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**ASSESSING THE IMPACT OF AGRICULTURAL RESEARCH
ON POVERTY USING THE SUSTAINABLE
LIVELIHOODS FRAMEWORK**

Michelle Adato* and Ruth Meinzen-Dick**

***Food Consumption and Nutrition Division**
****Environment and Production Technology Division**

International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006 U.S.A.
(202) 862-5600
Fax: (202) 467-4439

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ABSTRACT

As the goals of international agricultural research move beyond increasing food production to the broader aims of reducing poverty, both agricultural research and studies of its impact become more complex. Yet examining the magnitude and mechanisms through which different types of agricultural research are able to help the poor is essential, not only to evaluate claims for continued funding of such research, but more importantly, to guide future research in ways that will make the greatest contribution to poverty reduction. This paper reports on the approach used in a multicountry study of the poverty impact of research programs under the Consultative Group on International Agricultural Research (CGIAR).

The studies use an expanded understanding of poverty that goes beyond income- or consumption-based headcounts or severity measures, to consider many other factors that poor people in different contexts define as contributing to their vulnerability, poverty, and well-being. The sustainable livelihoods framework provides a common conceptual approach to examining the ways in which agricultural research and technologies fit (or sometimes do not fit) into the livelihood strategies of households or individuals with different types of assets and other resources, strategies that often involve multiple activities undertaken at different times of the year. Applying this framework requires interdisciplinary research and a combination of quantitative and qualitative methods.

This paper reports on the conceptual framework, methods, and findings to date of these studies. The paper provides an overview of the sustainable livelihoods approach,

how it can be applied to agricultural research, and describes detailed methods and results from five case studies: (1) modern rice varieties in Bangladesh; (2) polyculture fishponds and vegetable gardens in Bangladesh; (3) soil fertility management practices in Kenya; (4) hybrid maize in Zimbabwe; and (5) creolized maize varieties in Mexico. Applying the sustainable livelihoods approach highlights the multilayered interactions between technologies and the vulnerability context of households, their asset base, intervening institutions, and livelihood strategies. However, additional aspects of culture, power, and history need to be integrated with the framework to understand the role of agricultural research in the lives of the poor. Additional explicit attention must be given to the implications of gender, ethnicity, class, or other types of social differentiation. Although this approach is more difficult for research than conventional single-disciplinary analyses, it leads to a more complete understanding that can help develop technologies that better fit in with complex livelihood strategies, especially of the poor.

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Michelle Adato and Ruth Meinzen-Dick
International Food Policy Research Institute

1. INTRODUCTION

Assessing the impact of agricultural research on poverty is difficult, as there are so many ways in which agricultural research can have an effect (Kerr and Kolavalli 1999; IFPRI 2000). For this reason, many studies have tended to simplify the linkages between agricultural research and poverty and measure only one or two aspects of those linkages. While understandable, the approach can miss many important aspects of poor people's lives, including the diverse ways in which technology directly or indirectly affects their livelihoods.

This paper presents an alternative approach that is being employed in a study of the impact of agricultural research on poverty. This study, led by the International Food Policy Research Institute (IFPRI) on behalf of Consultative Group on International Agricultural Research's (CGIAR) Standing Panel on Impact Assessment (SPIA), currently includes five case studies led by four CGIAR centers and a wide range of technologies (see Table 1). The common thread in these case studies is the use of the sustainable livelihoods framework as the starting point for the analysis of how agricultural research has affected people's lives. The framework is more complex than those used in many approaches and calls for interdisciplinary research methods. However, experience to date suggests that the approach is not only manageable, but provides important additional insights that would not otherwise be obtained from conventional research approaches.

The next section of this paper presents the sustainable livelihoods framework, shows how agricultural research and technologies fit into this framework, discusses how

we have employed this approach, summarizes the benefits and limitations of this framework that have been revealed thus far, and presents implications for research methods. The concluding section assesses the value of this approach for studying the impact of agricultural research.

Table 1—Ongoing case studies of impact of agricultural research under the IFPRI/SPIA project

Country	Technology	Case study leader	Lead CGIAR center
Bangladesh	Modern rice varieties	Mahabub Hossain	International Rice Research Institute (IRRI)
Bangladesh	Polyculture fishponds Improved vegetables Modern rice varieties	Kelly Hallman	International Food Policy Research Institute (IFPRI)
Kenya	Soil fertility management	Frank Place	International Centre for Research in Agroforestry (ICRAF)
Zimbabwe	Modern maize varieties	John Hoddinott	International Food Policy Research Institute (IFPRI)
Mexico	Creolized maize varieties	Mauricio Bellon	Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT)

2. “SUSTAINABLE LIVELIHOODS APPROACHES” AND THE SUSTAINABLE LIVELIHOODS CONCEPTUAL FRAMEWORK

LIVELIHOODS APPROACHES

Sustainable livelihoods approaches have evolved from three decades of changing perspectives on poverty, how poor people construct their lives, and the importance of structural and institutional issues (Ashley and Carney 1999). The concept of “livelihoods” has become increasingly popular in development thinking as a way of conceptualizing the economic activities poor people undertake in their totalities. The

focus of development thinking in the 1970s on employment and “jobs” has given way to the realization that while job creation in the formal sector continues to be one important strategy for poverty reduction, the reality for poor people in the South is that survival and prosperity depends on the pursuit of diverse and multiple activities simultaneously, by different family members, taking advantage of different opportunities and resources at different times. As Chambers wrote in 1997:

They maintain a portfolio of activities. Different members of the family seek and find different sources of food, fuel, animal fodder, cash and support in different ways in different places at different times of the year. Their living is improvised and sustained through their livelihood capabilities, through tangible assets in the form of stores and resources, and through intangible assets in the form of claims and access (Chambers 1997, 163).

Livelihood activities may be composed of, for example, year-round or seasonal formal-sector employment, informal trading or sale of labor, home gardens and food processing, livestock production, cultivation or use of natural or common property resources, labor exchange among family or neighbors, contracted “home work,” borrowing, scavenging, stealing, and begging. They may be on or off farm, include local or international migration, involve elderly household members or children, be legal or illegal. For poverty analysis and poverty reduction interventions to be effective, it is important to understand these multiple activities in order to understand the multiple

sources of vulnerability faced by the poor, the multiple ways in which their lives are affected by structures and institutions, and the varied ways in which development interventions may strengthen or weaken these livelihood activities. In addition to recognizing these activities, using livelihoods approaches requires an attempt to understand the processes that underlie poverty, and the social, cultural, political, and institutional contexts in which poor people live. Although the individual, household, and community are the primary levels of analysis, livelihoods approaches seek out the relevant interactions at micro, intermediate, and macro levels. Hebinck and Bourdillon (2002) point out the different ways in which a livelihoods framework is used in the field of development:

For policy makers... 'livelihood' provides a framework that focuses on poverty within the contexts of the people who are poor, and on the processes that underlie poverty. For consultants who operate in the field of development, 'livelihood' represents a framework for the formulation of development projects that focus on the people being affected by the project and the variety of ways in which they might be affected. For social scientists, such as anthropologists, sociologists and economists, 'livelihood' provides a framework for a holistic interpretation of the dynamics of development and the different rhythms of change. For plant breeders, soil scientists, and other technologists, the livelihood framework serves the purpose of linking their specific work and capacities with what people are capable of doing, what they are looking for, and how they

perceive their needs. The livelihood framework thus provides a guide for research and intervention.

