Food and Agriculture Organization of the United Nations

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BRIEFING NOTE

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Using impact evaluation to improve policymaking for climate change adaptation in the agriculture sectors

Overview

Impact evaluation (IE) enables programme managers and policymakers to plan interventions in a rational and evidence-based manner. While a range of evaluation methods exists, this briefing note provides an overview of rigorous and quantitatively sound IE methods. These methods provide programme managers and policymakers with thorough evidence on the impact of adaptation interventions, allowing them to make informed policy choices on adaptation options. By engaging in detailed, evidence-based evaluation, policymakers and programme managers can address critical elements for the formulation and implementation of the National Adaptation Plans (NAPs).

Key messages

1. While a performance monitoring system collects, aggregates and reports quantitative data at the levels of input, activity and output on a routine basis, project evaluation techniques are expected to measure outcomes of the project. An impact evaluation is a special study that utilizes a counterfactual to attribute observed outcomes to the intervention as well as estimate the impact of a project.[i]

2. Experimental and quasi-experimental methods are at the forefront of quantitative impact evaluation. These techniques enable rigorous evaluation of agricultural projects, programmes and policies aimed at climate change adaptation. An experimental design is preferred, and should be embedded in project design early on. However, this may not always be feasible, in which case quasi-experimental techniques can be used to estimate impact.

3. Programme managers and policymakers need to make rational decisions in pursuing adaptation to climate change, in the form of projects, programmes and policies directed at the agriculture sectors. The impact evaluation techniques discussed in this briefing note will help them to generate rigorous evidence to do so.

4. Experimental and quasi-experimental impact evaluation techniques rely on the availability of technical staff (economists, statisticians) and appropriate data to quantify the impact on the target groups.

Impact evaluation for the formulation and implementation of NAPs

Understanding the impact of adaptation interventions is crucial for effective policymaking aimed at increasing resilience in the agriculture sectors. Engaging in the formulation and implementation of NAPs is an opportunity for countries to plan, implement, monitor and evaluate adaptation in the agriculture sectors (i.e. crops, livestock, forestry, fisheries and aquaculture).

This briefing note provides an overview of IE tools that programme managers and policymakers can use to address key elements of the NAPs, as shown in **Table 1**. It is intended for stakeholders involved in the formulation and implementation of NAPs and technical staff in ministries of agriculture, forestry, fisheries and the environment. By institutionalizing the capacity to use IE methods, governments can promote a shift towards evidence-based policymaking.

Table 1

IE methodologies as they relate to the NAP-Ag process

NAP Element	IE Contribution
Element B. Preparatory Elements: Reviewing and appraising adaptation options	Experimental and quasi-experimental techniques can be used to assess adaptation options in a rigorous evidence-based manner
Element C. Implementation Strategies: Prioritizing climate change adaptation in national planning	Evidence generated from experimental and quasi-experimental methods can help to select adaptation options that are effective
Element D. Reporting, Monitoring and Review: Reviewing the NAP roadmap to assess progress, effectiveness and gaps; Iteratively updating the NAPs	Evidence generated from experimental and quasi-experimental techniques helps with monitoring and reviewing – as a continuous process of testing and deploying new adaptation options and rejecting those options that do not work

Experimental and quasi-experimental evaluation techniques: what are they?

Impact evaluation methods are well established, data-driven and provide estimates that are widely accepted as reliable.[ii] With experimental and quasi-experimental techniques, programme managers and policymakers are better able to make choices that are oriented to adapting agriculture to a changing climate. Longer term adaptation actions – e.g. investments in large-scale infrastructure such as irrigation canal networks – may not lend themselves to IE easily since the time horizons involved are very long.

Experimental and quasi-experimental evaluation techniques rely on having a control and a treatment group as shown in **Figure 1** above. The control group is not exposed to the adaptation project, programme or policy, while the treatment group is. This enables for a comparison of the performance of these two groups by quantifying the impact of a given adaptation project, programme or policy. The group that acts as a counterfactual, i.e. the control group, allows for a valid comparison of similar groups at the same point in time, instead of having to compare the same (treatment) group before and after the adaptation intervention, programme or policy. This approach enables attribution of impact to the adaptation intervention, programme or policy being tested and ensures that confounding factors, such as farmer characteristics that drive increases in productivity, are not responsible for the result.

