because they have not been measured and hence are **not valued by the system**. This might especially be the case in low- and middle-income countries where data gaps are more prevalent. Moreover, the way in which benefits are measured can result in devaluing some transport solutions. For instance, distance and travel time are highly valued parameters and thus walking "loses" over other mobility modes.

An additional challenge to investing in sustainable, low-carbon transport infrastructure is that many benefits do not generate **direct cash flows**, despite achieving other desirable goals.[11] For example, expanding the public transport network or electrifying transport with renewable energy reduces emissions and air pollution. Improved air quality results in fewer respiratory diseases, lower health costs, and reduced income loss, especially in urban areas with high air pollution levels. While these avoided costs benefit society (see section 3 for specific examples), they do not represent direct cash transfers unless policies are introduced to put a price on emissions and air pollution.[12]

By expanding the analysis to include the **quantification and economic valuation of broader sustainability outcomes**, the magnitude and relevance of these outcomes can be assessed (see Box 2). This can offer valuable insights for **policy formulation** and evaluation, and ultimately inform **investment decisions**. Applying broader sustainability assessments also lowers project risks and helps to build a stronger case for the close integration of public transport, walking and cycling. For instance, demonstrating positive economic returns for the government due to reduced costs in human health and higher labour productivity can contribute to decisions in favour of higher investments in sustainable, low-carbon transport solutions.

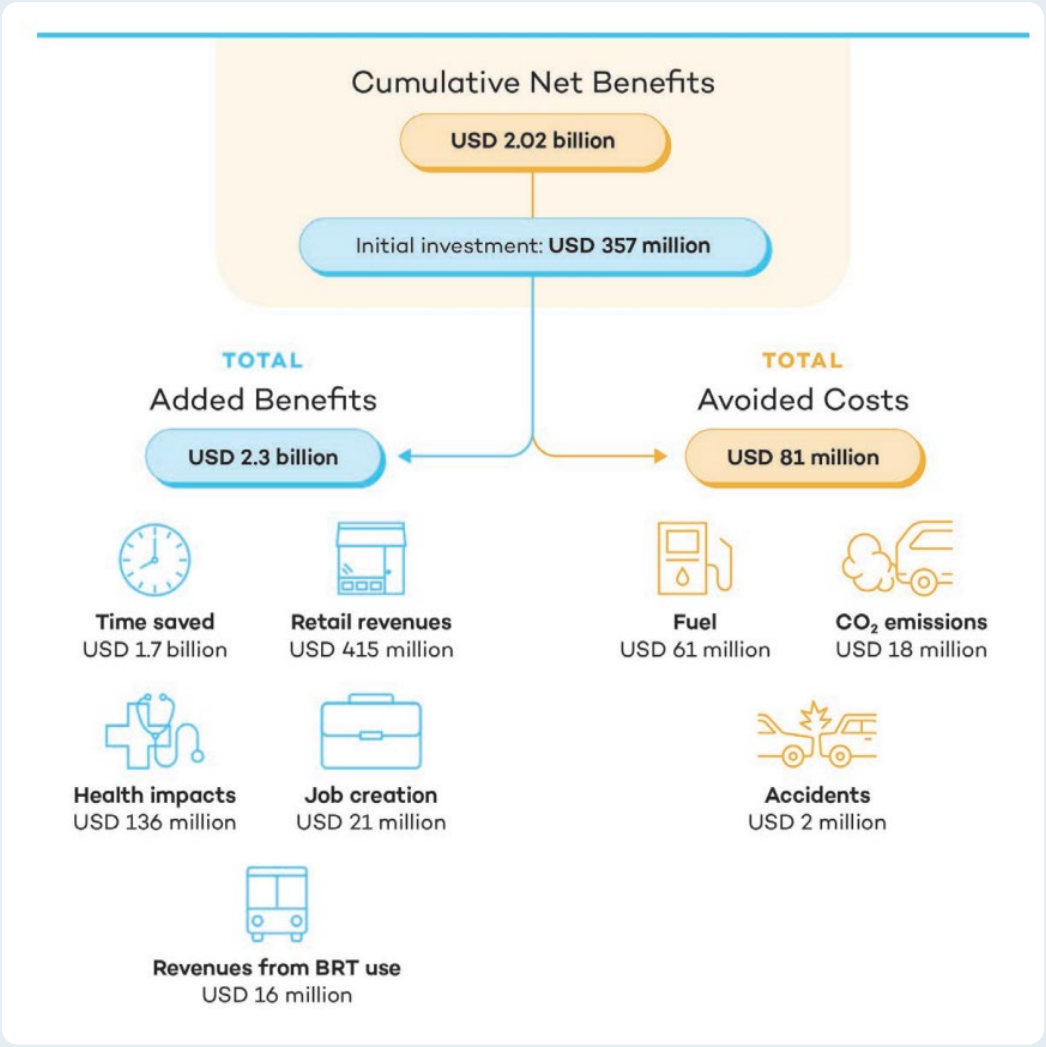
### BOX 2. Role of social and economic benefits: bus rapid transit (BRT) in Bandung, Indonesia

The BCR for the Bandung BRT system varies greatly depending on what is being measured.

