Ecosystem Services and Cost-Benefit Analysis: the case of BR-319 Road in Brazilian Amazon

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Mainly based on: Fleck (2009)

Short title: Cost-benefit analysis of road construction considering deforestation, Brazil

Key Message: Cost-benefit analysis (CBA) of infrastructure projects like road construction can be strongly influenced if the value of ecosystem services is taken into account. CBA can provide guidance for decision makers and the general public on the costs and efficiency of choices related to the implementation of such projects.

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What was the problem?

Road construction and paving in Brazilian Amazon has been subject of great debate during the last decades, especially regarding their ambiguous impacts, with regional development on one side and environmental degradation, as well as deforestation, on the other. This context encompasses the intention of the Brazilian government, announced in 2005, to reconstruct a road between the States of Amazonas and Rondônia, known as BR-319, as part of its Growth Acceleration Plan (know in Brazil by the acronym PAC). This route once connected the capital cities of Porto Velho and Manaus, but now requires extensive paving, bridges and reconstruction of an entire 406 km section, which has been virtually impassable since 1986. However, as indicated by recent models, its reconstruction will cause extensive deforestation between the Purus and Madeira rivers unless policy measures of unprecedented effectiveness are taken to restrain forest clearing.

Which ecosystem services were examined and how?

In this context, and considering that an official economic feasibility study was indispensable, the Conservation Strategy Fund – CSF, a non-governmental organization, conducted a pre-feasibility study of BR-319 reconstruction using cost-benefit analysis – CBA[1]. Two analysis scenarios were considered in order to clarify the effect of including or not environmental externalities: (1) a “conventional” one,

[1] A discount rate of 12% was applied over a period of 25 years (2009-2033), a typical rate for road projects in Brazil.

reflecting the approach commonly used in such projects, and (2) an "integrated" scenario, where some costs related to deforestation were also considered.

The "conventional" scenario considered aspects such as: local and regional benefits associated with cargo and passenger transportation savings (in time and operational costs) and road construction and maintenance costs. In the case of BR-319, even the "conventional" scenario already indicated that the project is not economically feasible, causing net losses of about R$316 million (US$150 million), or, in other words, each dollar invested generates only around 33 cents of benefits. Adding to this scenario the minimum costs for the basic implementation and maintenance of a set of new and current protected areas located along the road, a possible mitigation that should work refraining most of the potential deforestation, the net losses would be approximately 2.5 times higher.

Even if a high level of environmental governance is assumed that could potentially reduce the direct and indirect environmental damages associated with the road construction, the overall environmental costs would still be 3.6 times higher than private gains (Alencar et al. 2005). As experience shows, the costs for infrastructure projects in the Amazon have turned out to be far higher than previously assumed, exacerbating the economic risk of the project (Wilson Cabral, personal comment).

The "integrated" scenario, when some deforestation costs are taken into account, estimated net losses about 700% higher, reaching R$2.2 billion (US$1.05 billion), or just 6.5 cents of benefits for each dollar of cost. To estimate the costs of deforestation, the "integrated" scenario considered an additional deforestation induced by the project of 4.613.400 ha for the 25 years period considered for the CBA (2012-2033)[2]. The value of the forest predicted to be lost was then estimated based on literature review, considering: (1) option value (pharmaceutical bio-prospection); (2) existence value (willingness to pay for biodiversity conservation); and (3) indirect use (carbon storage). As the study points out, values considered comprise only part of total economic value of the forest, especially due to the fact that economic valuation of the Amazon forest is still limited. Also, it points that direct use (timber extraction, tourism, etc.) was not considered in order not to conflict with the indirect estimation adopted for local benefits.

In the case of existence value, the study adopted US$ 31.2/ha/year, which is the adjusted value proposed by Seroa da Motta (2002)[3] based on the estimate by Horton and colleagues (2002) using contingent valuation. This represents 27.4% of the estimated benefits and reflects the mean willingness to pay for Amazon forest conservation. The option value was based exclusively in pharmaceutical bio-prospection, assuming the value of US$ 0,20/ha/year, which represents the smallest value estimated by Simpson et al. (1996) in their model of willingness of pharmaceutical companies to pay for habitat conservation. This represents 0.2% of the estimated benefits. The last point, indirect use related to carbon storage, has the higher contribution to the final value of environmental benefits, reaching 72.4%. The value of US$ 0.16/tCO_2eq/year adopted is based on a review by Tol (2008), and represents the estimated global economic losses related to deforestation emissions. Although recognizing that this is probably a higher value than what is expected to be

[2] Based on model by Soares-Filho and colleagues (2006).
[3] Seroa da Motta (2002) adjusted the values aiming to: reflect only existence value (excluding non-use value) for world population (the original data was based on population of England and Italy) and for the whole forest (original data considered preserving 5% or 20% of the forest).

paid for REDD (Reducing Emissions from Deforestation and Degradation) projects, the study considers that it better reflects the opportunity costs of emissions to be caused due to deforestation related to the road.

Which policies were changed or adopted on the basis of the information on ecosystem services?

In general terms, by providing a CBA approach for BR-319 that considers the value of ecosystem services, the study highlighted the real costs of the project, providing an alternative source of information for public authorities, decision makers and general public about to the opportunity of implementing the proposed road. As a concrete example, CSF´s study directly influenced the decision of the Brazilian Senate, after requirement of Senator Marina Silva, former Minister of Environment, to demand an evaluation of the project by the Brazilian Court of Audit – TCU (TCU, 2010). Although the TCU´s decision was in the sense that economic feasibility is not a prerequisite in such a project, considering social interest and national security aspects alleged by the Ministry of Transportation (TCU, 2010), the study remains a resource for those coalitions advocating against the reconstruction of the road, as it allows for an important source of information on the cost of this arguments.

Another example, CSF was invited to present the results of the study during a public hearing promoted by the National Public Prosecutor´s Office – MPF, which is an independent public entity that aims to represent and defend public interest. After that, the MPF issued a recommendation report to IBAMA, the federal environmental agency, stating flaws in the environmental licensing process. The reconstruction of the BR-319 must be submitted, according to Brazilian legislation, to environmental licensing process, where the IBAMA has to define whether it is considered to be environmentally viable. This process is still going on and might, to some extent, be influenced by the CSF study or MPF´s recommendation.

What was necessary for doing the analysis?

In the present case, CSF relied on the work of an experienced analyst, with previous knowledge in conducting such analysis, and on the financial support of USAID and Gordon & Betty Moore Foundation. Substantial information is needed for conducting a CBA of a large infrastructure project, even more if ecosystem service values are considered. In this sense, great effort is needed if the information is not available or, at least, if a good approximation is not possible. In the present case, difficulty to get access to information from governmental sources can highlighted, what might also happen to other similar analysis, as they could, like in the present case, show the value of the economic and environmental losses caused by a major infrastructure project that involved large political interest. It is relevant to notice that without existent modeling of deforestation dealing specifically with the project, as well as previous studies on ecosystem valuation, the resources needed to carry out such an analysis would be substantially increased. This should be considered when replicating this approach.

What other factors were important for the success?

One aspect influencing the impact of the study is the fact that it was written in a style that can be generally understood to the average public; and has a good policy brief

that allow better diffusion of information among policy makers with few time. Usually studies of this kind are written with lots of economic jargon and equations, which frightens most readers. A large effort of communication of results was spent, also focusing in making the information comprehensible to the general public.

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