भाकृअनुप
ICAR

NATP PME notes 14

Task Force on Prioritization, Monitoring & Evaluation

Impact Assessment of Agricultural Technology from Simple Efficiency Analysis to Sustainable Livelihood Framework

LM Pandey and Mruthyunjaya*

August 2004

Introduction

Indian agriculture is facing many complex problems. In recent years, there has been fall in public investment in agriculture, declining growth in partial and total factor productivity, increasing inter and intra regional disparities, persistence of widespread poverty and decreased quantity and quality of natural resources like land, water and biomass. Stakeholders including international research communities, donors and national policy makers are looking for the research programs to help overcome these problems. Systematic impact assessment studies relating to returns to investment made by Indian National Agricultural Research System (NARS) should provide critical inputs needed to address some of these issues. It would also form a strong base for higher research funding and to achieve specific research and development objectives.

Analytical framework

The impacts are assessed in terms of product outcomes such as income and employment generation, poverty reduction, and conservation of natural resources, and process (institutional context) output/outcome such as organizational and institutional change. The process outcomes will provide crucial information relating to institutional requirements and relationships among various actors in the innovation system perspective for greater technology impact. The impact studies involve time period and spatial dimensions. The time horizon could be short, medium and long term based on the nature of the benefits and issues dealt with.

There are two types of benefits of research outputs: (i) tangible - those that can be assigned monetary values, e.g.; agricultural productivity growth and changes in rural wages and employment, and (ii) intangible- which cannot be easily identified and assigned monetary values but are important for the society. Examples for the latter type are improvement of environment, soil and water quality, better health, social differentiation and changes in power relationship, and increased or decreased vulnerability, etc. These benefits are important but difficult to assign monetary value and, therefore, documented in physical terms, scale and intensity. The basic conceptual framework involved is establishing causal links between the technology and its impact on multi-dimensional outcomes and how technology fits into people's livelihood strategies.

Impact indicators vary with technology and level of assessment. The impact indicators at farm, regional, national and global level will be different. At the farm level, the direct beneficiaries are affected by adopting the technologies. At higher level, the society and the environment are being influenced. Important farm-level impact indicators may be efficiency: income augmentation, unit cost reduction; household food security: nutritional security; poverty reduction: improving yield or income stability; cropping intensity, gender related issues, and natural resource conservation. Regional/ National-level impact indicators could be agricultural production, macro food security, employment generation, inter-regional and inter-personal equity issues, poverty and sustainability of natural resources.

Research as a product

There are two broad approaches for assessing the efficiency benefits of research/technology impact: the econometric approach and the economic surplus approach. The econometric approach including the total factor productivity analysis assesses the changes in marginal productivity of research investments. Economic surplus approach on the other hand estimates the economic surplus generated as a consequence of research outputs. The information derived through economic surplus approach is then used to estimate various measures of research efficiency such as benefit-cost ratio, internal rate of returns and net present value of research outputs.

Research as a process

Research as a process involves institutional issues and organizational framework for research resource allocation and technology development and dissemination. It emphasizes technological contextualization and inclusion of institutional issues into the research questions or research programs. The inclusion of institutional context of an enquiry will have diagnostic goals. The process of rationalization of allocation and use of resources to address priority goals not only helps in judging the efficiency of a research organization but also helps in identification of inhibitors of research productivity. The process may also be helpful in designing suitable concepts and their implementation for higher scientific productivity and organizational efficiency in a given context. The impact of project and diagnostic studies can be discerned in terms of their contribution in better planning and allocating funds to address the existing and anticipated problems.

To understand impacts of technologies, an essential institutional requirement is that of learning. Innovation actors/ organizations be equipped with the capacity for learning the rules/ norms that govern the other actors or define their own relationships with other actors in the innovation system (Hall et al, 2001). Also, there should be provision for adequate information and space for a healthy debate/ discussion on institutional choices and the reasons for their existence. Decentralization and participatory processes of information generation and decision-making are integral to issues-driven, multidisciplinary research. These, in turn, demand organizational and institutional changes and democratic decision-making processes in agricultural research and impact assessment.

To deal effectively with the institutional issues discussed above, a wider evaluation methodology is required which provides not only the tail end impacts but also highlights entire range of consequences, requirements and relationships. Internal learning processes or management systems are needed to identify and explore possible solutions for these institutional problems through modifications of existing rules and procedures.