When only conventional impacts are considered – such as investment and costs, revenues from BRT, income creation from employment and avoided cost of fuel use – the BCR is 0.3. So, for every USD 1 invested, the project generates USD 0.30.

In contrast, when the wider benefits and their economic valuation (based on the SAVi methodology) are included, the BCR is in the range of USD 6 to USD 7 per dollar invested. The wider impacts through the SAVi methodology include, in addition to the value of time saved, also the added retail revenues and added health benefits, among others.[13]

**FIGURE 2.** Overview of benefits and costs for BRT in Bandung, Indonesia




## Issue 4 **Limited systemic vision and integration of knowledge across different stakeholder groups**

The issues described above highlight the need for more systemic and integrated approaches. However, this is challenging in practice.

To get to a systemic approach, **multi-stakeholder sources of information and knowledge** are required across experts, local stakeholders and decision makers from different professional fields – such as engineers, planners, infrastructure developers, economists, etc. – who may have varying visions for the future. In a multi-stakeholder group, it is often difficult to gather and share information, interpret it objectively, and work towards optimising the whole system, rather than prioritising the performance of individual parts.

Working at the **systems level** implies that, at times, the goals of a single part are put aside to realise a stronger overall performance. This requires inclusive, transparent and participatory **multi-stakeholder engagement**. It also requires a robust and ambitious **guiding vision and/or strategy** and **political commitment** that galvanises multi-stakeholder collaboration and overcomes the inherent status quo bias in data as well as perceptions. A guiding vision from the highest government authority, committed to sustainable, low-carbon transport and the integration of walking, cycling, and public transport solutions, is essential.

**Knowledge integration** enables the identification, quantification and assessment of the **mutually reinforcing benefits** of implementing integrated walking, cycling and public transport solutions. For instance, better walking environments lead to increased public transport use, which in turn generates higher returns for public transport operators, thus improving the fiscal viability of public transport.

Overcoming these recurrent issues present in conventional economic appraisals for land transport is critical to improving both institutional frameworks, and policy and investment decision making. Considering the economic value of social and environmental impacts will provide more comprehensive and complete evidence on the economic viability of sustainable, low-carbon transport solutions, reduce risk and lower financing costs. It will also highlight synergies in economic development and prosperity objectives, thus increasing the bankability of such transport solutions. The conceptualisation and implementation of systemic transport approaches requires multi-stakeholder engagement and integrated knowledge and policy creation.

3

## The robust economic case for investing in public transport, walking and cycling

Economic appraisals based on broad sustainability criteria demonstrate how public transport, walking and cycling offer a **high return on investments**. The economic case for public transport, walking and cycling has been well verified through scientific research and is visible in many practical case studies (see Box 3).

A transport system based on public transport, walking, and cycling requires half of the transport spending from governments and individuals compared to a car-centric system, even without accounting for improved health and increased productivity.[14] In terms of $CO_2$ emissions, integrated public transport, walking and cycling solutions greatly reduce emissions at a much lower cost per unit of $CO_2$ compared to individual projects.[15]

### BOX 3. Economic, environmental and social benefits related to public transport, walking and cycling[16]

- Reduction in average household expenditure in transport, as a result of the avoided costs associated with car ownership such as purchase price, maintenance, fuel, parking and insurance.
- Time savings from avoided or reduced traffic congestion and increased economic productivity.
- Improved air quality and reduced noise pollution.
- Lower greenhouse gas emissions.
- Improved health through more physical activity, better air quality, less noise pollution, and fewer road deaths and injuries.
- Improved access for people with disabilities through inclusive design.

- Higher perception of individual safety in public spaces for women and girls and vulnerable groups.
- Savings for governments from reduced car infrastructure and fossil fuel subsidies.
- Higher property values and municipal revenues due to increased gains from property taxes and value capture. The risks of gentrification and displacement must be addressed.
- Improved use of public space and less soil sealing.

Every USD 1 invested in **public transport** yields economic benefits worth USD 5 in returns.[17] The benefits relate to job creation, reduction of global greenhouse gas emissions and lower community costs (i.e. expenses by public authorities and governments) compared to private transport (see Box 4).[18] The community costs of private transport are 28 times higher than the costs of public transport travel. Investing in public transport reduces global emissions by 20-45%, and doubling public transport capacity can halve transport emissions in cities. Moreover, it is estimated that 4.6 million additional jobs could be created in nearly 100 major cities alone with improved and expanded public transport services.[19]

## BOX 4. The economic case for public transport in the United States

The American Public Transportation Association (APTA) has collected key facts on public transport in US cities:

- Investing USD 1 billion in public transport can create around 50,000 jobs.
- A capital investment of USD 10 million in public transport can generate an additional USD 30 million in business sales.
- Operating investments of USD 10 million in public transport can result in an increase of USD 32 million in business sales.
- Home values are up to 24% higher in areas near public transport compared to areas without public transport access.
- Public transport saves 22.7 billion litres of petrol each year and reduces the nation's greenhouse gas emissions by 63 million tonnes of $CO_2$-equivalent annually.[20]

In the case of **walking**, studies suggest a benefit-cost ratio (BCR) ranging from 1.3:1 up to 20:1.[21] While the greatest monetary gains of walking projects are found in health benefits[22] through more physical activity and reduced air pollution (as well as reduced $CO_2$ emissions; see Box 5), walking projects also stimulate the local economy as people that walk spend significantly more than commuters that use motorised transport modes.[23] Barrier-free pedestrian infrastructure offers substantial benefits, yet these benefits remain largely unquantified.[24] Most importantly, walking is the beginning and end of every trip and serves as the key feeder to public transport.

## BOX 5. The economic case for reducing $CO_2$ emissions through walking in Bogotá, Colombia

Although few studies have focused on the impact of walking on $CO_2$ emissions, a research paper has quantified the relative emission benefits of individual and combined transport modes in Bogotá, Colombia. The study found that increasing the share of walking has the highest impact on $CO_2$ emissions reductions at the lowest cost, among the implementation scenarios for each transport mode.

Increasing the share of walking in all travel activities from 20% to 25% could reduce annual transport emissions by 6.9%, at a cost of USD 17 per tonne of $CO_2$. A combined implementation of bus rapid transit, walking and cycling would yield reductions of 25% at a cost of USD 30 per tonne of $CO_2$.[25]

The economic case for **cycling** has been demonstrated by studies showing an average BCR ranging from 2:1 to 19:1, depending on the analysis method and assumptions.[26] Individual project analyses have shown even higher economic benefits, such as USD 54.1 for every USD 1 invested in the Randwick-Sydney cycling route in Australia.[27] Analysis specific to healthcare benefits and fuel savings revealed a BCR ranging from USD 1.2 to USD 3.8 for every USD 1 invested in cycling.[28] Investments in cycling present major economic opportunities in bicycle and parts manufacturing, bicycle retail (sales, repair and services), infrastructure development (including shared services) and bicycle tourism (see Box 6).[29]

## BOX 6. Impacts of cycling infrastructure improvements in Sydney, Australia

A first-known attempt to estimate the economic impact of improvements to cycling infrastructure on cycling demand at a network level in Australia examined the development of the Inner Sydney Regional Bicycle Network. The study found that health benefits and journey ambiance account for 41% of the total benefits for the project. Even without these benefits, the bicycle network produces net benefits.[30]

Much of the literature focuses on **active mobility**, combining efforts on cycling and walking. The BCR resulting from appraising active mobility with sustainability criteria ranges from 1.3:1 up to 19:1, again with health benefits being central.[31]

Fewer studies focus on the economic case for **integrated public transport, walking and cycling solutions**. Based on several projects in Argentina, China, Peru, Tanzania, and the United Kingdom, such integrated approaches deliver a BCR of 1.1 to 4.5 for every USD 1 invested. The identified benefits include improved accessibility, congestion relief and localised safety benefits.[32]

Table 2 summarises the positive economic case for investments in public transport, walking and cycling. It is a summary of identified case studies and research, acknowledging that each case study is based on different calculation methodologies and responds to a given context. The benefits dominate greatly over the costs. Integrated public transport, walking and cycling solutions exponentially multiply such benefits.

A detailed overview of collected case studies and materials can be found in Appendix B.

**TABLE 2.** Economic case for investments in public transport, walking and cycling solutions[33]

| Transport mode | Return on investment range | Benefits most often evoked |
|---|---|---|
| **Public transport** | Every USD 1 invested returns USD 5 | **Avoided CO2 emissions**<br>• Mexico City bus rapid transit saves 26,000 tonnes per year. |
| **Cycling** | Every USD 1 invested returns between USD 2 and USD 19 | **Health benefits**<br>• Estimated annual value of USD 80 billion in Europe.[34]<br>• Patna, India saves an estimated USD 166 million per year and averts 755 premature deaths per year.[35]<br>Fuel cost savings |
| **Walking** | Every USD 1 invested returns between USD 1.3 and USD 20 | **Longer and healthier lives**<br>**Job creation**<br>• Walking projects create on average 9.9 jobs per USD 1 million invested.[36]<br>**Transport cost savings**<br>• People walking to city centres spend on average 40% more than those arriving by car.[37] |
| **Active mobility (combined walking and cycling)** | Every USD 1 invested returns between USD 1.3 and USD 19 | **Job creation**<br>• Cycling projects generate on average 11.4 jobs per USD 1 million invested.[38]<br>**Health benefits**<br>• Interventions in London of USD 105 million investment would generate USD 950 million in health benefits after 20 years.[39]<br>**Avoided costs of crashes**<br>• Addis Ababa, Ethiopia projects 80% fewer pedestrian and cyclist fatalities once the non-motorised transport strategy is implemented.[40] |
| **Integrated public transport, walking and cycling** | Every USD 1 invested returns between USD 1.1 and USD 4.5 | **Improved access**<br>**Congestion relief**<br>**Safety benefits**<br>• An urban transport improvement project in Tianjin, China reduced crashes involving cyclists or pedestrians by 8%.[41] |

