Assessing the Impact of New Technologies

The adoption of a new technology or a practice changes the way that farming households operate, the costs they incur, and the benefits they generate and/or receive. As pointed out earlier ("Evaluation of Current and New Technological Options," p. 49), any technology represents a particular way of solving one or several problems, and ideally it translates into an increase in the farming household's well-being. In assessing the impact of a technology, researchers want to determine whether the new technology has really addressed the needs and/or desires of the intended beneficiaries and whether it in fact has contributed to increasing their well-being. A new technology may also have many unintended consequences, including positive and/or negative effects on people that were not targeted originally, and it is important to learn about these other impacts.

The Complexity of Assessing Impacts

The complex nature of impact assessment has several sources:

- It is often difficult to separate the changes brought about by the adoption of a new technology from the effects of other factors that are unrelated to the new technology.
- Impact ideally should involve measuring "objective" impacts (e.g., changes in nutritional status, labor allocation, productivity, and income) as well as determining "subjective" impacts (e.g., changes in perceptions of well-being with the adoption of the new technology).
- The same technology may have a completely different impact on the various members of a household.
- A new technology may have unintended impacts, both positive and negative.
- A new technology may affect people who were never considered in its development and implementation.

This manual presents methods for assessing the *perceived* impacts of a new technology on its intended beneficiaries, including different members of a farming household. While the manual also attempts to deal with unintended impacts, it does not consider impacts on people who are not members of the target group, such as urban food consumers or farmers located outside the study area.

The Impact Assessment Process

Goal: Assess the changes that the farming household *perceives* to have occurred as a result of adopting a new technology or practice. These changes

may be positive or negative and may be not be the same for different household members.

Rationale: Changes brought about by the adoption of a new technology or practice ideally should translate into increased well-being for all members of the farming household, but unfortunately this is not always the case. For this reason, it is important to establish which changes have been brought about by the new technology/practice and the extent to which these changes have increased or decreased the well-being of the members of the household. Obviously, such an assessment depends on household members' perceptions of well-being.

Method: Given the complexity of impact assessment, this manual presents a set of guidelines rather than a fixed methodology for assessing impact. Although the focus is on the perceptions of impacts rather than on the actual impacts, the guidelines presented here may be appropriate for both.

Establish a set of impact indicators. Impact indicators are a set of variables, conditions, and/or perceptions that both farmers and scientists expect to change with the adoption of a certain new technology or practice. These indicators may be different for farmers and scientists.

The first step is to identify indicators of well-being that are relevant for different members of the farming household. Many of these indicators should have been identified in the diagnostic phase described earlier, for example during the classification of farmers or the wealth ranking (see "Diagnosis of Farmers' Conditions," p. 24). It is also possible to have discussions with key informants or groups of different types of households and household members to identify which conditions signal that they are doing well (e.g., they have no need to buy food during the year, or they have additional time for new activities or leisure).

The second step is to identify indicators of the changes that may result from using the new technology. To do this, scientists and key informants or groups of different types of households or household members discuss the following question:

If you adopt this technology, what do you expect to be different?

This question may seem vague, but the point is to be as open and broad as possible—in other words, to "cast the net widely." Besides identifying the indicators, the answers to this question allow farmers and scientists to discuss which indicators are reasonable and which are not, or, put another way, what is reasonable to expect from a technology. Far-fetched expectations may disappoint farmers and create a perception of failure, even when a technology may have had very positive impacts.

Once the indicators have been identified, the next step is to relate the two sets of indicators, since not all indicators of well-being may be relevant to the specific technology being adopted. Researchers should also ask themselves the same questions so that they develop one list of indicators for farmers and another for themselves, which may or may not coincide but will be explicit.

Establish a baseline. Since impact assessment is based on an analysis of changes, it is fundamental to generate a baseline to which changes can be compared. The baseline describes and, if possible, measures the impact indicators

that have been identified, and any associated relevant conditions, before a new technology/practice is adopted. The relevant conditions depend on the technology/practice to be adopted, particularly with respect to the current technologies or practices that may be modified or displaced by the new ones. Ideally, the baseline should be done among a random, representative set of farming households so that generalizations can be made. Alternatively, it can be done among key informants or focus groups that encompass the range of potential beneficiaries of a new technology or practice.

Establish a monitoring system. Once the indicators have been established and the baseline done, researchers should follow up systematically among a sample or subgroup of people who participated in the baseline. A follow-up consists of visiting the sample or subgroup and collecting information on the impact indicators from them. To identify unintended impacts, the follow-up visit should also feature an open-ended discussion of people's views, positive and negative, of the adopted technology/practice. Obviously, the follow up cannot be done immediately. Time (at least a year) has to pass between the introduction of a new technology/practice and the first follow-up, and several follow-up visits may be made at subsequent intervals. Unfortunately, lack of funding may constrain the ability to carry out these visits, but a system should be in place so that if they do take place, the information collected is valuable.

Carry out a final assessment. At some point after a new technology or practice has been introduced and (one hopes) adopted, a "final" assessment should be done. The idea of a "final" assessment is slightly artificial, because the impacts of a technology will probably continue to unfold after the impacts study has been completed, but funding considerations or the closure of the research project make it important to choose a specific time to carry out this assessment. The final assessment consists of a dialogue that includes scientists, farmers who adopted the new technology/practice, and farmers who did not. Ideally the discussion will include farmers who participated in the baseline analysis, but it need not be restricted to them.

