



## Agricultural Technology Assessment Tool (Example)

Example 1: Fertilizer trees (*faidherbia albida*) in Central Malawi

Basic objective: Increase adoption of nitrogen fixing trees for interplanting with crops

*Note: This is only an example, not intended to serve as a real evaluation of the potential for fertilizer tree scale up in Central Malawi.*

In assessing the utility and appropriateness of an agricultural technology for farmers and other actors in the value chain, it is important to consider multiple interlinked factors. These include the potential for risk exposure, the availability of complementary inputs, and the reliability of delivery institutions. The decision to introduce or promote a new technology should weigh the potential pitfalls—such as increased risk to farmers, or environmental degradation—alongside the magnitude of potential benefits. It is also essential to evaluate the quality of the evidence on costs and benefits (i.e. the certainty with which pitfalls or positive impacts can be estimated or predicted). Note that we define technology broadly to include improved agricultural practices, crop varieties, inputs and associated products such as crop insurance.

This tool is designed for use as a framework for assessing the potential scalability of an agricultural technology and to facilitate decision-making discussions by NGOs, donors, governments, technology developers and other stakeholders. The tool is broken into three sections:

- Section one helps identify the problem that the technology seeks to address and to identify alternative solutions.
- Section two offers a rubric for estimating the magnitude and certainty of a technology's benefits to small-holder farmers, their communities, and to other actors in the agricultural value chain.
- Section three provides a framework of potential pitfalls to consider. Each type of potential pitfall is accompanied by a series of questions intended to stimulate discussion. Not all questions are relevant to all settings, and many relevant questions are omitted, so those included should be used to start the conversation, not as an exhaustive list.

In using this tool, you should be able to roughly estimate the probability of appropriate technology adoption and the scalability of the technology, given existing knowledge of potential benefits and failures. "Appropriate technology adoption" is defined to mean the take-up and use of a technology in a way that proves utility-enhancing, profitable, and/or welfare-increasing for farmers and others along the agriculture value chain.

## A. Problem Identification

What problem is the technology intended to address? On what evidence is the definition of the problem based? What are alternative or competing technologies (or non-technological approaches) for addressing this problem? Where did the idea for the proposed technology come from? What evidence is there on what has worked/failed in for addressing similar problems?

## B. Magnitude & Certainty of Benefits

### What is the magnitude of the technology’s benefits for small-holder farmers?

*The benefits for each technology will be different—a technology might reduce yield variability, increase yields, reduce labor costs, etc. There are trade-offs between benefits and costs, but let’s begin by identifying and listing the types of benefits and their magnitudes. Describe and discuss, then use the table below to select the overall magnitude of the benefit you expect: Low, Medium, or High.*

### How certain is the estimate of magnitude? Is there high quality evidence to support that prediction?

*Consider whether this technology is new or has been adopted elsewhere. If the latter, have rigorous impact assessments been carried out to measure not only changes in yield/output, but also changes in household welfare (e.g. nutrition or consumption)? How extensively has the technology been adopted elsewhere—what is the take-up rate? Who are the main adopters in these settings? How do these settings differ from the proposed context? Describe and discuss, then use the table below to select how certain the benefits are: Low, Medium or High.*

Example: A fair amount is known about the technology based on field trials conducted by CG centers and by agricultural research stations. These trials suggest high fertility benefits. However, these trials tend to ignore inputs, such as labor, and also the variability of benefits coming from the fertilizer trees. Consequently, the certainty around the true benefits that accrue to the farmer still require rigorous evidence. The certainty of the magnitude of potential benefits is probably “medium”.

		Magnitude of the potential benefits		
		Low	Medium	High
Certainty about the magnitude	Low			
	Medium			
	High			

## C. Pitfalls of Scaling Up

Below is a listing of potential barriers to the appropriate (i.e. profitable or utility enhancing) adoption of a new technology. For the technology under consideration, please explain how appropriate adoption might be affected by each of the barriers listed below. How problematic is each barrier likely to be in the proposed context (“magnitude” of problem)? Is there any evidence to support this prediction (“certainty” of failure)?