THE SUSTAINABLE LIVELIHOODS FRAMEWORK

The sustainable livelihoods conceptual framework is a particular form of livelihoods analysis used by a growing number of research and applied development organizations, including the Department for International Development (DfID) of the United Kingdom (one of its most ardent supporters), the United Nations Development Program (UNDP), as well as nongovernmental organizations (NGOs) such as CARE and Oxfam (DfID 1997; Carney et al. 1999).¹ It is primarily a conceptual framework for analyzing causes of poverty, peoples' access to resources and their diverse livelihoods activities, and relationship between relevant factors at micro, intermediate, and macro levels. It is also a framework for assessing and prioritizing interventions. The IFPRI/SPIA study is testing and adapting the sustainable livelihoods framework for use in agricultural research, with the aim of assisting agricultural researchers to conduct ex-post and ex-ante assessments of the impact of their interventions on poverty. To date, the vast majority of impact assessments in CGIAR centers have used conventional measures of poverty based on income and consumption data, and sometimes nutrition indicators. The sustainable livelihoods framework takes as a starting point an expanded definition of poverty that looks *beyond* the following:

¹ Many key readings on sustainable livelihoods, as well as discussion on its applications, are available on the web at www.livelihoods.org. While each organization has its own variations on the framework, emphasizing different aspects, there are many common elements.

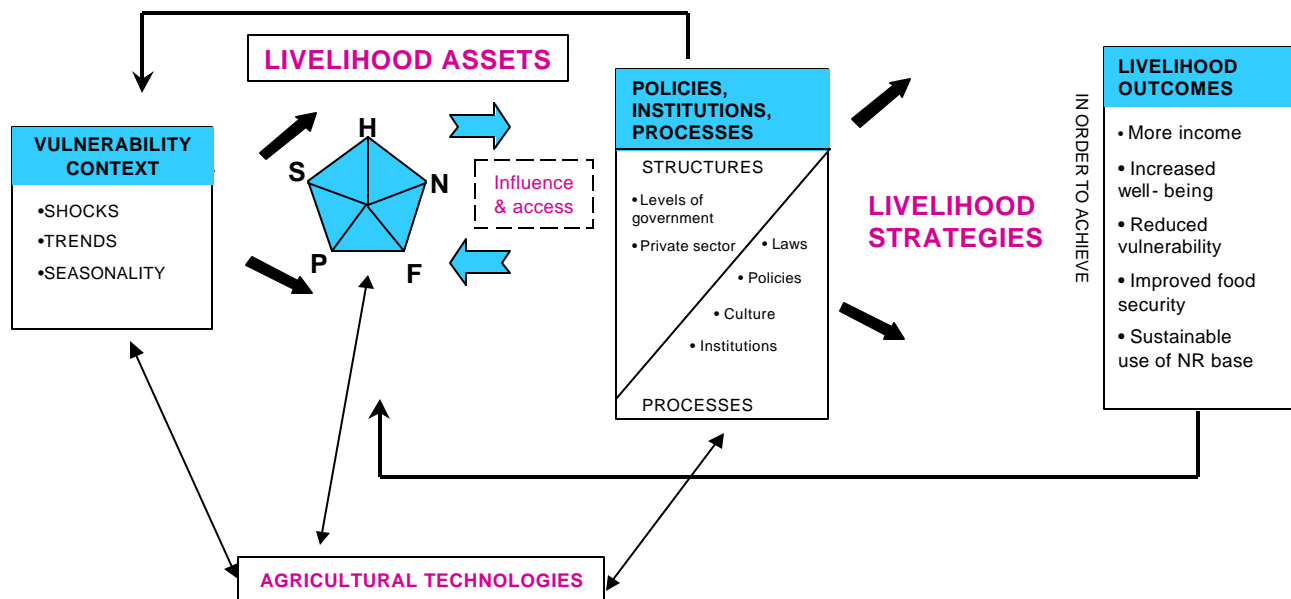
- conventional poverty measures based on income, consumption, or nutrition to *additional aspects of poverty and well-being*, e.g., access land, water, credit, or education, vulnerability to natural disasters, political rights, physical safety, and social relationships that provide economic security and social well-being;
- “today’s poor” to who is vulnerable or likely to be “*tomorrow’s poor*”;
- aggregated household or head counts to *the effects of social differentiation* by class, ethnic group, gender, and other locally-specific social differences; and
- external standards to *self-perceptions by local communities* on who is poor and what poverty means, taking into account what people themselves value (Narayan-Parker et al. 2000).

One feature of this framework is that it looks at more aspects of people’s lives than how many live on a purchasing power of \$1.00 a day or how many households consume less than 2,000 calories per person per day. For example, participatory poverty assessments or case study research can identify the features by which people in rural areas themselves identify poor or well-off households.

A second key feature of the sustainable livelihoods framework is that it recognizes people themselves, whether poor or not, as actors with assets and capabilities who act in pursuit of their own livelihood goals. While this may seem obvious, in many cases the poor have been regarded as passive victims or recipients of government policies and external aid.

The overall conceptual framework for sustainable livelihoods is illustrated in Figure 1 (see, also, Carney 1998; DfID 2001). The framework is intended to be dynamic, recognizing changes due to both external fluctuations and the results of people's own actions. The starting point is the vulnerability context within which people operate. Attention is next given to the assets that people can draw upon for their livelihoods.

Figure 1—The sustainable livelihoods conceptual framework with agricultural technologies



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Source: Adapted from DfID 2001.

Assets interact with policies, institutions, and processes to shape the choice of livelihood strategies. These, in turn, shape the livelihood outcomes, which are often the types of impact we are interested in. However, those outcomes are not necessarily the end point, as they feed back into the future asset base.

The vulnerability context encompasses

- *trends* in population, resources, and economic indicators such as prices, governance, or even technology;
- *shocks* such as changes in human or animal health, natural disasters, sudden economic changes, or conflict; and
- *seasonality* in prices, agricultural production, employment opportunities, resource availability, or health.

Vulnerability here refers to things that are outside people's control. It is usually negative but it can also provide positive opportunities. It is not objective "risk" that matters, but people's subjective assessments of things that make them vulnerable. These matter because both perceived and actual vulnerability can influence people's decisions and hence their livelihood strategies. This is especially important for whether people are willing or interested in adopting agricultural technologies.

The **asset base** upon which people build their livelihoods includes a wider range of assets than are usually considered. Rather than looking only at land or other classic wealth indicators, the sustainable livelihoods framework suggests consideration of an asset portfolio of five different types of assets:

- *Natural capital* includes land, water, forests, marine resources, air quality, erosion protection, and biodiversity.
- *Physical capital* includes transportation, roads, buildings, shelter, water supply and sanitation, energy, technology, or communications.
- *Financial capital* includes savings (cash as well as liquid assets), credit (formal and informal), as well as inflows (state transfers and remittances).
- *Human capital* includes education, skills, knowledge, health, nutrition, and labor power.
- *Social capital* includes any networks that increase trust, ability to work together, access to opportunities, reciprocity; informal safety nets; and membership in organizations.