4

# Four recommendations to decision makers to evolve conventional economic appraisals for land transport

Four key recommendations are proposed to decision makers to evolve conventional economic appraisals for land transport towards broad sustainability criteria. This would enable more accurate valuation of the financial and economic case for investing in integrated public transport, walking and cycling solutions. These recommendations have emerged from both a literature review and an assessment of good practices. Each recommendation is accompanied by an example of a practical tool.

**Recommendations to evolve conventional economic appraisals for land transport:**

1. Establish suitable policy and institutional frameworks.
2. Standardise comprehensive and integrated economic appraisal approaches and tools.
3. Build multi-stakeholder engagement in the economic appraisal process.
4. Quantify and monetise all costs and benefits.

Recommendations 1 and 3 relate to the context or enabling environment needed to consistently apply economic appraisals based on broad sustainability criteria. Recommendations 2 and 4 focus on evolving the economic appraisal methods. All recommendations should be implemented in parallel and in a mutually reinforcing manner.

## Establish suitable policy and institutional frameworks

- Create an enabling environment for sustainable transport investments.
- Signal clear policies with phased implementation mechanisms.
- Develop an ambitious vision to drive multi-stakeholder action.
- Apply systemic and integrated frameworks across planning and financing strategies and procurement.
- Enhance horizontal and vertical multi-stakeholder coordination and cross-sectoral performance indicators.

## Standardise comprehensive and integrated economic appraisal approaches and tools

- Identify challenges and opportunities, and assess social, economic, and environmental outcomes over time.
- Use a mix of methods (Cost-Benefit Analysis, Cost-Effectiveness Analysis, Multi-Criteria Analysis).
- Factor in normative and political choices, as well as data limitations.

## Build multi-stakeholder engagement in the economic appraisal process

- Ensure inclusive, transparent, and participatory stakeholder engagement.
- Expand performance indicators to build broad support for projects.
- Leverage local knowledge to improve data quality and assessment.

## Quantify and monetise all costs and benefits

Advance Cost-Benefit Analysis to cover:

- Financial performance (project-specific cash flows).
- Holistic economic performance (social and environmental impacts).
- Financial and economic returns for all actors (i.e. private sector, government, and citizens).

RECOMMENDATION 1

## Establish suitable policy and institutional frameworks

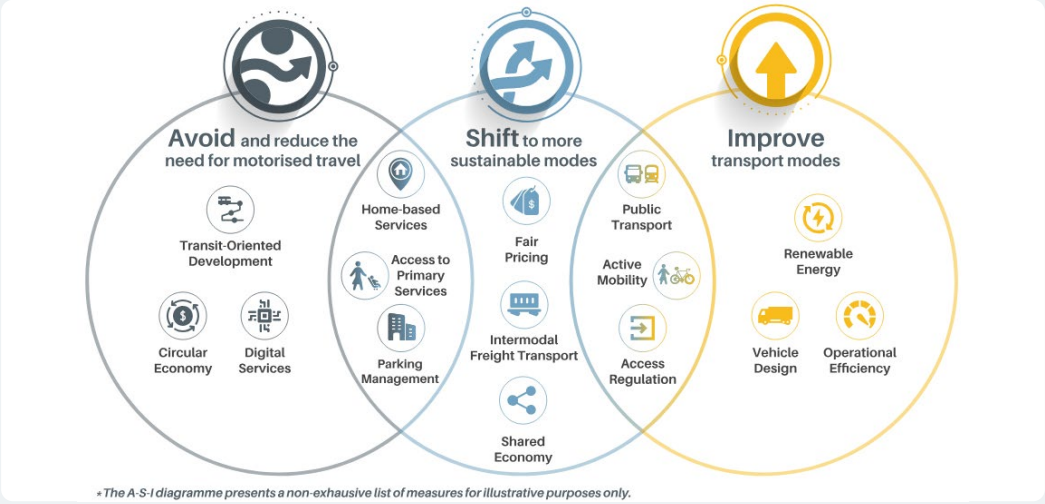
Policy and institutional changes can create an **enabling environment** for investments in sustainable, low-carbon transport. Sending the right **policy and institutional signals** and adopting phased implementation mechanisms from the short- to the long-term will incentivise transport economists to embed in their economic appraisals the appropriate sustainability criteria (see Recommendation 4) and lead to the development and wide adoption of standardised, comprehensive and integrated economic appraisals and tools (Recommendation 2). One example of a policy signal is the prioritisation of the sustainable transport hierarchy in the Wales Transport Strategy of 2021, which was subsequently used to align the Welsh Transport Appraisal Guide in 2024.[42]

Efforts should focus on achieving a **robust and ambitious guiding vision – preferably established by national governments** – that can galvanise multi-stakeholder action. Raising awareness among decision makers of **systemic and integrated frameworks** for sustainable, low-carbon land transport is key. While these frameworks should be based on best practices, it is essential to customise them to the local context.[43] For example, the *Avoid-Shift-Improve Framework* can offer a structured approach to reducing carbon-intensive transport activities and their inducers, as well as to integrating public transport, walking and cycling solutions (see Box 7).

