Making the case for investment in sustainable infrastructure with the SAVi methodology

IISD
International Institute for Sustainable Development

IISD's Sustainable Asset Valuation (SAVi) is an assessment methodology that helps governments and investors steer capital towards sustainable infrastructure and demonstrates how this can deliver better value-for-money for all.

Questions SAVi can answer for Governments & Cities

- How does environmental, social and economic performance increase value for money for taxpayers?
- Is sustainable infrastructure systematically more expensive to build? Can these costs be recuperated during the use phase?
- Do sustainable assets trigger more positive externalities such as higher GDP, Green GDP, employments, innovation, productivity, etc.?
- Will this asset help trigger sustainable development?

SAVi Methodology

Simulation

Based on systems thinking, system dynamics simulation, spatial modelling and project finance modelling.

Valuation

Developed by placing a financial value on economic, social and environmental externalities and risks.

Customization

Customized to reflect local conditions and needs.

Co-created through a multi-stakeholder approach that enables the identification of material risks and opportunities that are unique to the project.

Valuation: Cost of Externalities

SAVi identifies and values in financial terms the externalities that arise as a direct consequence of infrastructure projects.

Environmental: water and air pollution, greenhouse gas emissions, degradation or rehabilitation of land and habitats, deforestation or reforestation, biodiversity impact.

Social: Loss of traditional jobs, generation of new jobs, increase and decrease of wages, impacts on human health and health costs, effects on urbanisation trends and rural livelihoods, impacts on public space, social conflicts, contribution to education and skills building.

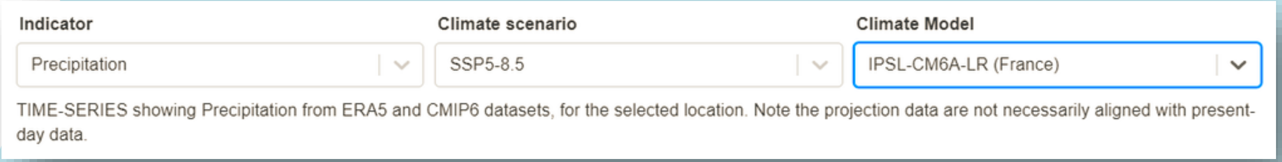
Economic: Contribution to economic development, effects on land and real estate prices, revenues in affected sectors, new trade opportunities, commercialisation and acceleration of technological innovation.

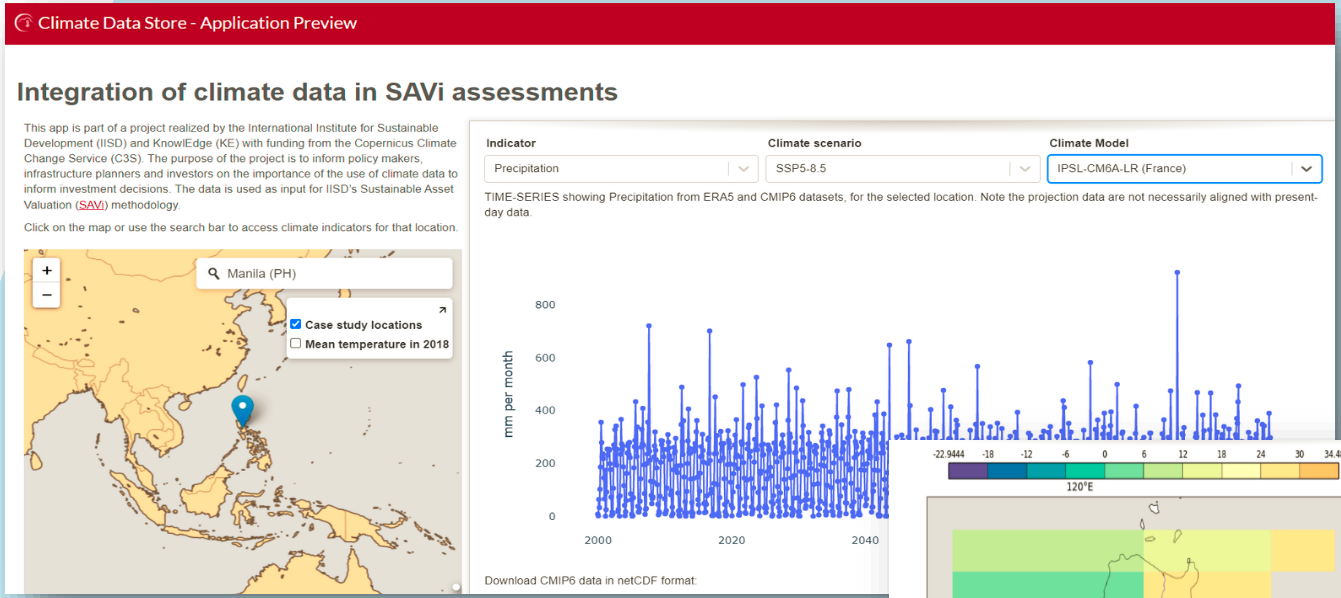
EU Copernicus data for climate change impacts