Though most versions of the sustainable livelihoods framework are limited to these five kinds of capital, some add political capital as a sixth type of asset, which can include, for example, citizenship, enfranchisement, and membership in political parties—all assets that can be key in obtaining or operationalizing rights over other assets.

Policies, institutions, and processes affect how people use their assets in pursuit of different livelihood strategies. This box on the diagram refers to both formal and informal institutions and organizations that shape livelihoods by influencing access to assets, livelihood strategies, vulnerability, and terms of exchange. They may occur at multiple levels, from the household to community, national, and even global levels. The

public and private sectors, civil society, and community institutions may all be relevant considerations; laws as well as culture can also be included.

All of these influence people's **livelihood strategies**, i.e., the choices they employ in pursuit of income, security, well-being, and other productive and reproductive goals. As discussed above, what is important about the livelihood strategies approach is that it recognizes that households and individuals may pursue multiple strategies, sequentially or simultaneously. This means that, even in the context of agricultural research, we should not assume that someone is automatically a "farmer," or that people with other businesses are not involved in farming. Nor should we overlook even small livelihood strategies, because they can be very important, especially for the poor, who often pursue many livelihood strategies either to make up enough income or to provide a measure of security. The pursuit of multiple activities can have important implications for cash and labor availability at different times of the year, and for the relevance of specific development interventions for poverty reduction.

Livelihood outcomes encompass many of the types of impact of interest for the study of the impact of agricultural research on poverty. Potential outcomes include conventional indicators such as income, food security, and sustainable use of natural resources. Outcomes can also include a strengthened asset base, reduced vulnerability, and improvements in other aspects of well-being such as health, self-esteem, sense of control, and even maintenance of cultural assets, and thus have a feedback effect on the vulnerability status and asset base.

The sustainable livelihoods framework draws on a number of theoretical and conceptual approaches to development thinking; in this sense it is more a holistic and synthetic framework than an entirely new set of concepts. What the framework does is provide a method for thinking about the multiple and interactive influences on livelihoods without overlooking important explanatory factors. In this respect, it provides a “checklist” (Ashley and Carney 1999) of issues to be considered in designing research initiatives or program evaluations. Not everything on the checklist can be included in one study, so prioritization is necessary. The framework provides the advantage of allowing researchers to understand the parameters of the “big picture,” and then narrow the scope of the study to what can have the highest impact or what is most relevant to the important stakeholders (including researchers). The framework may guide researchers to consider and prioritize less visible factors and local priorities that may or may not revolve around production and consumption or even physical or financial resources, but could instead relate to education, safety, or legal rights.

The framework may also identify issues that are highly salient in explaining livelihood impacts, but are either (1) too far outside of the domain of the research to be a focus of study, e.g., vulnerability to domestic violence in the context of a study of agricultural research; or (2) while relevant to the study, are impossible to include, e.g., a high level of political violence that is either too sensitive or dangerous to address. In these cases, the framework can help make explicit what is *not* included, but may still be important to understanding chains of causality or important constraints on the ability of a technological intervention to affect livelihoods. Use of the sustainable livelihoods

framework involves acknowledging complexities that can be hard to manage in a study. Rather than shy away from this complexity, use of the framework implies a willingness to acknowledge that livelihoods—and the process of affecting them—are complex. It also implies making an effort to achieve the most comprehensive understanding of these issues possible.

The framework requires researchers to think holistically, not just about certain types of assets such as land and credit, but also about the potential interaction of five or six kinds of assets, and the complementarities between assets and their sequencing. For example, membership in a social group (social capital) may be necessary for access to rights (political capital) and land (natural capital), which is necessary for access to credit (financial capital), which, in turn, is needed to purchase inputs to take advantage of a new technology. This understanding may lead to a different choice of intervention. The framework can also provide a structure for thinking about conflicts between livelihood objectives, e.g., whether increased production might conflict with human capital development or protection of the natural resource base, or whether income maximization through increased cash crop production might increase vulnerability of women through decreased production of crops used for small enterprises.

3. APPLYING THE FRAMEWORK TO THE IMPACT OF AGRICULTURAL RESEARCH

The sustainable livelihoods framework brings in many considerations that are often not included in an impact study dealing with agricultural research. At the same

time, it may not be obvious how agricultural research and technologies might fit into this framework.² In Figure 1, we have indicated three ways in which agricultural research can fit in: by affecting the vulnerability context, through linkages to the asset base, or as part of policies, institutions, and processes.

Agricultural research and technologies can reduce vulnerability, such as when irrigation reduces susceptibility to fluctuations in water supply, or pest control technologies reduce vulnerability to crop or animal loss. However, research and technologies can also increase vulnerability, such as when new varieties are more susceptible to crop failure if conditions are not right, or farmers have to purchase the seed again every year under conditions of cash constraints. In Bangladesh, the susceptibility of polyculture fish production to disease was cited by rich and poor alike as a serious problem. In Mexico farmers find that improved varieties of maize have advantages in terms of height and yield but are more susceptible to rotting and certain pests. Drought in the early 1990s was a particularly severe source of vulnerability in Zimbabwe, affecting farmers who had adopted hybrid maize through widespread crop loss, fertilizer burn, and loan defaults. Richer farmers who had used increased incomes from higher maize yields to diversify into cattle were better protected from these drought shocks. The importance of *perceived* vulnerability is illustrated in the Zimbabwe case in terms of the extent to

² UNDP's approach to sustainable livelihoods makes technology and investment one of the "drivers" (along with policy and governance) that affect local adaptive strategies, assets, knowledge, and technology, which in turn have sustainable livelihoods as an outcome. While this approach gives more explicit attention to technology, DfID's version, upon which our approach is based, has the advantage of being more explicit about the links between vulnerability, assets, and livelihood strategies.

which people perceived themselves as vulnerable to magic and witchcraft—seen as a significant factor explaining good and bad yields.³

Research and technologies are strongly linked to the asset base. The best-researched aspects of this relationship are the types of assets that are required to adopt new technologies. For example, much of the debate on the Green Revolution centered around whether or not large landholdings (natural capital) were required to adopt the various components of the green revolution package. Considerable policy emphasis has also been given to expanding agricultural credit (financial capital) and roads or transportation (physical capital) in order to permit technology adoption. Human capital, in the form of knowledge and skills, is often required to properly make use of many new technologies. It is now increasingly recognized that social capital can facilitate adoption of technologies that operate on a large spatial scale, wherein collective action is needed to coordinate the action of individuals for common investment or adherence to rules. Many natural resource management practices, including integrated pest management, community nurseries, rangeland management, irrigation, forestry, and watershed management fall into the category of technologies that are facilitated by collective action (Knox McCulloch, Meinzen-Dick, and Hazell 1998). In the case study of fish ponds in Bangladesh, one NGO disseminated the technology to households that had private fishponds, which meant that natural capital (rights to land with a fish pond) were required for adoption; this favored relatively well-off households. In another study district, an

³ Findings from the case studies reported in this paper are mainly drawn from interim project progress reports and papers (Bourdillon 2001; Hallman et al. 2002; Lewis 2001; Hebinck and Hoddinott 2002; Hebinck et al. 2002; Hossain et al. 2002; Omosa 2001).