For each potential pitfall, describe and discuss how it applies to the setting and technology under consideration.

**1. Does this technology increase the amount of risk that farmers or other actors in the agricultural value chain face?**

In the short run, trees will be vulnerable to many threats, including drought, fire and pests. While in the long run, the trees may help lower risk by providing a reliable source of nitrogen for crops even when chemical fertilizer is not available, the returns on investment for the farmer are quite risky.

**2. Does this technology require any other inputs, systems, institutions or supporting markets?**

The main input is labor, and in dry years, the amount of watering needed may be high. If the farmers are being asked to establish nurseries, they will need materials for seedling germination and for the physical nursery. The main complementary input that is needed is training (see #3).

Fertilizer trees rely on a number of supporting institutions and markets. First, agricultural extension workers will be relied upon for ongoing technical assistance. Past experience suggests high turnover of these staff that may complicate reliable support from them.

Second, seed supplies have faced shortages in the past. Reliance on existing suppliers will be inadequate if demand takes off. Local supplies will be developed as part of the scale up effort, with community-level training for nursery establishment. However, these local supplies are relatively untested and may be a major vulnerability.

**3. Does the use of this technology require any information or training?**

Correct planting and care does require training of farmers. Once trees are established, further technical inputs should not be required. Seed germination requires additional training and possible ongoing technical assistance.

**4. Are there social or cultural constraints to adoption of this technology, or its product?**

Subsidized chemical fertilizer is distributed annually in the target scale up area. This may lower willingness to pay for fertilizer substitutes (fertilizer trees). The trees do not affect food or other agricultural production beyond (hopefully!) impacts on future yields. They are unlikely to face cultural constraints.

**5. Are profits, benefits or yields shared among many people?**

The shared benefits of the technology come mainly from the nursery. Community members who do not assist with the nursery construction and seedling germination may still be able to access and benefit from the seedlings.

Some of the benefits of the trees benefit to others in the form of less fertilizer run off during the rains. Benefits from the trees are not particularly gender-biased, though women may benefit from less weeding once the trees are mature (they drop their leaves at the first rain, forming a ground cover that suppresses weed growth).

**6. Are yields and profits distributed across time?**

Benefits do not accrue until ~3 years after planting. This is longer than most agricultural investments in the area. The costs come in the first year. This is likely to be a major challenge for scale up.

**7. Will geographical constraints or a need for targeting make distribution difficult?**

The technology is appropriate for the vast majority of farmers in the target area. Distance to the nearest nursery may increase the costs for some farmers.

**8. Does the purchase or use of this technology have any negative spillover effects?**

No, in fact, it has positive spillovers by lowering soil depletion from chemical fertilizers and lessening dependence on the fertilizer subsidy program.

**9. Are local microclimates or agro-ecological zones appropriate for this innovation?**

The trees will grow best in damp soils near streams. They will be vulnerable to pests and drought when they are young. With watering and proper care, they will grow in most soils in the scale up area.

**10. Does this technology require cooperation among groups of farmers or households?**

The nurseries do require cooperation, and may benefit some more than others. Someone has to provide land for the nursery construction (unless communal land is available). Some community members may strategically wait until the seedlings are ready for planting before joining in. Attempts to prevent free riding might generate some community conflict. On the other hand, the nursery is unlikely to involve much in the way of cash transactions, so risks may be lower.

## **11. Is this technology sustainable?**

*What is the long term growth opportunity? Does this technology help a dying market or a declining crop? Is the technology accessible/affordable for farmers? Does the technology require long term support from the public sector (NGOs, donors, governments)?*

The technology may face some sustainability challenges given the limited private sector opportunities, given that farmers make a one-time investment (purchase seedlings) that provides little profit margin for suppliers. Development of community nurseries is intended to address this sustainability concern. The technology is a partial substitute for chemical fertilizer, so depending on long-run oil prices, demand for fertilizer trees may have a very bright future!