### BOX 7. Avoid-Shift-Improve Framework[44]

The Avoid-Shift-Improve Framework for sustainable, low-carbon transport[45] provides comprehensive and clear entry points to *avoid* and reduce the need for unnecessary motorised transport while guaranteeing access to transport, *shift* to more sustainable modes, and *improve* the vehicle design, energy efficiency and energy sources. This framework also supports the identification of the direct and indirect benefits generated when implementing each approach.[46]

FIGURE 1. The Avoid-Shift-Improve Framework for sustainable, low-carbon transport



The sustained application of such frameworks across **planning and financing strategies**, as well as **procurement processes**, can ultimately lead to the **phase-out of fossil fuel subsidies** and the adjustment of financing mechanisms (taxes, costs and prices) to favour integrated public transport, walking and cycling solutions.

Policy and institutional frameworks that are conducive to sustainable, low-carbon transport investments should be co-created leveraging the multi-stakeholder approach. This may require **horizontal and vertical multi-stakeholder coordination** and **cross-sectoral performance indicators** at the policy level. Lessons can be learned from the horizontal and vertical coordination used in Sustainable Urban Mobility Plan (SUMP) approaches, as shown in examples from Malmö (Sweden), Utrecht (the Netherlands) and Yaoundé (Cameroon).[47]

Experts from different fields, government departments and levels of government should contribute their respective priorities (e.g. health, welfare, job creation, equity, etc.) to the systemic, integrated vision for sustainable, low-carbon land transport. This in turn will support the development of more robust sustainability criteria (Recommendation 4). For instance, establishing joint planning and more coordinated responsibility for health and transport, or equity and transport, or job creation and transport in public administrations and investors will result in requiring accounting for the health, equity or job creation benefits of different land transport solutions in the overall economic appraisal of a project.

RECOMMENDATION 2

## Standardise comprehensive and integrated economic appraisal approaches and tools

It is recommended to **standardise the approach and tools used for integrating broad sustainability criteria** in an economic appraisal beyond conventional approaches. This can be achieved by i) defining challenges, ii) identifying opportunities, and iii) determining social, economic and environmental outcomes, for different stakeholders over time. Examples and guidance materials are presented in Box 8.

### BOX 8. Illustrative example of how to evolve conventional economic appraisals

- Focus on **people and goods** instead of vehicles.
- Focus on the **transport system** instead of on infrastructure.

To respond to the Avoid-Shift-Improve Framework, the set of indicators used in economic appraisals for land transport projects needs to capture, where relevant, aspects such as the following:

## INDICATORS TO MEASURE *AVOID*

- Improvements in proximity planning:
  Urban population density (people per square kilometre)
  Distance to services
- Impact on transport demand: passenger-kilometre, tonne-kilometre, vehicle-kilometre
- Changes in motorisation: vehicle ownership rates
- Walking and cycling activity: distance and time spent walking and/or cycling
- Improvements of access to opportunities (via catchment areas or travel time): access to markets, education and jobs, employment opportunities directly through the project

## INDICATORS TO MEASURE *SHIFT*

- Impacts on modal split:
  % of trips by collective transport, walking and cycling
  % of goods transported by rail or waterways
- Access to public transport and active mobility: % of population that has convenient access to public transport and to safe and convenient walking and cycling infrastructure
- Travel time changes: average time of travel per day
- Attractiveness of collective transport:
  Amount of people transported
  % of women feeling safe using collective transport
  % of vehicle fleet/stops and stations that are accessible to people with disabilities
- Impacts on costs:
  Changes in transport expenses for households
  Changes in the freight transport costs for operators
- Access to all-weather roads in rural areas: % of the rural population who live within 2 kilometres of an all-season road

## INDICATORS TO MEASURE *IMPROVE*

- Uptake of fleet electrification: % of fleet that is/can be electrified
- Improvements in efficiency:
  People and goods transported on corridor per hour
  Fleet energy consumption in megajoules per kilometre
- Renewable energy uptake:
  % of energy provided through renewable electricity
  Volume of advanced biofuels
- Road safety-focused infrastructure and service improvements: number of traffic fatalities and injuries compared to exposure (volume of different mobility modes)