NGO assisted in the formation of groups of landless or land-poor households that could collectively rent a pond, and then disseminated polyculture fish technology to the groups. Here social capital, as embodied in the groups, became a way of overcoming natural capital constraints. However, success of the technology then hinged upon maintaining cooperation, and many households lost out when disputes erupted within the group.

Further illustrations from the SPIA case studies of the relationship between agricultural technologies and access to assets can be found in Mexico, where poor farmers say they do not plant the improved maize varieties because they perceive them as more management intensive, requiring more fertilizer and labor (financial and human capital constraints). Similarly, in the case study in Kenya, land and labor availability were cited as constraints on adoption of ICRAF soil fertility replenishment (SFR) technologies. Although adoption of SFR technologies were seen as increasing yields and improving soil quality, leaving land fallow, as required for some of these technologies, is difficult for resource-poor farmers. This can potentially be a source of increased inequality if better-off farmers are able to take advantage of the technology and achieve higher yields than can poorer farmers. Access to assets is, in turn, affected by the vulnerability context, where vulnerability to shocks such as AIDS and other illnesses reduces labor availability.

Even technologies that are designed to be adapted to less favored areas and poor farmers may not do so without farmers' access to certain assets. The Zimbabwe case study has found that although the HYV maize was designed to do well in drought prone areas, farmers in better agroecological zones adopted faster than those in middle and poor zones. Preliminary results indicate that this is because in these zones, farmers had more

agricultural capital stock and livestock to protect them from risk, and had better marketing channels. Assets and people's access to them also have many gender dimensions, affecting the value of technologies to men and women. In Zimbabwe, men have been found to prefer the improved varieties, while women seek out the open-pollinated varieties. This is because women have less access to the credit and cash required for certified seed and fertilizer. Moreover, women use their social networks to acquire open-pollinated seeds and find these do well with cow manure. Women also have less access to formal maize markets where improved maize is sold, an example of how policies and institutions influence technology adoption choices and consequences among different social categories of farmers.

Agricultural research can shape the asset base as well. This is most easily seen in new equipment that becomes part of physical capital, or irrigation or soil fertility management practices that improve the natural capital of water and land. As noted above, for example, in Zimbabwe, increased yields and incomes from HYV maize enabled some farmers to diversify into livestock. Participatory or action research processes can strengthen the human and social capital asset base when knowledge is generated and groups are formed to work together on the research. The knowledge generated through NGO training programs in fish or vegetable production in Bangladesh was a clearly valued addition to local human capital.

Social capital plays an important role in influencing impacts of agricultural technology, because of the ways in which social networks and social relationships facilitate and constrain technology dissemination. Pre-existing social capital may be used

in dissemination, or new forms of social capital may be developed for the purpose of dissemination. The latter is the case in Western Kenya, where ICRAF and its partners, as well as several NGOs and the Ministry of Agriculture and Rural Development, have developed new local groups and innovative methods for dissemination of technology, information, and training among and between villages. In Mexico, many poor farmers prefer to obtain seed through their informal social networks of family and friends, and prefer to learn from their neighbors' successes and problems, rather than through official government channels. In Zimbabwe, social capital plays a role in the relationship that rich and poor male farmers growing HYV maize have developed with marketing institutions, as well as networks they use for information and technology dissemination. Women farmers obtain open-pollinated varieties and market maize through their own social networks. For Zimbabwean households, higher yields from HYV maize strengthen reciprocity relationships with kin and friends, especially urban-rural relationships: the ability to send maize to the city ensures that other resources are sent back to the country, suggesting that the well-being impacts of social capital can depend on the ability of both parties to bring resources to the table.

Social capital, perhaps more clearly seen as complex social relationships, can also interact with new technologies and produce negative consequences, or otherwise complicate dissemination efforts. For example, in the ICRAF Western Kenya study, social status in the village influenced dissemination processes in a number of ways. The perceived low status of the local farmer chosen as an extension agent sometimes contradicted peoples' expectation that innovation comes from external and superior

sources. Furthermore, which farmers attend training and dissemination meetings depends on who in the village makes the invitations, and the political alignment and social standing of other invitees. While SFR technologies give new status to farmers who are seen as “successful farmers” and attract visitors to the village, strong social tensions have been created where some farmers are seen as “favored” by external organizations, exacerbated by “clanism” and politics.

Finally, the policies, institutions, and processes (PIP) dimension of the SL framework is relevant to the study of agricultural research in several ways. Agricultural research and technologies can be considered as a component of the PIP that composes the environment in which farmers operate. They are institutions whose interventions change people’s options in pursuing their livelihood strategies. By changing the relative returns to different factors or assets, technologies can effectively change the distribution of the value of assets within and between households. For example, aquaculture technologies allow people to make flooded land produce fish for income and home consumption, while research on drought-tolerant crop varieties can allow farmers without irrigation to pursue farming with less fear of disastrous losses. In Bangladesh, modern rice varieties have increased labor productivity and led to better labor contracts for the landless, with not only higher real wages but also more dignity. Productivity increases also affect income, which may have other complex impacts on institutional arrangements, such as by creating demand for other products, which, in turn, creates more employment opportunities through forward and backward linkages.

Agricultural research also interacts with other political institutions at national, regional, and local levels, and is facilitated or constrained by public policies. Land tenure arrangements, legal rights to natural capital, marketing institutions, input packages, prices, and other policies influence the ability of farmers to take advantage of technologies, and influence rich and poor farmers, and men and women farmers differently. In Zimbabwe from the early 1980s, farmers were only allowed to plant HYV maize; they were provided with input packages and credit, and marketing services. These had mixed consequences: it had positive impacts on yields, but failure of these varieties and damage from fertilizers during drought led to loan defaults, and women suffered decreased control over maize crops and income.