The basic steps of impact evaluation methods

In an experimental evaluation, the selection of control and treatment groups is random. This is an important feature that enables valid IE.[iii] When a purely experimental evaluation is not feasible, programme managers and policymakers can turn to quasi-experimental methods. There are four quasi-experimental methods – regression discontinuity design,

instrumental variables, difference-in-difference and matching – that can be used when allocation to control and treatment is non-random. See **Figure 2** below for a schema of a policy process and the selection of an appropriate evaluation method.

Figure 1

Experimental ideal for an impact evaluation

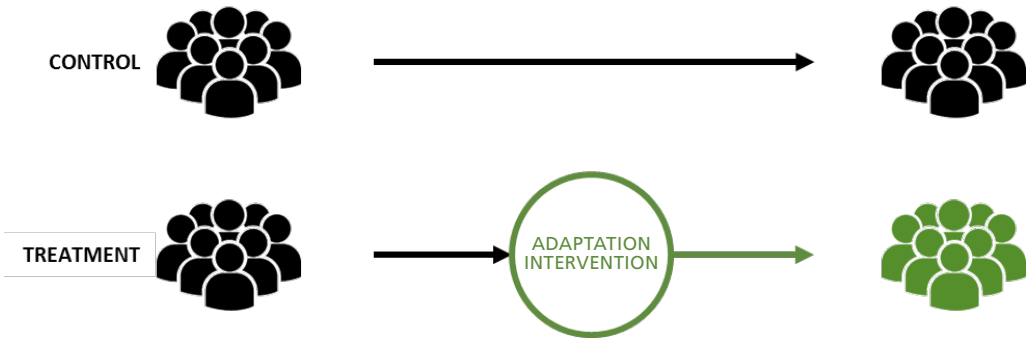
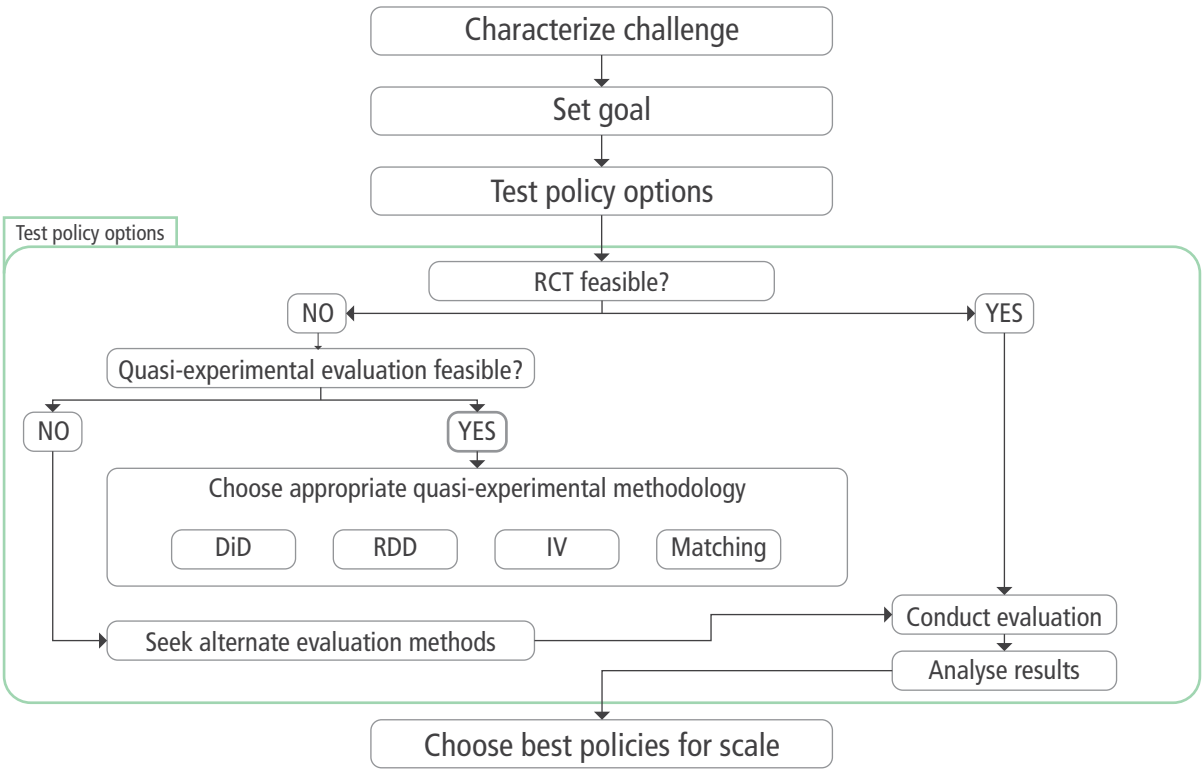