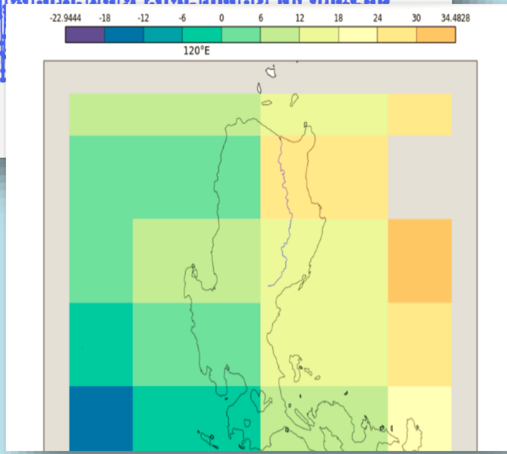
IISD and KnowlEdge developed an app that allows to view and download location-specific climate data from the Climate Data Store, and to integrate the data into SAVi.

Users can select the location, climate indicator, climate scenario and climate model

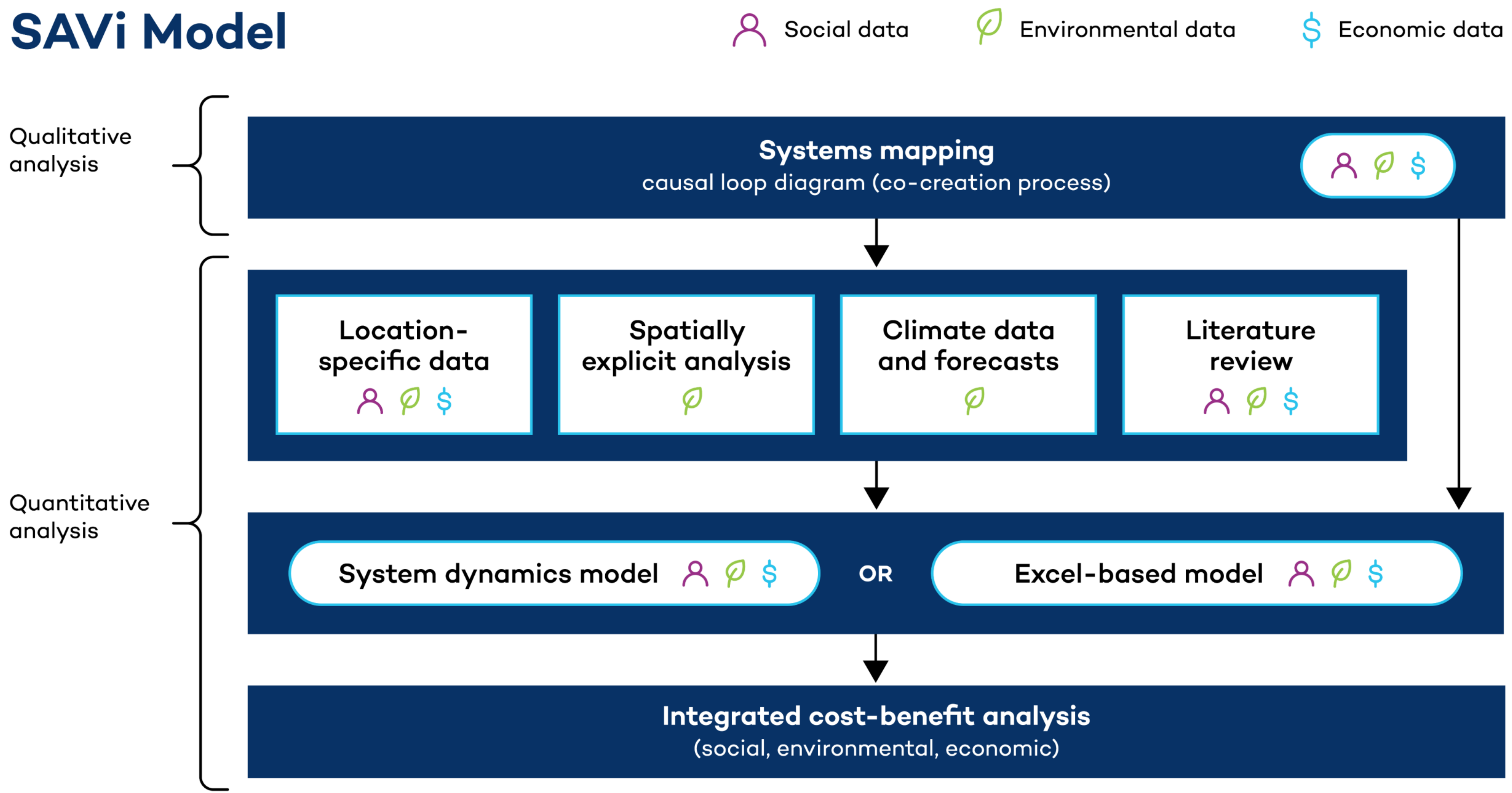
The app presents climate data as graphs showing time series or as maps.







The app is available here:
https://cds.climate.copernicus.eu/apps/27053/iisd-demo


SAVi Model
Social data
Environmental data
Economic data
Qualitative analysis
Systems mapping
causal loop diagram (co-creation process)
Quantitative analysis
Location-specific data
Spatially explicit analysis
Climate data and forecasts
Literature review
System dynamics model
OR
Excel-based model
Integrated cost-benefit analysis
(social, environmental, economic)

Main infrastructure types covered by SAVi

Energy infrastructure

Transport infrastructure

Buildings

Water and irrigation infrastructure

Wastewater infrastructure

Nature-based infrastructure

Current use of SAVi & infrastructure sectors

Energy

Transport

Buildings

Water & irrigation

Waste

Nature-based infrastructure

https://www.iisd.org/savi/projects/

SAVi Transport Applications

Country	Assets Analyzed		
India	ELECTRIC VEHICLES POLICY	NON MOTORIZED TRANSPORT	PUBLIC BICYCLE SHARING
Indonesia	BUS RAPID TRANSIT SYSTEM	NET-ZERO TRANSPORT STRATEGY	
Colombia	MASS RAPID TRANSIT	SUSTAINABLE TRANSPORT STRATEGY	
Senegal	BUS RAPID TRANSIT SYSTEM		
Albania	TRAIN LINE		
Morocco	BYPASS		
Malaysia	HIGHWAY		

Conclusion: What is the added value of the SAVi Methodology?