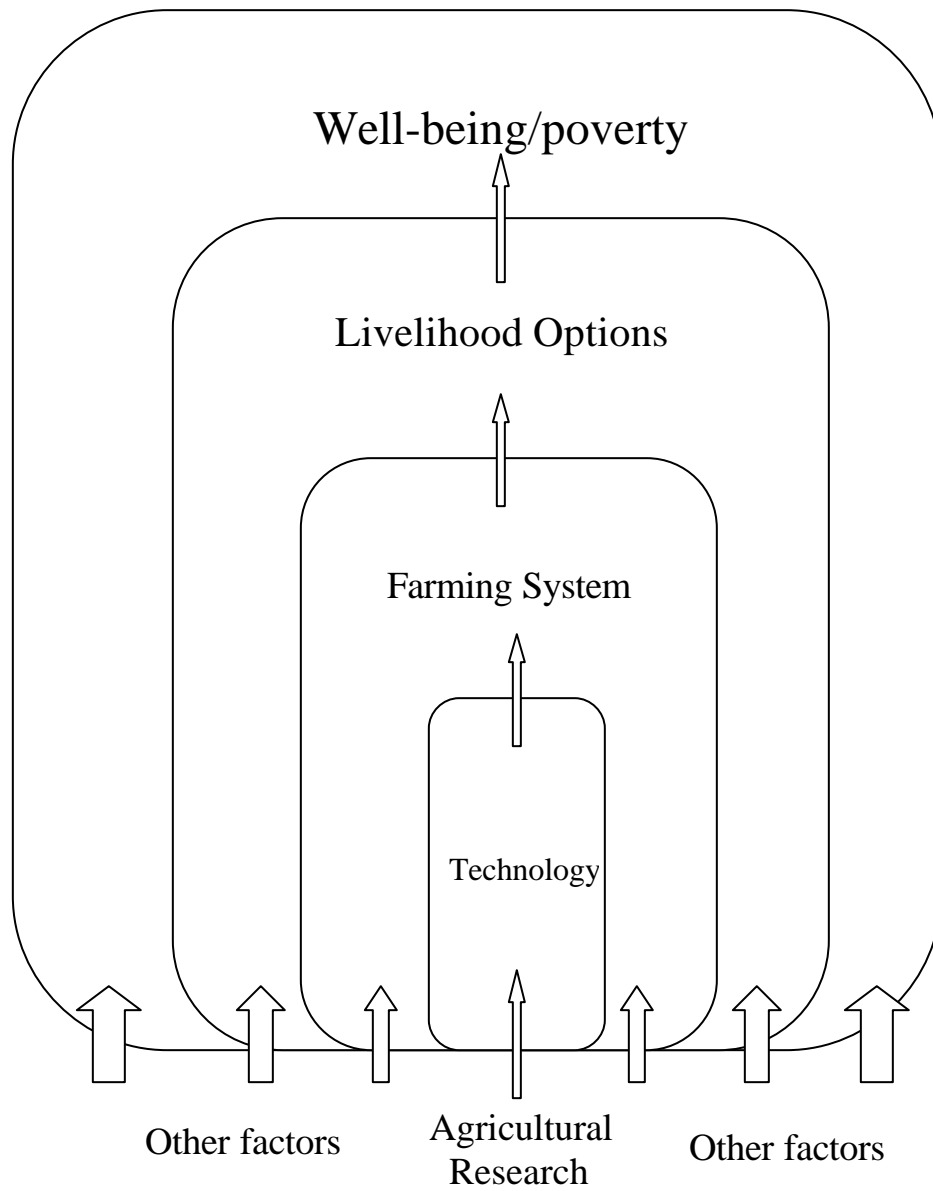
In Figure 1, the arrows between agricultural technologies and the vulnerability, assets and PIP boxes point in both directions, because each of these domains has the potential to shape technologies. Vulnerability factors may lead people to change the seeds used, such as in Mexico where farmers have, by design and accident, promoted crosses between improved and local maize varieties (Bellon and Risopoulos 2001). Some of these “creolized” varieties are perceived to be more resistant than the improved maize to drought and pests—and require less labor at critical times—hence reducing these farmers’ vulnerability. The vulnerability context and asset portfolios of farmers should lead agricultural researchers, including farmers themselves, to adapt technology to these contexts. Moreover, the organized efforts of farmers (social capital) as well as individual farmer’s experimentation, adaptation, and innovation can lead to changes in technology that better meet the needs of resource-poor farmers (Chambers, Pacey, and Thrupp 1989).

Finally, policies, institutions, and processes can shape the decisions of agricultural researchers in technology development, e.g., through commodity markets and prices, laws and policies related to land and water, education and extension, as well as direct financial investments in technology at the national level.

The sustainable livelihoods framework is not the most direct way of examining the impact of agricultural research, because it requires consideration of so many intervening factors at multiple levels, factors that may or may not have a major impact and may or may not relate to the technology. But this reflects reality. After all, agriculture is only one part of people's livelihoods, and agricultural research and technologies may affect only one part of the total farming system, as illustrated in Figure 2. Understanding the other factors that impinge at each point can be critical to improving the ultimate impact of agricultural research.

Experience with the IFPRI/SPIA project has shown that, although use of the sustainable livelihoods framework can appear daunting, using it to assess the impact of agricultural research is both manageable and helpful in suggesting relationships to examine. Employing this expanded conceptual framework can change the findings on the impact of agricultural research. Technologies that stabilize yields in the face of climatic or other fluctuations, thereby reducing vulnerability, may emerge as more valuable for improving people's livelihoods and well-being than technologies that maximize average production, but with higher fluctuations. Technologies that do not require many purchased inputs may be more accessible to households with low income or access to transportation and market infrastructure. Those that reduce labor requirements, especially

Figure 2—Role of agricultural research and technology in livelihoods and well-being



Source: Adapted from Small and Svendsen 1992.

for women, may allow households to diversify into other income-earning activities or devote more time to childcare, or be more suitable for families with one or more members who are sick—an especially important consideration with the rise of HIV/AIDS. On the other hand, decreases in agricultural employment opportunities may be a negative outcome of laborsaving technologies, highlighting the need to conduct disaggregated analysis of impacts on differentiated groups.

These factors can be identified in conventional farm management and intrahousehold analyses (see Knox McCulloh, Meinzen-Dick, and Hazell 1998), but are often omitted in poverty impact studies because of the difficulty in measuring them, especially quantitatively. Where there are trade-offs involved in a new technology, such as between average productivity increases and higher vulnerability, the qualitative methods can improve understanding of how different categories of households and individuals value those trade-offs. Using focus groups and other qualitative methods is also useful in identifying factors that might otherwise be overlooked, or to prioritize which of the many potential effects are important for poor people in that area. In the Bangladesh case studies, labor power (the most basic form of human capital) emerged as the critical dividing line between the poor and the extremely poor. Therefore, technologies that improve the health of family members can be very important, while those that increase the risk of disease could deepen poverty. Similarly, vegetable cultivation that could be undertaken by women around their homestead emerged as having a more important role for poor families than conventional economic analysis

would indicate, not only because of the contribution to household nutrition. Additional benefits identified through the sustainable livelihoods analysis include

- strengthening social capital linkages through sharing of “high-status” vegetables with friends and relatives;
- production in the homestead site, so that women could be economically active without leaving the home and being vulnerable to harassment or violence; and
- empowerment of women as they learned to deal with traders who came to buy vegetables. (Conversely, men in one community prohibited women from participating in aquaculture training or production because the women might then overstep their “appropriate” roles.)

Using a common conceptual framework facilitates comparison of results across case studies. The IFPRI/SPIA case studies were originally developed with a variety of different research questions, conceptual frameworks, and research designs. When the sustainable livelihoods framework was adopted across the five cases, the first step was to look at how the original questions “mapped” into the sustainable livelihoods framework. Many issues that had been identified related to either aspects of vulnerability, assets, intervening institutions (e.g., extension services), livelihood strategies (e.g., employment opportunities created), or outcomes. After this mapping exercise, in national workshops for each case study we discussed other critical questions that the sustainable livelihoods framework raised. Because this generated more questions than the case studies could

address, the questions were prioritized according to their importance and linkage to the impact of the agricultural technologies under consideration. The result was a set of key questions and hypotheses. Following this, we identified sources of information for each of the key questions and developed research methods to address them. In the analysis phase, we will use the sustainable livelihoods framework to structure the analysis, synthesize the information gathered, and make comparisons across case studies.