## ADDITIONAL OVERARCHING INDICATORS

- Avoided fuel use: barrels of oil avoided
- Greenhouse gas emissions avoided or reduced: absolute emissions in tonnes of $CO_2$-equivalent and well-to-wheel transport emissions in grams of $CO_2$ per kilometre
- Improvements to air quality: particulate matter ($PM_{10}$ and $PM_{2.5}$) pollution levels
- Improvements in mobility-related noise levels: % of population exposed to mobility-related noise over specific decibel (dB(A)) levels
- Increase of physical activity: minutes of moderate-intensity physical activity per week
- Improvements in adaptation and resilience:
  Infrastructure resilience
  Transport adaptation towards extreme weather events
- Enhancement of just transition: number of new jobs created and people trained, % of women in the workforce
- Improvement of gender responsiveness:
  % of women feeling safe commuting/travelling
  % of women employed in the project
  Access of women through the project

To fully capture the social, economic and environmental impacts of sustainable, low-carbon land transport projects, it is essential to **use several methods and to develop a diverse set of models**. No single model offers a complete overview of all relevant indicators. For example, the SAVi methodology uses systems thinking, system dynamics simulation, spatial modelling, and project finance modelling, all integrated into a single analytical framework. **Cost-benefit analysis** (CBA) and **cost-effectiveness analysis** (CEA), together with **multi-criteria analysis** (MCA), can be used to assess the economic viability of a project (see Box 9):

- CBA provides information on the financial and economic (i.e. societal) viability of the investment.
- CEA determines value for money when a specific target needs to be realised.
- MCA allows for the use of an integrated set of indicators in the analysis, even if some of these cannot be quantified.

Ideally, the methods and tools used should be open-source and easily accessible. Otherwise, stakeholders with limited resources may find it difficult to apply them.

Appraisal criteria and perspectives are always influenced by **normative and political choices** on which criteria to include and what weight to attach to each of them. Additionally, any appraisal relies on **input data**, which may be biassed or not fully representative of all relevant aspects. Therefore, it is crucial to raise decision makers' awareness of these limitations. This will ensure the long-term impact and effective adoption of evolved economic appraisals for land transport.

### BOX 9. Methods and models for multi-modal, integrated analysis of walking and cycling in urban environments: the FLOW project

The FLOW project aimed to show that walking and cycling can be put on an equal footing to solutions around motorised modes of transport when it comes to reducing urban congestion. This was accomplished by enhancing existing transport modelling tools and creating a new impact assessment tool to evaluate the effects of walking and cycling activities on urban transport network performance, including congestion, as well as other socio-economic factors.

The major strength of the FLOW assessment is the integration of the congestion reduction potential of walking and cycling while considering environmental, social and economic aspects within a single integrated tool. This approach enables the measurement of impacts on transport network performance, environment, society and economy for all transport modes, surpassing current practices with its innovative approach.

The FLOW assessment procedure involves three key steps: 1) developing an integrated target system based on city objectives, 2) determining indicators for assessment, and 3) using comprehensive approaches such as MCA, WBA, CBA and Qualitative Appraisal to aggregate the impacts of walking and cycling measures. This methodology covers both qualitative and quantitative impacts, applicable for both pre- and post-evaluations, allowing the assessment of both infrastructure and soft measures, developed iteratively with input from project partner cities.[48]

RECOMMENDATION 3

## Build multi-stakeholder engagement in the economic appraisal process

The economic appraisal process should ensure the inclusive, transparent and participatory **engagement of all relevant stakeholders**, including municipal, regional, and national governments, private sector actors, non-governmental organisations, local communities and civil society.[49] Engaging with these diverse actors enables better identification of issues and solutions, and thus of the **key performance indicators** to include in the economic appraisal and assessment (see Box 10). It also supports the creation of a **broad and representative support base** for the project, countering and challenging the leverage that lobbies would normally be able to exert on decision makers. The economic appraisal process is even more robust if the key performance indicators of different officers and departments include the existence of such a broad and representative support base.