It reduces project related risk and uncertainty

The more economic, social and environmental indicators are considered in the project assessment, the more policymakers can prepare and plan ahead to mitigate potential risks. With conventional project assessment approaches policymakers only consider investment costs and do not anticipate negative social and environmental impacts.

It increases the effectiveness of investments and delivers positive social and environmental impacts

Sustainable projects that consider economic, social and environmental indicators perform better and maximize the value for money from taxpayers while also delivering significant social and environmental benefits.

Case Study of the Highway project in Uzbekistan

The following slides explain the overview, causal loop diagram, key indicators and results of the

Project Context

Transport problems and solutions

The planned route of the highway will pass through an increasingly important corridor between the Republic of Karakalpakstan (through the city of Uchkuduk) and the Navoi region with access to Kazakhstan. The project will help provide an adequate, efficient, safe and sustainable road network in the region which will contribute to economic growth and increase domestic and foreign trade.

The main objectives of the highway project are to:

- Increase road capacity
- Increase efficiency of trade
- Reduce vehicle operating costs
- Reduce travel time

SAVi Assessment Goals

Assess the environmental, social and economic impacts of the highway project in Uzbekistan

Quantify the added benefits, avoided costs and direct costs of the highway project in Uzbekistan

Evaluate the economic and financial performance of the highway project in Uzbekistan

Integrated cost benefit analysis indicators

Added Benefits

Income creation from employment

Value of time saved

Revenues from transport (private)

Public revenues from trade of raw materials

Avoided Costs

Road routine maintenance (old road)