Using this process to guide the research design, each case study focuses on a set of research questions driven by the nature of the project under study, informed by a sustainable livelihoods perspective, and falling within a set of cross-cutting themes. In this way, the studies will demonstrate how to contextualize a common set of concerns and arrive at an assessment of the types of outcomes to which the conceptual framework points. The crosscutting themes that have been identified include

- *Dissemination pathways.* How do different types of research and dissemination pathways affect poor people's ability to influence research priorities and access research outcomes? How do poor people view, respond to, and come to trust different pathways?
- *Social differentiation.* How does social differentiation mediate the impact of research on poor people? This includes intrahousehold (gender, age, relationship, etc.) and interhousehold (class, religion, caste, ethnicity, agricultural or pastoral, etc.) dynamics.

- *Assets*. How does poor people's capacity to access and manage assets affect their ability to access research outcomes/technologies and convert them into positive livelihood streams?
- *Institutions and processes*. How do different policies, institutions, and organizations mediate poor people's ability to access research outcomes/technologies and convert them into positive livelihood streams? (IFPRI 2000)

Comparability across case studies is also addressed by a set of guiding principles across case studies, including

- adoption of a shared understanding of core concepts, including poverty, assets, livelihoods, and vulnerability;
- application of a common conceptual framework for assessing the likely impact of agricultural research on poverty; and
- commitment to applying interdisciplinary perspectives, combining qualitative and quantitative research methods, and integrating the economic and social analyses into a unified study.

4. OVERCOMING LIMITATIONS OF THE SUSTAINABLE LIVELIHOODS FRAMEWORK

Although it is too early to take stock of lessons learned from using the framework and its analytical potential, certain limitations have emerged in applying it at the design phase. One objective of the SPIA project is to test the use of the framework in the context of agricultural research and adapt it to increase its usefulness. In designing the SPIA case studies, we have identified aspects of people's lives that are not captured in the framework, and yet are important to explaining people's decisions and choices, and consequent livelihood outcomes. One aspect is the notion of "culture." How things have been done in the past, the relationship of certain crops or practices to ancestors, or their importance in festivals can influence whether people adopt a new crop or related farming practice, or whether they value the traits of that new crop. In this sense, the framework could be expanded to include "cultural assets," which would include, for example, beliefs, traditions, language, identity, festivals, and sacred sites. Other aspects that can be attributed to culture may include taste and texture of agricultural products, as well as status that is associated with certain varieties of crops or values that determine how certain resources should be used, or the age or gender appropriateness of cultivating certain kinds of crops or involvement in the management or marketing activities that accompany them. These cultural assets or factors may not have direct economic value but are centrally important in people's lives, choices, and well-being. They can have economic value as well, such as where assets are transformed into tourism or handcraft production. In one village included in the Mexico SPIA study, sewing was an important

activity for the purpose of keeping the village supplied with dresses for its almost monthly festivals.

There is something unsettling, however, about trying to fit these aspects of culture, identity, and values into an “assets” or “capital” framework, and it may not be worth doing so. Hebinck and Bourdillon (2002) take exception to the livelihoods framework’s overreliance on the notion of “capital,” because of the overemphasis that this places on the material aspects of people’s lives:

One of the problems is that it is an economic metaphor that does not do justice to the nature of people’s activities, which are not entirely oriented towards material gain. Although material gains are a very important aim in the notion of livelihood, ‘livelihood’ does not span only the commoditized world and associated values. The term also incorporates the noncommoditized, nonmaterial, and cultural part of life and sets of values that are embedded in local cultural repertoires...for example... community values determine how and under which conditions forest resources should be used, and how the rights to these resources are embedded in culturally defined relationships.

They also draw on Long’s (2001) work on knowledge to critique its inclusion conceptualization as part of “human capital,” because as such it implies that knowledge is a universal, culture-neutral resource that can be accessed as a commodity, rather than recognized as a social construct or a relationship that is redefined within a local context.

Also missing from the sustainable livelihoods framework are the notions of power and power relationships. There is a large body of literature on these topics, for example, on intrahousehold power relationships and women's empowerment (Afshar 1998; Kabeer 1999), and the extent and nature of women's power as well as its increase or decrease can have a powerful influence on livelihoods. A new agricultural technology may increase or decrease women's decisionmaking power; participation in a group involved with village-to-village technology dissemination (such as in the Kenya study) may increase members' confidence, which involves material and nonmaterial aspects of improved well-being. Class-based power imbalances may lead to technology access, or the extension needed to benefit from the technology, being captured by richer farmers. Lack of political power may mean that poor farmers do not have access to certain marketing channels, or cannot get sufficient prices for their crops. As Ashley and Carney (1999, 35) note, "the SL framework overall can convey a somewhat cleansed, neutral approach to power issues. This contrasts starkly with the fundamental role that power imbalances play in causing poverty." Institutional aspects of power can be captured through the PIP and social capital dimensions of the framework, and empowerment can be identified among livelihood outcomes. However, this needs to be made explicit where these factors are considered important to a given study. Also, whereas the household can be seen to be one of the "institutions" to be considered within PIP, and intrahousehold power relationships a part of this, individuals and class-based social groups are not institutions and it is difficult to see where individual, class-based, or ethnic group-based power dynamics or conflict suggest themselves within the SL framework. There is also a question as to how

“politics” fits within the framework. In one district in Zimbabwe, farmers have been wary of new technologies because they view the phase out of older varieties and their replacement with new varieties as a conspiracy between Agritex officers and the private-sector distributor to discredit the government. This argues for the interpretation of PIP to include political party politics as part of institutional processes, but more broadly for the incorporation of an explicit notion of politics to capture these significant dynamics, even where they are not related to formal institutions.

Finally, the framework does not lead one to incorporate the importance of historical factors. For example, where people have had a history of problems with external interventions, this can influence their reception to new interventions. In the Zimbabwe study, we are exploring the ongoing influence of farmers’ bad experiences with loans taken in conjunction with the adoption of earlier varieties of improve maize. In focus groups conducted as part of the Mexico SPIA study, some villagers reported that they distrust government agents and programs, and thus the advice they give on modern maize varieties, preferring to learn from their neighbors’ successes and problems. They also said they trusted more the seeds they acquire from friends, family, and neighbors. Poor people in Bangladesh also reported that government agencies served the rich rather than the poor, and tended to prefer NGOs, except in one village where a bad experience with an NGO had also eroded trust in such organizations. This illustrates the continuing significance of historical social relationships in contemporary development initiatives. In all five case studies, we are considering people’s “trust” of different dissemination pathways. Trust normally encompasses a historical dimension, where trust in a

dissemination institution is based on past experience, whether related or unrelated to the institution in question.