The dialogue is based on a discussion of farmers' and scientists' perceptions of the changes that occurred in the impact indicators as the result of adopting the technology. The discussion should include an open-ended consideration of positive as well as negative changes and should particularly try to identify the unintended impacts of the technology. For example, the discussion could be guided by the following questions.

Earlier you said that you expected changes in these things (refer to the indicators previously identified).

Do you think that those changes have occurred?

Have they been positive or negative for you, and why?

Have changes occurred with the adoption of this technology that you did not expect or foresee?

Or, in more general terms:

What do you do you consider has changed in your livelihood with the adoption of (name the technology/practice)?

Which of those changes do you consider to be positive, and why?

Which of those changes do you consider to be negative, and why?

This dialogue can be organized as a series of group discussions between scientists and farmers, including different members of the household. It may also include a more formal survey, particularly with those in the baseline study. A more formal survey may include techniques for evaluation of the new technological options, such as the rating methodologies explained above. It may also include specific questions based on the indicators identified by both farmers and scientists, such as the numbers and types of varieties now planted, adoption of the new soil fertility improvement technologies, knowledge of new concepts, application of new techniques, and so on. The results of this dialogue should be documented and used to reassess the new technology/practice.

Example: The Oaxaca Project includes an impact assessment component. To assess the impact of this project, farmers and scientists established a set of indicators (Table 19). Farmers' indicators referred mainly to enhanced food security and access to landraces with valuable traits, either by recuperating old materials or acquiring new ones. Scientists' indicators referred to an increase in the diversity of landraces grown at the household and community levels, as well as the genetic diversity present in those landraces.

The baseline study of a representative random sample of farming households in the six communities provides a control against which researchers and farmers can eventually compare the changes resulting from the Oaxaca Project (which, as of this writing, has not yet concluded). The baseline study included questions on maize requirements, distribution of yields, storage practices, numbers and types of maize currently and no longer grown, and a rating of traits for each maize type grown. All information was collected for male and female members in the household involved in maize production, preparation, and consumption. The baseline also included a collection of the maize types grown by a subsample of these farmers.

During the different interventions (demonstrations and field days, training sessions, joint experiments), researchers recorded the names and addresses of participants and selected a random sample of participants for monitoring. At the end of the growing season after the demonstrations took place, these farmers were interviewed about their own socioeconomic characteristics, the maize types they grew, and their perceptions of the landraces they bought, including a systematic rating of their characteristics. Additionally researchers and farmers participated in open-ended discussions about gaining access to these "new" landraces. The discussions yielded information on unforeseen impacts. For example, the availability of a short duration, red-grained maize (Belatove) had two advantages. First, it offered some farmers the possibility of growing two crops a year. Second, it gave others the opportunity to plant and harvest an earlier maturing crop that provided

Table 19. Impact indicators identified by farmers and scientists in a participatory research project, Oaxaca, Mexico

Farmers' impact indicators	Scientists' impact indicators
Maize harvest does not get spoiled while stored	Farmers grow new maize types with desirable traits
Less need to purchase maize	Farmers grow more maize types
Recover desirable maize types that were lost	Genetic diversity increases at the household level
Identify new maize types with good consumption and/or sale characteristics	Genetic diversity increases at the community level

maize for home consumption when stores from the previous year were finished, thus decreasing the need to purchase maize. Another of the landraces offered was in great demand by women, who liked its purple husk for making tamales (a special maize preparation wrapped in the husk). Before the project, this maize type was very rare, but now it seems to be diffusing rapidly throughout the region.

It is too early to provide an accurate picture of the impacts of the Oaxaca Project, but to date, the monitoring shows that the project is having an impact on farmers' indicators and to some extent on scientists' indicators (although the impact on genetic diversity has not yet been established). Farmers have shown great enthusiasm for purchasing diverse sets of landraces. During the 1999 demonstrations, 804 kg of seed were sold in 197 purchase events (a farmer purchasing seed of a landrace), with a total of 123 farmers (27% female) purchasing seed (the same farmer could purchase seed of more than one landrace). As part of the follow-up, researchers also interviewed farmers who did not participate in demonstrations and experiments. These farmers explained that they had chosen not to participate because they thought that the landrace varieties offered would not work under their conditions, they lacked time to participate in project activities, and they did not want to take the risk of planting landraces that they did not know.

The example provided here is not typical of most new technologies offered to farmers, because the technologies in this instance are sets of landraces. More commonly new technologies consist of improved varieties, inputs, and improved crop management practices. However, the basic procedure illustrated above is applicable to other kinds of technology.

Comments: As pointed out, impact assessment is complex and ideally includes subjective as well as objective indicators. Because subjective perceptions may not coincide with objective conditions and vice versa, if researchers focus exclusively on one or the other kind of impact, they will develop an incomplete picture of the true impacts of a new technology and/or practice. It is also important to remember that *externalities*—unintended impacts that go beyond the target group—should also be taken into account in the impact assessment. There is no scope to discuss this subject in this manual, but it is covered extensively in the literature on impact assessment.