Air pollution from construction

Air pollution from road transit

CO_2 emissions

Fuel use

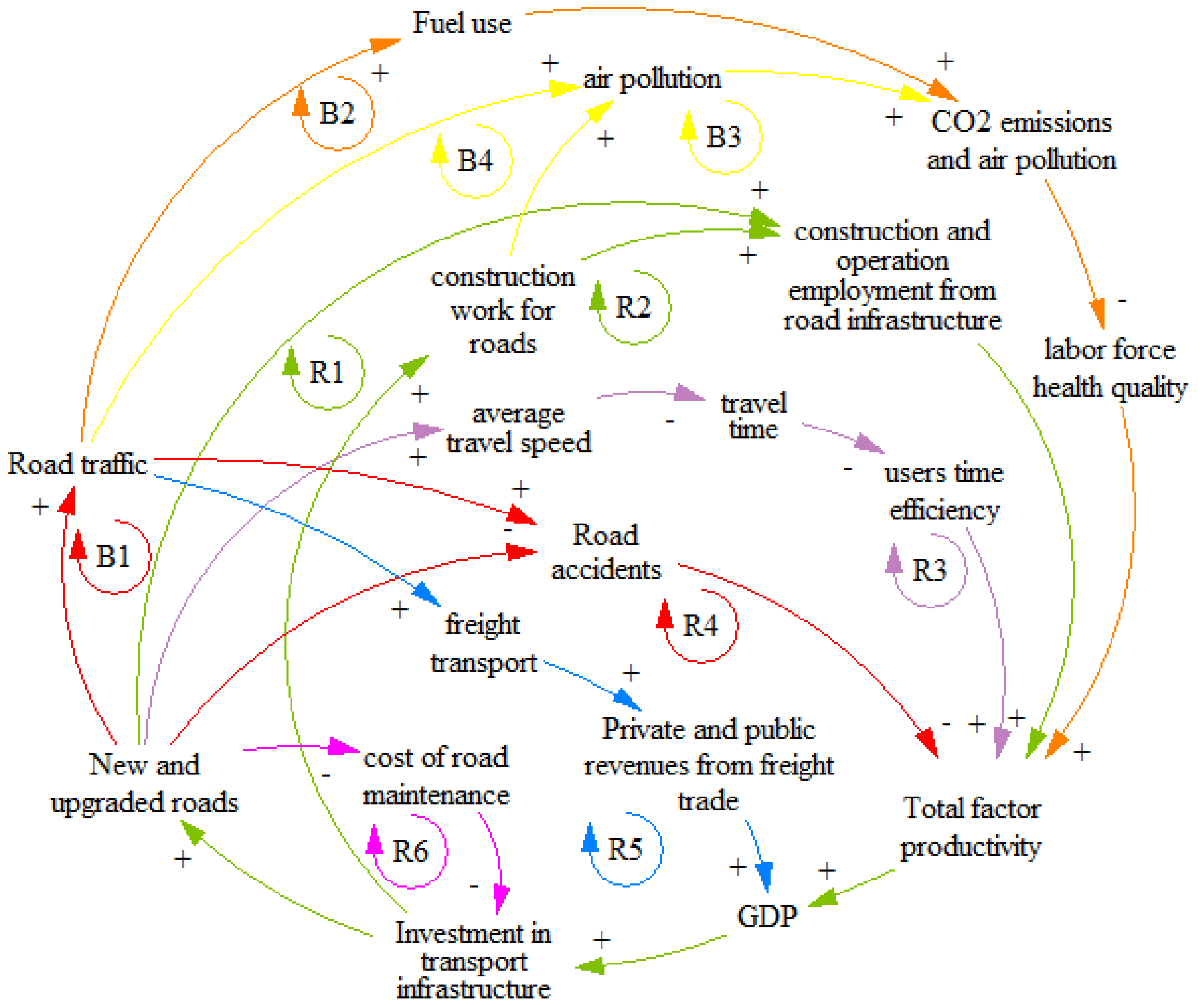
Traffic accidents

Direct Costs

Total Investment

Road routine maintenance (new road)

Interest payment



Fuel use
air pollution
CO2 emissions and air pollution
construction and operation employment from road infrastructure
construction work for roads
labor force health quality
average travel speed
travel time
users time efficiency
Road traffic
Road accidents
freight transport
Private and public revenues from freight trade
New and upgraded roads
cost of road maintenance
Total factor productivity
GDP
Investment in transport infrastructure
B1
B2
B3
B4
R1
R2
R3
R4
R5
R6

Scenarios of the highway project in Uzbekistan

Scenario	Assumptions
Low cost of accidents	In this scenario, only the direct costs of the traffic accidents are considered, such as: - Vehicle damage repair - Road infrastructure and property repair - Accident causes investigation expenses - Medical costs - Pensions to persons who become disabled - Mortuary and funeral expenses
High cost of accidents	In this scenario, both direct and indirect costs are considered. The additional indirect cost considered is the loss of part of the national income due to permanent disability or death of the victims.