Figure 2

Policy-making process and choice of an IE methodology



By integrating evaluation into the design of a programme or policy at inception, programme managers or policymakers give themselves the best chance of identifying the impact that an adaptation programme or policy has on the target group. Ideally, control and treatment groups are chosen randomly, in what are called randomized control trials (RCTs), which ensures that results on impact are valid since the two groups are, on average, identical. The adaptation project, programme or policy of interest is administered to the treatment group and after it has run its course, the difference in outcomes is recorded in both control and treatment groups.

However, when random selection of the control and treatment groups is not possible, quasi-experimental methods are used. Quasi-experimental methods seek to overcome the issue of non-random allocation to control and treatment.[iv] Because allocation to treatment is non-random, the methods attempt to create a valid counterfactual, that is, to create a control group with which to compare the treatment group. As stated in a recent survey by Gertler *et al* (2016), there are four quasi-experimental methods of IE:[v]

1. Regression discontinuity design (**RDD**) is an IE method that can be used for programmes or policies that have a continuous eligibility index with a clearly defined eligibility threshold (cutoff score) to determine who is eligible and who is not (e.g. farmers with an income below $X are eligible while those above it are not). The RDD estimates impact around the eligibility cutoff - those farmers just below $X and those just above $X - as the difference between the average outcome for units on the treated side of the eligibility cutoff and the average outcome of units on the untreated, or comparison, side of the cutoff.

1. Instrumental variable (**IV**) method relies on some external source of variation to determine treatment status. An instrumental variable influences the likelihood of participating in a programme or policy, but is outside of the participant's control and is unrelated to the participant's characteristics (e.g. geographic features or weather can often influence decisions but are outside the control of farmers).

1. Difference-in-differences (**DiD**) method compares the changes in outcomes over time between a population that is enrolled in a programme or policy (the treatment group) and a population that is not (the comparison group). So, even though both groups may have differing trends over time for the outcome of interest, the method compensates for this by comparing the difference in outcome accounting for the 'natural' trend of the control and treatment groups.

2. Matching uses statistical techniques to construct an artificial comparison group. For every possible unit under treatment, it attempts to find a non-treatment unit (or set of non-treatment units) that has the most similar characteristics possible.

Impact evaluation relies on the availability of appropriate data, whether it is collected specifically for the purposes of a given programme or policy, or as part of routine data collection efforts, such as national surveys, from the statistical and census offices. In general, it is important that data collection is kept distinct from the intervention activity that is being assessed. So, for instance, in the case of an experimental evaluation of an agricultural programme it is crucial that the party implementing is distinct from the party that is responsible for data collection. Data collection can be an expensive and complex undertaking. Sometimes, it is possible to rely on routine data collection such as regularly conducted national agricultural surveys, as these may be timed in a manner that allows for an adaptation programme's or policy's impact to be assessed. This can be cost-saving but it is not always the case that such routine data collection coincides well with the needs of a given impact evaluation. Data for IE will need to be rich, meaning it must be able to characterize the target group (e.g. household size, education, access to credit etc.) and may often require information across more than one point in time.

