NATURE-BASED INFRASTRUCTURE
GLOBAL RESOURCE CENTRE

NBI Methodology

Over the next few years, the NBI Global Resource Centre will analyze more than 40 nature-based infrastructure projects worldwide—from reforestation to the introduction of green spaces in urban environments. Our modelling approach, based on IISD's Sustainable Asset Valuation (SAVi) methodology, assesses the projects using systems thinking and simulation methodologies to provide a systemic project analysis and a project finance assessment.

Our valuations are customized to each project by working with asset owners and stakeholders to identify the local project context, uncertainties, and unique dynamics. Engaging with our partners over several weeks to design the assessment and gather project-specific data, we can capture and integrate all material risks and externalities that can occur. In addition, we work extensively on data verification and filling in data gaps using internationally recognized sources.

The models' time frame extends to the whole lifetime of the investment and beyond, covering a 5- to 10-year period after the project conclusion to allow us to determine all possible outcomes of project implementation.

The Steps and Outputs of a Valuation

<table>
<tr><td>1) Engage and learn
A virtual meeting with IISD and the NBI project partner to discuss the project context and characteristics and determine the scope of the valuation.</td><td rowspan="3">Outputs:
Description of scenarios and scope of assessments
Creation of a Causal Loop Diagram
Completion of data collection</td></tr>
<tr><td>2) Collect data
IISD shares a data request file with the NBI project partner, who then collects information, including through engagement with other stakeholders.</td></tr>
<tr><td>3) Verify data and confirm scenarios
A virtual meeting with IISD, the NBI project partner, and other stakeholders to clarify, complement, and verify data and assumptions.</td></tr>
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4) Develop and run the simulation IISD creates customized simulation models, runs the simulation, and records preliminary results.	**Outputs:** • Creation of customized simulation models • Presentation of preliminary results
5) Discuss preliminary results A virtual meeting with IISD, the NBI project partner, and other stakeholders to share and discuss preliminary results. IISD will modify assumptions where needed after this meeting.	
6) Publish report IISD publishes a technical report outlining the approach and results of the project valuation, as well as other relevant communication products.	**Outputs:** • Technical reports • Presentation
7) Present results IISD and the NBI project partner present the results of the project valuation to stakeholders and/or the wider public.	

Systems Thinking

The NBI Global Resource Centre uses systems thinking to understand how different parts of a system are interconnected. Systems thinking is the qualitative approach that underpins our methodology and allows us to create a shared understanding with our local stakeholders of the rationale for the project and the dynamics affecting and shaping the local context. Systems thinking helps us investigate and understand the socio-economic and environmental system in which the project is implemented, strengthening the forecast of project outcomes across sectors and actors, in different places, and over time.

For example, we can use systems thinking to understand the impacts of restoring a forest. Reforestation would, among other things, support climate mitigation efforts and affect the microclimate (by storing carbon), support local livelihoods (by providing wood and water), and foster climate adaptation (by reducing flood risks).

System Dynamics

While systems thinking helps us to understand how a system works qualitatively, system dynamics allows us to quantitatively model the behaviour of this system. System dynamics allows us to estimate the extent to which socioeconomic and environmental drivers of change interact, shaping future trends and ultimately determining the economic and societal viability of the project. System dynamics add data and equations to the analysis, providing much-needed evidence on the multi-faceted outcomes of investments for investors and society as a whole.

The creation of the system dynamics model starts from the Causal Loop Diagram (CLD), a blueprint for quantitative analysis. As a result, each model we create is fully customized to the local context and co-created with local project partners and stakeholders.

CLD Animations

We develop CLDs for a fast, accurate analysis of cause-and-effect relationships. Once this blueprint is complete, we create a mathematical model that forecasts how the infrastructure project will affect and be affected by the environmental, social, and economic dynamics of the "system" in which it is being planned, financed, built, and operated. We then simulate different risk scenarios to calculate how the asset performs under each of them. We can also change model inputs in real time, generating updated results within seconds.

This approach helps us to show the impacts of NBI and grey infrastructure on different economic sectors, people, and the environment. System dynamics allow us to look at both short- and long-term developments. For example, we can use it to calculate the dollar value of avoided flood damages after reforestation based on land cover dynamics and climate data inputs, or we can model how many tonnes of carbon the reforestation project would store based on the type of tree planted and its growth period.

Spatial Analysis

The performance of NBI depends on the local context; therefore, we use spatial (geographic information system) data and spatially explicit models, such as the Integrated Valuation of Environmental Services and Trade Offs (InVEST) model to quantify, map, and value the benefits provided by ecosystems. These benefits include regulating, provisioning, and cultural and supporting services, some of which are comparable to the services provided by built infrastructure, including carbon storage and water filtration and retention.

The spatial models show where the ecosystem services are provided and how they would change under different scenarios—for instance, when land use changes. With the InVEST model, we can value the ecosystem services of NBI for different spatial scales, such as entire landscapes or a single city. The location of a change in ecosystem service is essential to determine its value, which we integrate into the integrated cost-benefit analysis and the project finance assessment.

Project Finance

We use project finance models to estimate the financial performance of investments, both for the project and society at large. Our project finance models consider the costs of environmental, social, economic, and governance risks and externalities, and incorporate them into forecasts of future cash flows.

A project finance model helps identify the optimal capital structure for a project, assess its financial viability, and calculate the expected return on investment under different scenarios. For example, we can model how a carbon tax would change a project's operating costs and thus its financial performance.

Project finance modelling and system dynamics modelling are closely related and draw on each other's results. The finance model is built in Microsoft Excel and follows the international best practice approach Corality SMART.

Climate Scenarios

Our assessments of NBI projects include information about weather and climate change trends from the EU Copernicus Climate Data Store. This allows us to understand how climate risks affect the financial performance of infrastructure projects. It also helps us understand how infrastructure projects affect climate resilience. For example, reforestation can help people adapt to climate change by protecting them from increasing floods and droughts. Climate scenarios can show that these benefits can be even more pronounced under more extreme climate change predictions.

How is this Information Used?

We create and use simulation models to bridge knowledge gaps. We integrate biophysical and monetary indicators into an extended cost-benefit analysis and project finance assessment. Here, we consider the cost of the project, as well as the benefits and the avoided costs it generates. Further, we present both material costs and benefits in a conventional assessment, as well as non-material or intangible costs and benefits, representing externalities and all project outcomes beyond those that directly impact investors. Practically, we conduct a societal assessment, determining whether the project is economically viable for investors and whether it generates value for society.

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