Integrated CBA – Cumulative discounted over lifetime of the project- in USD

Integrated CBA	Unit	Conventional road scenario (2022-2052)	
		Low cost of accidents	High cost of accidents
Total Investment and costs	**USD million**	**599.3**	**599.3**
Total investment	USD million	541.0	541.0
Road routine maintenance costs	USD million	6.1	6.1
Interest payment	USD million	52.2	52.2
Total Added benefits	**USD million**	**731.9**	**731.9**
Income creation from employment	USD million	0.1	0.1
Value of time saved	USD million	10.8	10.8
Revenues from transport	USD million	107.8	107.8
Public revenues from trade of raw materials	USD million	613.3	613.3
Total Avoided Costs	**USD million**	**97.5**	**434.5**
Road routine maintenance (old road)	USD million	81.7	81.7
Health cost of air pollution from construction	USD million	(0.0)	(0.0)
Health cost of air pollution from road use	USD million	(5.6)	(5.6)
CO2 emissions	USD million	(10.2)	(10.2)
Accidents	USD million	19.3	356.2
Fuel use	USD million	12.4	12.4
Net results of valued added benefits and avoided costs			
Cumulative net benefits(discounted)	USD million	**230.2**	**567.1**
Benefit-Cost Ratio (BCR)		**1.38**	***1.95***

The benefits of the highway project in Uzbekistan are significantly higher when the valued added benefits and avoided costs are integrated into the cost-benefit analysis, for both scenarios.