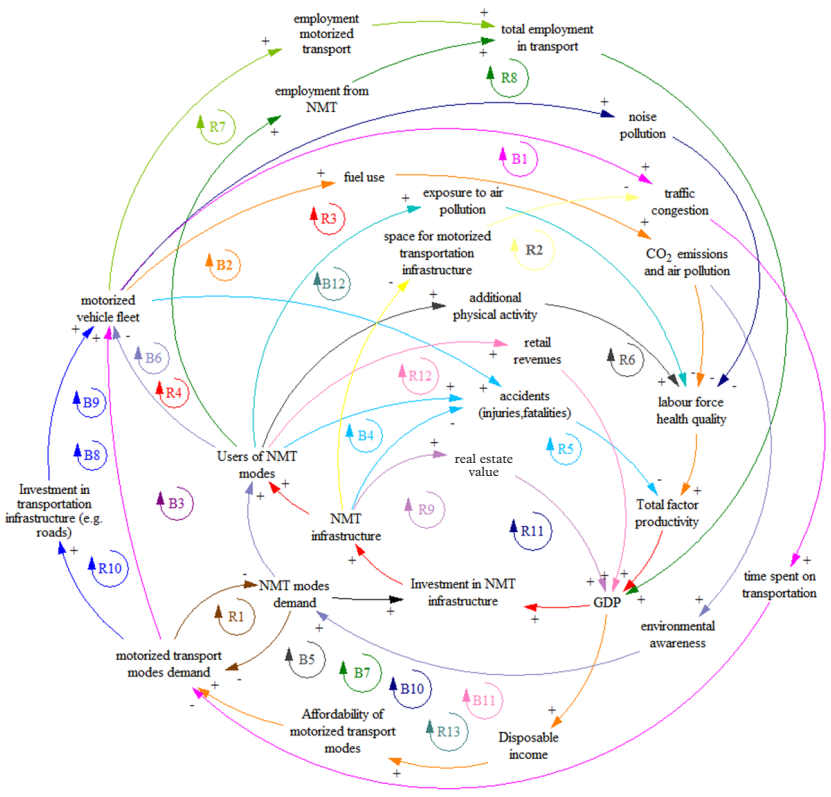
The **local knowledge** provided by relevant multi-stakeholder groups can also support the collection and interpretation of data, reducing reliance on assumptions based on secondary data, and hence improving the **reliability of the overall assessment** performed. It ensures that the local context is adequately reflected, avoiding generalisations based on standardised assumptions that would otherwise lead to suboptimal planning.

## BOX 10. Co-creation in action: using Causal Loop Diagrams to map the non-motorised transport network in Coimbatore, India

Causal Loop Diagrams (CLD) are systems thinking maps that are co-created with local stakeholders and help integrate different views, knowledge and data in a specific context. CLDs can facilitate the co-creation process by capturing and visually demonstrating the multiple economic, social and environmental impacts of sustainable, low-carbon transport projects in a comprehensive way. The knowledge and data collection that results from this process with different stakeholders can then feed into the economic and financial analysis of the project.

An example of a CLD from a walking and cycling network project in Coimbatore, India can be seen in Figure 3. The wide range of economic, social and environmental impacts shown in the CLD are imperative in the economic viability of the project.[50]

**FIGURE 3.** Causal Loop Diagrams for the non-motorised transport network in Coimbatore, India



RECOMMENDATION 4

## Quantify and monetise all costs and benefits

Planners, engineers and policy makers should avoid using only conventional methods, such as cost-benefit analysis, when appraising and assessing sustainable, low-carbon land transport projects. This is especially the case when decision makers are limited to financial indicators that consider solely the direct costs and benefits of a project and only scratch the surface of its **full sustainability and decarbonisation potential**.

In sustainable, low-carbon land transport projects, the economic and social impacts are often more prominent than the revenues collected and budgets invested. Therefore, it is crucial to **identify, quantify and analyse** (**e.g. via economic valuation**) **all impacts** surrounding a project, including the social and environmental impacts.[51] The lack of data should not prevent the creation of a comprehensive assessment. Methods and models exist to facilitate this analysis, including to assess the variability of results under different assumptions **(see Box 11)**.

### BOX 11. Health Economic Assessment Tool (HEAT) for walking and cycling[52]

A best practice for quantifying and monetising wider benefits is the Health Economic Assessment Tool (HEAT) developed by the World Health Organization. HEAT is a web-based tool that estimates the health and economic impacts of walking, cycling and electric cycling. The tool was launched in 2009, and the current version, as of August 2024, is HEAT v5.2.0.

The tool is mainly for transport and urban planners, traffic engineers and anyone working on transport, walking, cycling or the environment. Assessments are possible on the national and local levels, and the tool ensures minimal data input requirements through the availability of default values.

The main benefits of the tool are that it calculates the mortality benefits of regular physical activity from walking or cycling. It also integrates the effects of air pollution and crashes on mortality. The carbon emissions for shifting from motorised travel to walking or cycling are also shown.

The HEAT tool can expand appraisals by providing estimates of direct benefits from walking and cycling.

This means that **an evolved cost-benefit analysis has to be performed by considering:**

- **Financial performance** – i.e. using cash flows directly related to the project.
- **Holistic economic performance** – i.e. adding the economic valuation of all social and environmental impacts to determine the broad societal contribution of the project.
- **Financial and economic returns by economic actors** – i.e. including private sector, government and citizens.[53]

These considerations determine:

- The **financial sustainability** – the sustainability of the project for the investor.
- The **economic sustainability, including all costs and benefits** – the contribution of the project to sustainable human development and prosperity.
- The **formulation of the most adequate financing strategy** – whether the project generates sufficient positive impacts for all beneficiaries.

Important **concepts related to sustainable development**, such as transport poverty (i.e. the lack of adequate transport services necessary to access general services and work, or the inability to pay for these transport services[54]) can be more explicitly considered in the analysis when using a systemic, or societal approach, especially in relation to the interpretation of the CBA results.

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## APPENDIX A.