More generally, the framework diagram suggests a snapshot approach, when, in fact, it should be seen as dynamic. Livelihood strategies, vulnerability factors, asset portfolios, and policies, institutions, and processes are often in a state of flux, so it is important to operationalize the framework in a way that incorporates this temporal dimension.

The above critiques are addressed by including these additional concepts wherever they are relevant. Thus, use of the sustainable livelihoods framework does not have to be limiting; it is simply not sufficient on its own for pointing to all possible factors relevant to a study or development intervention. It must be used in conjunction with concepts, tools, and modes of analysis that have long been used in other fields, such as development sociology, anthropology, and history.

Sustainable livelihoods analysis needs to draw on a set of “tools” that may include gender analysis, institutional appraisal, stakeholder analysis, market analysis, and others (Ashley and Carney 1999; DfID 2001). The framework does not explicitly address the differential conditions, assets, and strategies of socially differentiated groups. Therefore, additional explicit attention must be given to the implications of gender, ethnicity, class, or other types of social differentiation. It is likely that in a given community, livelihoods analyses will need to be conducted for different social groups, and sometimes even at the level of the individual rather than the household. Even key concepts often emphasized as “sustainable livelihoods principles,” such as the idea that “poor people themselves should

be key actors in identifying and addressing livelihood priorities” (Ashley and Carney 1999; DfID 1999), are not explicit in the framework (outsiders could presumably apply the framework). Instead, participatory poverty assessments are another tool that is recommended for use when using the sustainable livelihoods framework (DfID 2001). In fact, as Ashley and Carney (1999, 36) point out, there is “no explicit mention of poverty in the SL framework” and that the assumption that use of SL approaches will contribute to poverty elimination must be continually tested.

One potentially paradoxical aspect to using the framework lies in its advocacy of participation and stakeholder analysis while simultaneously specifying a certain set of concepts that may or may not be the choice of a particular community or set of stakeholders. We experienced this problem in our stakeholder meetings for the Kenya project, where we structured the participation around the concepts in the sustainable livelihoods framework (e.g., “vulnerability” and “assets”). We found that this limited participation, given that some participants had difficulty in understanding what these meant in the sense that the framework uses them and this led to less time for bringing out problems and priorities in a less structured format. Learning from this experience, in the subsequent Zimbabwe stakeholder workshop, we presented the framework but then solicited participation in an open brainstorming session around experiences with the use of hybrid maize. Later, we brought the framework back in a smaller group to organize and prioritize issues raised by stakeholders. This was a valuable lesson that contributes to our understanding of how to operationalize the framework while simultaneously incorporating stakeholder input in planning an impact evaluation.

5. RESEARCH METHODS

The prospect of covering all aspects of the sustainable livelihoods framework, or even all questions identified as critical for assessing the livelihood impact of agricultural research, can be daunting. Especially for econometric analysis, the way in which so many factors are interrelated creates endogeneity problems that would require ever larger data sets to resolve. What is required, then, is an integrated, interdisciplinary approach that draws upon both quantitative and qualitative data collection and analysis.

By piecing together data from a variety of sources, it is possible to cover key aspects of the sustainable livelihoods framework relatively efficiently. Rather than seeing this as a second-best solution, such a combined approach can actually provide a more convincing analysis than any single method. This is because studies have found that people respond differently to quantitative and qualitative information. Numbers are required to convince some audiences, while others will be unimpressed by numbers, but relate more to in-depth and contextual information gathered using qualitative techniques.⁴ The fact that livelihood activities are so varied, and often intermittent, “small” or noncommoditized means that surveys are likely to pick up some activities and miss others. Providing examples from their work in Zambia, Norton, Owen, and Milimo (1994, 93) argue that:

⁴ During one of the case study planning meetings, Binayak Sen summarized the complementarity of methods as “Numbers give one a feeling of facts; qualitative stories give one a feeling of truth.”

Most aspects of rural livelihoods are not captured in either income or expenditure-based survey data. This is because they are neither commoditized nor evident enough to the researchers to be allocated 'imputed values' ...Energy (fuelwood) and herbal medicines are two examples. A significant element of the 'safety net' for rural people in times of stress consists of 'famine foods' that can be gathered from bush and fallow lands (Norton, Owen, and Milimo 1994, 93).

Triangulation and crosschecks on the results of different methods can improve confidence in the overall study. Use of quantitative and qualitative methods provides a richer base for analysis, where data from each method help to interpret the other. In the IFPRI/SPIA study, the major data-collection methods used include surveys, focus groups, key informant interviews, in-depth household case studies, and secondary data. The case studies combine social and economic (as well as some biophysical), qualitative and quantitative, participatory, and conventional (or extractive) data. Although there is often a tendency to equate social, qualitative, and participatory data collection on the one hand, and economic, quantitative, and extractive data on the other, the studies also collect quantitative social information, qualitative economic information, and use both participatory and extractive methods for each.

All the SPIA poverty impact case studies include household surveys. Some have panel data for the same households over a number of years, which allow for analysis of changes over time. Some of the surveys (notably on vegetables and fish in Bangladesh,

and maize in Zimbabwe) have collected data at the level of the individual household member, which allows for comparison between men and women, and also helps to capture the full range of livelihood strategies within the household. Sampling to cover the range of wealth/poverty categories is critical for the surveys. Although some qualitative data are included in the surveys, researchers analyze most survey data using econometric techniques.

All the case studies make use of focus groups to elicit collective experience and opinions. Separate groups are convened for men and women of different wealth/poverty categories. For example, in Bangladesh, six focus groups are held in each selected village (men and women separately for the very poor, poor, and nonpoor categories of households). Preexisting survey data helps in the disaggregation of wealth groupings for the focus groups, particularly in communities where a wealth ranking exercise may be divisive or difficult to carry out (e.g., because of large community size or time limitations that prevent researchers from getting sufficiently acquainted with a community to comfortably carry out such an exercise). Where possible, households that are selected for the surveys are included in the focus groups to improve the comparability of the information obtained by the different sources.

During the focus group meetings, a range of participatory and extractive data collection activities is conducted: seasonality mapping, identification and ranking of livelihood activities and sources of vulnerability, as well as discussions of the technologies being studied and dissemination approaches. In some of the studies (e.g., Kenya, Zimbabwe, and Mexico) focus groups are used following a series of household

case studies to further investigate issues raised (including the experiences of households not included in these studies), check whether the findings resonate or contradict, and receive feedback on the research findings. In other studies (especially in Bangladesh) focus groups are the primary means of qualitative data collection, but are followed up with in-depth interviews or case studies of individuals who participated in those groups. Analysis of focus group data is done partly by the respondents themselves, partly by the field staff's summaries, and partly by the lead researchers on each case study team.

Key informant interviews allow the research team to follow up in more detail with individuals that have specialized knowledge. This may include researchers from CGIAR and national centers, NGO, community organization, or government project staff, extension agents, local seed distributors and shops, agricultural researchers from the private sector, community elders, chiefs, early adopters, etc. Semi-structured interviews allow the researchers to go in with a core set of information that they hope to collect, but also to follow up on relevant topics that emerge during the course of the discussion. This information is especially important to address the policies, institutions, and processes affecting the research. As with the focus groups, analysis is shared between the respondents and lead researchers.