This is demonstrated by the difference between the conventional benefit-cost ratio (BCR) which is based on the estimation of only tangible parameters such as investment costs, road routine maintenance, interest payments and revenues from transport and the sustainable benefit cost-ratio (S-BCR) which includes the full range of economic social and environmental benefits and costs.

	BCR		S-BCR	
Parameters considered	Investment cost, road routine maintenance, interest payments, revenues from transport		Investment and costs, full range of economic, social and environmental added benefits and avoided costs	
Scenario	Low cost of accidents	High cost of accidents	Low cost of accidents	High cost of accidents
Benefit-cost ratio	**0.18**	**0.18**	**1.38**	**1.95**

It is also important to note that as the added benefits and avoided costs are accumulated over the years of the project period, the S-BCR increases.

Results of the Highway project in Uzbekistan

The highway project in Uzbekistan has a wide range of benefits that are typically overlooked in traditional infrastructure assessments. The highway will produce significant economic benefits for the public sector in Uzbekistan and the inhabitants of the Navoi region such as revenues from transport and public revenues from trade of raw materials, avoided costs of road accidents, and avoided costs of fuel use and maintenance. On the other hand, the project will lead to some negative environmental impacts such as an increase in *CO_2 emissions, and air pollution from road use.

Key lesson : When there is uncertainty around some of the impacts of sustainable infrastructure projects and it is difficult to quantify them, it is important to develop a scenario analysis/sensitivity analysis for comparison

Case Study of Sustainable infrastructure in Kazakhstan

The following slides explain the overview, causal loop diagram, key indicators and results of the sustainable infrastructure in Kazkahstan

Project Context

Transport problems and solutions

- The main objectives of the infrastructure development projects in the trade corridor between Kazakhstan and Uzbekistan are:
    - Increase efficiency of trade
    - Increase energy efficiency and reduce energy use
    - Reduce congestion, commuting times and number of accidents
    - Reduce emissions
    - Create employment
    - Reduce use of raw materials

SAVi Assessment Goals

Assess the environmental, social and economic impacts of the sustainable infrastructure (transport & buildings in the trade corridor) in Kazakhstan

Quantify the added benefits, avoided costs and direct costs of the sustainable infrastructure scenario

Evaluate the economic and financial performance of the sustainable infrastructure scenario