# Overview of economic appraisals for sustainable, low-carbon transport

As shown, economic appraisals should use a comprehensive and integrated approach, in alignment with the multi-dimensional impacts generated by investments in sustainable, low-carbon transport. Also, an adequate framework should include social, economic, and environmental indicators, ensure multi-stakeholder engagement, and develop a cost-benefit analysis that highlights the financial and economic viability of the project, and the extent to which it generates value for different stakeholders.

This section compiles some useful resources (see Table 3), as well as an activity checklist to embark on the appraisal of sustainable, low-carbon transport investments (see Box 12).

**TABLE 3.** **Overview of some resources for the economic appraisal of sustainable, low-carbon transport**

| Resource | Entity | Key indicators, principles and frameworks | Key methodologies or tools |
|---|---|---|---|
| 2nd Edition Sustainable Urban Mobility Plan (SUMP) Guidelines | Rupprecht Consult | ✓ | |
| Avoid-Shift-Improve Framework | SLOCAT | ✓ | |
| Emissions Calculator and the MRV Framework | MobiliseYourCity | ✓ | |
| EU Taxonomy for Sustainable Transport | European Commission | ✓ | |
| FLOW Impact Assessment Tool | CIVITAS | | ✓ |
| Global Tracking Framework | Sustainable Mobility for All (SuM4All) | ✓ | |
| Green Leadership in Transportation and Environmental Sustainability (GreenLITES) | New York State Department of Transportation | | ✓ |
| Greenroads Rating System | Sustainable Transport Council | | ✓ |
| Health Economic Assessment Tool (HEAT) | World Health Organization | | ✓ |
| National Air Toxics Assessment (NATA) | US Environmental Protection Agency | | ✓ |
| Sustainable Asset Evaluation (SAVi) | International Institute for Sustainable Development | | ✓ |
| Sustainable Transport Appraisal Rating (STAR) | Asian Development Bank | ✓ | |
| Transport Sector Climate Action Co-benefits Evaluation Tool (TRACE) | NewClimate Institute | | ✓ |
| Welsh Transport Appraisal Guidance (WelTAG) | Government of Wales | ✓ | |

**BOX 12.**
## Steps for an evolved economic appraisal in support of integrated public transport, walking and cycling projects

1. Identify the key issue(s), objectives and related causes.
2. Identify key stakeholders of relevance to the issues and possible solutions.
3. Create a systems map (CLD) for the identification of all relevant indicators.
4. Review and adjust the list of key stakeholders of relevance to the issues and possible solutions.
5. Work with the multi-stakeholder group to identify key performance indicators.
6. Work with a multi-disciplinary research team to collect and verify data, and explore interconnections across key performance indicators.
7. Verify data and assumptions.
8. Formulate scenarios.
9. Create customised simulation models and analyse their results with the multi-stakeholder group, with support from the multi-disciplinary research team.
10. Discuss and present preliminary results.
11. Revise the analysis as needed, and formulate a communication and outreach strategy.
12. Present the final results and publish the reports.

## APPENDIX B.

# Studies in support of the economic case for public transport, walking and cycling

The following overview shows all the studies and case studies that were integrated in Table 2.

| Mode | Study focus and geography | Benefit-cost ratio | Source |
|---|---|---|---|
| Cycling | Lima (Peru) | 19:1 | World Bank (2021), "What would happen if the bike was used more in Lima?" https://www.worldbank.org/en/news/infographic/2021/02/03/uso-bicicleta-lima-plan-bici-costos-beneficios. |
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| | Dedicated cycleway and network scale (complete cycling network) in Sydney (Australia) | 2.61:1 (cycleway); 3.42:1 (complete networks) | Standen, C. et al. (2019), "The value of slow travel: Economic appraisal of cycling projects using the logsum measure of consumer surplus", *Transportation Research Part A: Policy and Practice* 123: 255-268, https://doi.org/10.1016/j.tra.2018.10.015. |
| | Off-road bike path and green bridge in Utrecht (Netherlands) | 1.7:1 | van Wee, B. and M. Borjesson (2015), "How to make CBA more suitable for evaluating cycling policies", *Transport Policy* 44 (November): 117-124, https://doi.org/10.1016/j.tranpol.2015.07.005. |
| | Three dedicated bicycle infrastructure projects in Victoria, Kelowna and Halifax (Canada) | 1.7:1; 1.9:1; 2.1:1 | Whitehurst, D.G.T., DeVries D.N., Fuller D. and M. Winters (2021), "An economic analysis of the health-related benefits associated with bicycle infrastructure investment in three Canadian cities", *PLOS ONE* 16(4), https://doi.org/10.1371/journal.pone.0251031. |
| | EU PROMISING Project | 9:1 to 12:1 | Davis, A. (2014), "Claiming the Health Dividend: A summary and discussion of value for money estimates from studies of investment in walking and cycling", UK Department for Transport, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/371096/claiming_the_health_dividend.pdf. |
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