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Evaluating economic costs and benefits of climate resilient livelihood strategies

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ABSTRACT

A major challenge for international development is to assist the poorest regions to achieve development targets while taking climate change into account. Such 'climate resilient development' (CRD) must identify and implement adaptation strategies for improving livelihoods while also being cost-effective. While the idea that climate resilience and development goals should be compatible is often discussed, empirical evaluations of the economic impacts of actual CRD investments are practically non-existent. This paper outlines a framework to evaluate economic returns to CRD and applies it in two adaptation strategies trialed in Nusa Tenggara Barat Province, eastern Indonesia. The evaluation framework is composed of three models: a household benefit cost model, a diffusion model, and a regional benefit cost model. The models draw upon the impact evaluation, technology diffusion, and risk assessment literatures, respectively. The analyzes are based on expert opinion and locally-derived information, and hence can be applied in data-poor situations typical of developing countries. Our results explore economic costs and benefits at the household and regional scale, and we identify key input variables that greatly influence the economic returns of the strategies. These variables should therefore be a focus of ongoing investment. We also discuss how the framework is more generally applicable, its limitations including challenges in accounting for less tangible social and ecosystem service benefits, potentially leading to the underestimation of impacts, and how the approach should be complemented by qualitative methods.

Introduction

Many developing countries will be among the most severely impacted by climate change, and failure to act now to mitigate and adapt to climatic risks could lead to greater future costs to lives and livelihoods (Ranger and Garbett-Shiels, 2012). In the context of international development assistance, the key question is not "how can damage from climate change be minimized?" but rather "how can development targets be reached while taking climate change into account?" Joint consideration is critical, not only because climate change can pose risks to meeting development goals, but more importantly, considering climate change presents an opportunity to address development challenges with a fresh perspective (Butler et al., 2014, 2015).

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'Climate compatible development' aims to minimize risks and maximize opportunities, and requires decision-makers to identify 'triple win' strategies that generate climate adaptation, mitigation and development benefits (Mitchell and Maxwell, 2010). More recently, this approach has been termed 'climate-resilient development' (CRD; (USAID, 2014)). Although empirical evidence of the potential benefits of CRD is gradually accumulating (Economics of Climate, 2009), no attempt has been made to simultaneously evaluate the economic costs, benefits and uncertainties of CRD-based international development assistance projects (Tompkins et al., 2013).

In this paper, we propose an evaluation framework to fill this gap. The framework is composed of a three-stage simulation model developed using a Monte Carlo simulation with benefit cost analysis (BCA) drawing insights from the literature on impact evaluation, technology, and risk assessment. We demonstrate this framework by assessing the economic returns and uncertainties of two CRD strategies developed by a project that aimed to establish adaptation pathways for rural livelihoods in Nusa Tenggara Barat Province (NTB), Indonesia through participatory development and extension approaches. The evaluation framework involves assessing the economic profitability of the strategies and providing suggestions to improve the performance of future investments into them. This is important because international development resources are expected to be stretched to meet growing demands under a changing climate, and cost-effective international development assistance is an issue of increasing urgency (Tompkins et al., 2013). The results of the analysis contribute to the evaluation of the project, which is featured in this special issue (Butler et al., 2016a).

Methods and data

An evaluation framework for climate-resilient development strategies

We developed a framework to evaluate the economic efficiency of CRD interventions targeted at household livelihood strategies. The framework consists of three models: a benefit cost (BC) model at an individual household level, a diffusion model, and a BC model at a regional level. Each model draws upon literature from impact evaluation, technology diffusion and risk assessment, respectively (Fig. 1).

In the first stage, the BC model estimated the benefit of CRD investment at the household level. The benefit is the difference between the net benefit of an innovative farming practice development and extension project and a 'counterfactual', defined in the impact evaluation literature as an estimate of what the consequence would have been in the absence of an intervention (Gertler et al., 2011). Drawing on lessons from the agricultural technology adoption literature, we developed a diffusion model to predict the benefit of investment at a regional level. Finally, guided by literature on risk assessment, we calculated the economic efficiency of the project investment and applied Monte Carlo analysis to present both the range and the expected value of the collective impact of various uncertain factors determining benefits and costs.

Household benefit cost model

Impact evaluation assesses the net effect of a policy intervention by comparing its outcomes with an estimate of what would have happened in the absence of the intervention (Mayne and Stern, 2013). It links cause and effect by assessing the direct and indirect causal contributions of the intervention to change in people's lives (AusAID Office of Development Effectiveness, 2012). Ideally, measures of impact require comparisons of the same ecosystems, individuals, and social groups with and without the intervention at the same point in time. Clearly, such evaluations are not often possible, and evaluators must confront the problem of a missing counterfactual.

In solving this problem, scholars and practitioners have developed different evaluation methodologies, including experimental approaches such as randomized controlled trials (RCTs), quasi-experimental approaches such as instrumental variable (IV), regression discontinuity (RD) and difference-in-difference (DID) (Gertler et al., 2011). The evaluation methods differ in several respects, though they all, in one way or another, try to deal with the problem of missing counterfactuals. That is, they try to assess what would have happened without the intervention by defining a comparison or control group (Lensink, 2014).

Impact evaluation is not a unified practice. Different schools of thought have developed their own approaches and have long debated the merits of one design over another. Yet, most evaluators now support methodological diversity and pluralism (Preskill, 2009; Bell et al., 2011; AusAID Office of Development Effectiveness, 2012), and relying on a single method or technique will be weaker than obtaining multiple perspectives, termed triangulation (Leeuw and Vaessen, 2009).

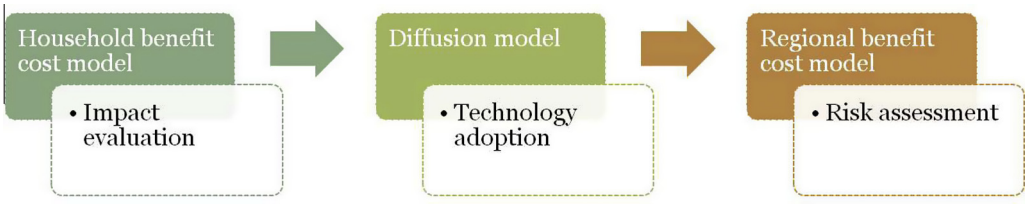

Fig. 1. The evaluation framework for climate-resilient development strategies.