Integrated cost benefit analysis indicators

Added Benefits

Revenues from railway

Income creation from railway employment

Income creation from buildings employment

Income creation from power generation employment

Value of time saved

Avoided Costs

Air pollution

CO_2 emissions from transport

CO_2 emissions from buildings

Number of accidents

Fuel use

Energy cost of buildings

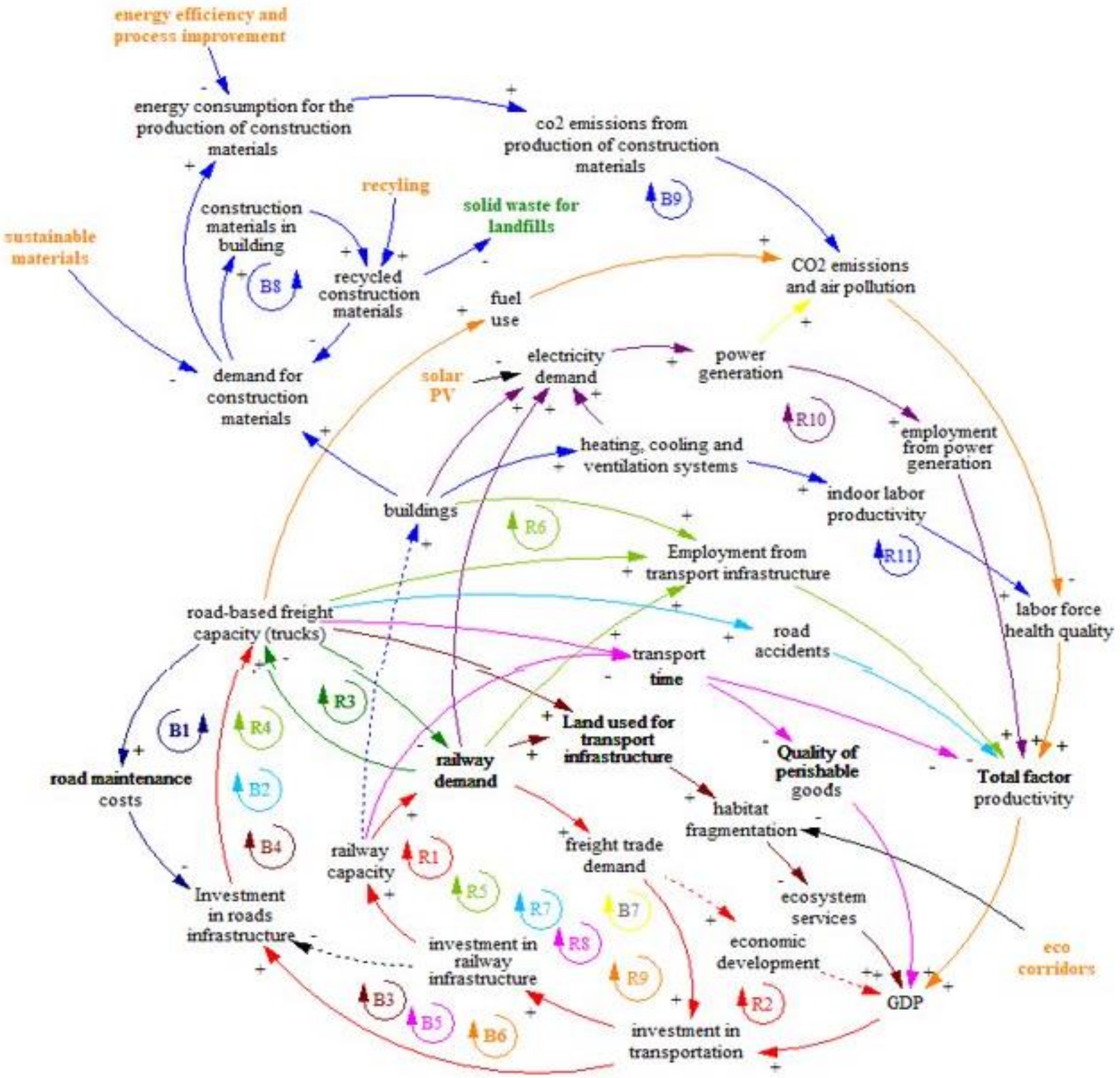
Capital costs and O&M costs of conventional energy generation

Direct Costs

Capital costs and O&M costs of the railway

Capital costs and O&M costs of the buildings

Capital costs and O&M costs of renewable energy generation



energy efficiency and process improvement
energy consumption for the production of construction materials
co2 emissions from production of construction materials
B9
recyling
solid waste for landfills
construction materials in building
B8
recycled construction materials
sustainable materials
CO2 emissions and air pollution
fuel use
demand for construction materials
electricity demand
power generation
solar PV
R10
heating, cooling and ventilation systems
employment from power generation
indoor labor productivity
buildings
R6
Employment from transport infrastructure
R11
labor force health quality
road-based freight capacity (trucks)
road accidents
transport time
R3
Land used for transport infrastructure
B1
R4
railway demand
Quality of perishable goods
Total factor productivity
road maintenance costs
B2
habitat fragmentation
B4
railway capacity
R1
freight trade demand
R5
R7
B7
ecosystem services
Investment in roads infrastructure
R8
investment in railway infrastructure
economic development
eco corridors
R9
R2
GDP
B3
B5
B6
investment in transportation