In-depth household case studies provide more detail on the complexity of household livelihood strategies, particularly in the Kenya, Zimbabwe, and Mexico cases. Researchers live in sample villages for three to six months, spending time in the homes of a subsample of the survey households, conducting informal interviews, observing and participating in their daily activities, such as farming, extension field days, and social

interactions and activities. Such participant observation can provide insights that are not available from other methods and inform and refine the questions asked in other, more structured, data collection. Qualitative data are coded according to issues identified by the research questions in advance, as well as issues that emerge through the fieldwork. These data are analyzed by the research team, taking into account findings of the focus groups and surveys.

Secondary data sources from government and other researchers' studies should not be overlooked. These can provide the basis for sampling frames, cross-check the information from the study with other regions or nationally representative samples, and even provide direct information for the existing study. For example, participatory poverty assessments (PPA) conducted in Bangladesh (Nabi et al. 1999) provided the basic criteria for classifying households according to poverty or wealth status. These criteria could then be applied to the households in the survey, and used to select participants for the focus groups. In Mexico, where earlier ethnographic studies of communities included in our case study region exist (González 1993; Pérez Sánchez 1997) they provide important historical information on livelihoods, institutions, and processes. In Kenya, previous and ongoing studies carried out in the same region as the case study provide additional information on related technologies, asset portfolios, gender issues, cultural issues in adoption, social networks, and other issues.

Explicit attention must also be given to linking the different sources of data. Depending on the sequence of data collection, insights from the surveys might be followed up in the focus group or key informant interviews and participant observation,

or vice versa. In most of the cases an iterative approach to data collection is used. However, in each of the case studies, the quantitative and qualitative data take a somewhat different relationship to each other and provide different types of interpretative power. In the Kenya and Mexico cases, pre-SPIA qualitative studies informed small surveys. The SPIA projects then initiated new qualitative work (household case studies and focus groups) in a wider set of communities (and included new issues), which were informed by the earlier work. Larger scale household surveys have been designed drawing on the findings of the new qualitative work, and household level case studies will provide a depth of understanding that will be used to interpret findings of the surveys. In Mexico, qualitative work explored reasons for people's preferences for different maize varieties, and the main risk factors that they face. The importance of these risk (or vulnerability) factors and perceived advantages of maize characteristics identified in this qualitative work will be tested quantitatively through a survey of a wider sample of farmers. Case studies will deepen our understanding of how different maize characteristics respond to this vulnerability context, as well as issues such as people's perceptions and trust of the pathways through which seeds enter communities (whether by government channels or informal social networks) and how this influences people's choices.

The Bangladesh case on vegetable and fish technologies used an iterative process of survey data collection and qualitative data collection on intrahousehold dynamics and women's empowerment followed by another round that collected individual-level indicators of empowerment. The focus groups built upon the analysis of the survey data,

e.g., looking at why, if the technologies were profitable, households had not expanded their vegetable or fish production and why household incomes of adopting households were not necessarily higher than for non-adopters. Key informant interviews can then follow up on problems with the program that focus group members identified. Careful attention was given to sampling for the surveys, focus groups and household case studies, with links between the samples. For example, efforts are made to include the same households in the surveys, focus groups, or in the surveys and household case studies. Thus, the quantitative and qualitative data can lend each other the maximum interpretive power.

One of the most challenging aspects of such multi-method research involves assembling a research team with the proper mix of skills. Each of the IFPRI/SPIA studies has a case study leader (usually an economist) who is an international staff member of the lead CGIAR center, with extensive experience in the case study country. Although technical scientists are not formally part of the research team, they often serve in informal advisory capacities and in some cases assist with aspects of the study. The case study leader is paired with an international social analysis team member (a sociologist or anthropologist) with extensive experience in the region and is involved in at least one other case study, which increases comparability across cases. Each case also has national economics and social analysis experts who guide the data collection and analysis, and who work with teams of less experienced researchers, engaging in training and capacity building. The field staff require strong analytic and facilitation skills in order to conduct the focus group and household case studies, while the key informant interviews are often

conducted by the national or international social or economics experts. Finally, an external Advisory Committee composed of a leading economist, social analysis expert, and livelihoods expert advise the project on best practice methods, integration of the research, and dissemination strategies.

Working with interdisciplinary groups from the international to the local level has been a valuable learning process in mixed method research and in integrating economics, sociology, and anthropology, and can provide a model for strengthening the capacity for future CGIAR research to address poverty. The challenges of developing such mixed teams lie in ensuring that members can communicate across disciplinary lines, respect each other's contributions, and find the time to integrate the findings or insights from the other members into their own work. The sustainable livelihoods approach helped in this integration because it provided a common framework into which each member could contribute but also required the contributions of others. It also helped that all members of the team were familiar with the situation of poor people in rural areas, and the livelihoods framework drew on concepts that they were familiar with from their experience in the field. The significant contribution from DfID for social analysis sent a strong signal of the increasing recognition among the international development community of the importance of interdisciplinary and mixed method research. The additional budget that the social analysis has for data collection as well as analysis also means that qualitative data collection is not seen as taking resources away from survey data collection, but is a valued addition to the project. On the other hand, largely separate budgets for the economic and social analyses can also lead to separation rather than integration of the

components, requiring more vigilance for integration. The coordination of activities, especially between people based at different institutions, remains a challenge, which could be reduced if all members of the team were within one institution or could focus only on this project. Yet drawing from different institutions can also be an important aspect of capacity-building. Ultimately, however, interdisciplinary work within each institution would be strengthened by having more disciplines represented within the research staffs.

6. CONCLUSIONS

The sustainable livelihoods framework is gaining popularity as an approach for addressing poverty among a wide range of development organizations. The framework introduces many factors and relationships that are often missing from conventional reductionist approaches. This can provide important insights about the reality that rural households, especially the poor, face—insights that might otherwise be missed. In particular, the framework highlights the importance of different sources of vulnerability. A broad range of assets is considered, not only conventional land and financial resources. Households and even individuals are not regarded as only “farmers,” “laborers,” or “business operators.” Instead, a wide range of simultaneous livelihood activities and strategies is recognized. Policies, institutions, and related processes that form the environment in which livelihood strategies are pursued are considered central to the analysis. Finally, the outcomes include much more than just income levels or food security. Although there are important dimensions of people’s lives that the framework

does not explicitly address, these can be integrated into the framework or addressed through the inclusion of other types of analysis in the study.

Agricultural research and technologies may not play a central role when we take into account the full picture of people's livelihoods. But understanding the full picture can help develop technologies that better fit in with the complex livelihood strategies, especially of the poor.

Conducting impact studies using the sustainable livelihoods framework requires interdisciplinary teams with different skills in data collection and analysis, but with a shared commitment to the research and interest in each other's contributions. The framework can then provide a basis for overcoming disciplinary boundaries, help build a more complete analysis of the impact of agricultural research, and point to how technologies could further improve the livelihoods of the poor.

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