Case Study

Impact evaluation for agricultural projects[vi]

Climate change is projected to exacerbate the likelihood of extreme weather, such as floods. Rice farmers in Odisha, India, are subject to flooding on an annual basis. The risk of floods makes farmers conservative in that they do not cultivate as much land as they can or the full extent of their available land. Moreover, they hold back on investing in their land because of this risk, they deploy fewer inputs and fewer land improvement investments. To address this, researchers tested a new flood resilient rice variety (called Swarna-Sub1), measuring impacts on yields, profit and farmer behaviour. In order to test the impact of Swarna-Sub1, researchers designed a randomized controlled trial in which treatment farmers in 64 treatment villages were offered the new resilient variety to plant while farmers in 64 control villages were not. By comparing treatment farmers with farmers in villages where Swarna-Sub1 was not distributed, researchers measured the impact of the improved seeds on rice yields, the amount of land cultivated, planting techniques, use of credit products and savings habits. The new flood resilient variety was successful in reducing farmer losses due to flooding, increased farmer investment in their land and increased farmer profitability. This made it a promising candidate for scaling up to other farmers in this flood-prone area of India. The adaptation option that was tested – flood resilient rice – improved farmer outcomes in relation to current climate variability and change, making them more resilient. As the climate continues to change, programme managers and policymakers must continue to experiment with new varieties and scale up those that improve farmer outcomes.

Capacity for impact evaluation

Impact evaluation requires the participation of three distinct parties: i. programme managers and/or policymakers who set the mandate for an evaluation, as they are interested in generating evidence for adaptation projects, programmes or policies; ii. a private firm or government statistical and census offices that performs data collection to measure change brought about by the projects, programmes or policies; and iii. economists, academics and researchers with experience in quantitative and statistical methods, either outside or within the government, who design the IE, monitor its execution and analyse data.

Conclusions and recommendations

As countries move towards implementing NAPs, it is critical that they develop and deploy the capacity to conduct IE as an effective means to prioritize adaptation options. Impact evaluation methods provide policymakers and programme managers with a sound way to understand the impact of adaptation options they are pursuing. Designing and executing a rigorous IE allows policymakers and programme managers to pursue or reject a given course of action in a rational, evidence-based manner. Ideally, IE is embedded into the design of an adaptation project, programme or policy early on and is carried out through an experimental method such as a Randomized Control Trial (RCT). If an RCT is not feasible, quasi-experimental methods can be used depending on the nature of the intervention and the data available. Executing a high-quality IE takes considerable planning and the guidance of experts.

References and further reading

Dar, M.H., de Janvry, A., Emerick, K., Raitzer, D. & Sadoulet, E. 2013. Flood-tolerant rice reduces yield variability and raises expected yield, differentially benefiting socially disadvantaged groups. *Scientific Reports* 3:1–8.

Duflo, E., Glennerster, R., & Kremer, M. 2007. Using Randomization in Development Economics Research: A Toolkit. *Handbook of development economics* 4: 3895-3962.

Gertler, P.J., Martinez, S., Premand, P., Rawlings, L.B., Vermeersch, C.M.J. 2016. *Impact evaluation in practice*. Washington, DC: World Bank Publications.

Glennerster, R., & Takavarasha, K. 2013. *Running randomized evaluations: A practical guide*. Princeton: Princeton University Press.

Gayer, T. & Greenstone, M. 2009. Quasi-experimental and experimental approaches to environmental economics. *Journal of Environmental Economics and Management*, 57(1): 21-44.

J-PAL, CEGA, and ATAI Policy Briefcase. 2015. *Resilient Rice*. Cambridge, MA: Abdul Latif Jameel Poverty Action Lab, Center for Effective Global Action, and Agricultural Technology Adoption Initiative.

Notes

[i] A counterfactual is simply what would have happened had a given project, programme or policy not been undertaken.

[ii] All methods will be discussed ahead but for broader overviews please consult: Duflo *et al.* 20074 and Gayer and Greenstone 2009.

[iii] Specifically, randomization means that anyone of an equivalent group could have been allocated to control or treatment. This allows for valid statistical inference on the causal effect of a given intervention (project, programme or policy).

[iv] Glennerster and Takavarasha 2013. 2013. *Running randomized evaluations: A practical guide*. Princeton University Press.

[v] Direct quotations from Gertler *et al.* 2016. *Impact evaluation in practice*. World Bank Publications.

[vi] For a summary, see J-PAL *et al.* 2015. For more details, see Dar *et al.* 2013.

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*See: www.fao.org/in-action/naps/resources/webinars/economics-of-adaptation




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