Business-as-usual vs sustainable infrastructure scenarios in Kazakhstan

Scenario	Assumptions
BAU transport	In this scenario, the railway project is not implemented and 100% of trips are made by road transport
Sustainable transport	In this scenario 35% shift from road transport to rail transport
BAU buildings	In this scenario, none of the electricity of the buildings is generated from renewables sources.
Green buildings	In this scenario part of the electricity of the buildings is generated from renewable energy and in particular solar energy from solar panels that are located on site (74% of electricity). This reduces energy consumption from the grid and generates cleaner energy.

Integrated CBA – Cumulative discounted over lifetime of the project - USD

Integrated CBA	Unit	Sustainable Infrastructure scenario (2022-2050)		
		2022-2030	2022-2040	2022-2050
Total Investment and costs	USD million	**678.28**	**692.38**	**698.21**
Capital costs of railway	USD million	670.52	670.52	670.52
O&M costs of railway	USD million	6.18	19.99	25.68
Capital costs of renewable energy	USD million	1.54	1.74	1.83
O&M costs of renewable energy	USD million	0.04	0.14	0.18
Total Added benefits	USD million	**3,510.68**	**4,823.13**	**5,950.72**
Revenues from freight trade	USD million	125.42	420.06	574.43
Income creation from employment of railway	USD million	10.24	14.90	16.42
Income creation from employment of power generation	USD million	0.07	0.07	0.07
Value added from freight trade	USD million	3,370.47	4,365.50	5,319.98
Value of time saved	USD million	4.48	22.60	39.81
Total Avoided Costs	USD million	**1.51**	**5.32**	**7.09**
CO_2 emissions from transport	USD million	0.44	2.07	3.27
CO_2 emissions from buildings	USD million	0.01	0.03	0.04
Accidents	USD million	0.46	1.42	1.68
Fuel use	USD million	0.56	1.72	2.00
Energy cost of buildings	USD million	0.03	0.07	0.08
Capital costs of conventional energy	USD million	0.01	0.01	0.01
O&M costs of conventional energy	USD million	0.00	0.00	0.01
Cumulative net benefits (discounted)	USD million	**2,833.90**	**4,136.06**	**5,259.60**
Benefit-Cost Ratio (BCR)		**5.18**	**6.97**	**8.53**

The benefits of the sustainable infrastructure scenario in Kazakhstan are significantly higher when the valued added benefits and avoided costs are integrated into the cost-benefit analysis.

This is demonstrated by the difference between the conventional benefit-cost ratio (BCR) which is based on the estimation of only tangible parameters such as capital costs and operation and maintenance (O&M) costs for both the railway and power generation as well as revenues from freight trade, and the sustainable benefit cost-ratio (S-BCR) which includes the full range of economic social and environmental benefits and costs.

	BCR	**S-BCR**
Scenario	Sustainable infrastructure scenario	
Parameters considered	Investment and costs, revenues from freight trade	Investment and costs, full range of economic, social and environmental added benefits and avoided costs
Benefit-cost ratio	**0.82**	**8.53**

It is also important to note that as the added benefits and avoided costs are accumulated over the years of the project period, the S-BCR increases.

Results of the sustainable infrastructure scenario in Kazakhstan

The sustainable infrastructure scenario in Kazakhstan has a wide range of benefits that are typically overlooked in traditional infrastructure assessments. Both the transport and buildings components produce significant economic benefits for Kazakhstan such as value added from freight trade and revenues from freight trade, time savings, income creation from employment from both the railway and power generation, as well as avoided costs of CO_2 emissions, traffic accidents, energy costs and fuel use.

Key lesson : Most indirect economic, social and environmental benefits of sustainable infrastructure projects take a long time to materialize and become more valuable over time, compared to the benefits of conventional infrastructure projects that decrease over time