The Sustainable Livelihood Framework

Agricultural research and technological changes impinge upon rural livelihood and income through changes such as farm productivity, vulnerability context, agricultural employment, food prices, gender and power relations and off-farm activities. It is a

* National Centre for Agricultural Economics and Policy Research, New Delhi. We are grateful to Drs Suresh Pal and R.Sulaiman V. of NCAP for helpful comments.

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complex, interactive and ongoing process in which a variety of factors affect uptake and impacts of technologies and development programs.

The sustainable livelihood framework offers a conceptual model for understanding the wider livelihood constraints people face and the specific institutional context in which livelihood is embedded (Figure 1). The starting point of the livelihood analysis is the understanding of livelihood strategies and vulnerability of the poor (Carney, 1998 and Scoones, 1998). In a given vulnerability context, different forms of capital assets are formed through institutional and organizational settings (state, NGOs and the private sector), policy making (macroeconomic, regulatory and rights-based policy; governance reform; and organizational change) and the transaction/ exchange processes to constitute livelihood strategies leading to various livelihood outcomes. A livelihood may comprise of five types of capital assets, viz; financial, physical, natural, social and human (DFID, 1999). More structured and rigorous analysis may consider other forms of capital and power relations as well. Understanding the linkages and the trade-offs between them, however, is critical as relationships between assets change over time. Similarly, institutions evolve and the organizational structures are created over period through community and familial structures and norms and social and cultural arrangements. Therefore, the framework is dynamic and considers change from people's actions at multiple levels.

Data and methodology

Research methods involve multidisciplinary approach and integrated qualitative and quantitative data collection and analysis such as surveys, focus group discussion, key informant interviews, in-depth household case studies, and secondary data collection. Many conventional economic approaches to the impact assessment

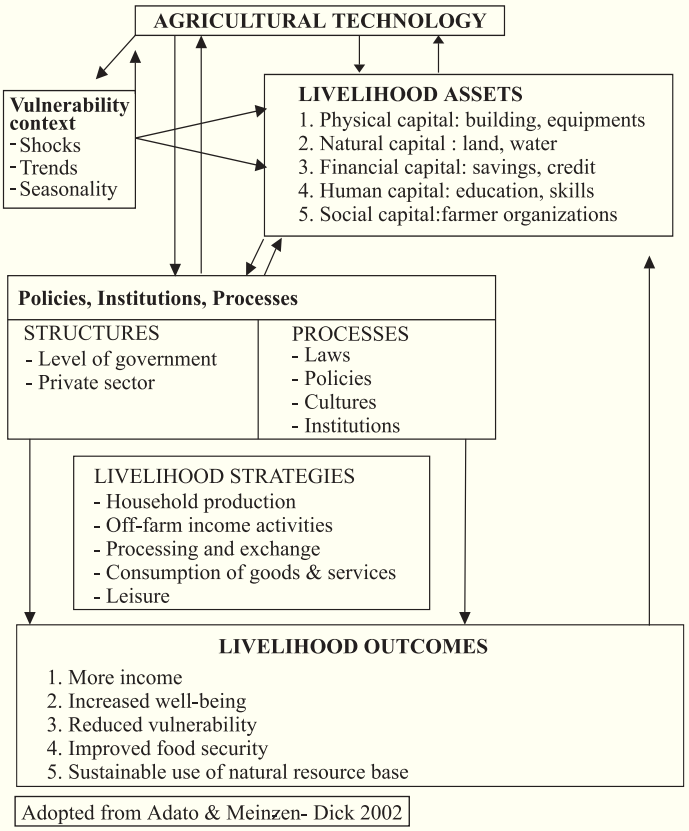

Figure 1: Sustainable Livelihood Framework

such as rate of return, pattern and determinants of technology adoption, resource use efficiency, socio-economic impacts, policy analysis, etc. can be factored into the sustainable livelihood framework. Qualitative data are linked to quantitative data. The framework also provides additional information critical for future research strategy and planning. For example, possibility and scope for alternative technology development and dissemination process can be explored in the livelihood systems approach.

Future directions

Impact assessments are means for linking priority setting, monitoring and evaluation (PME) to the development of plans for HRD, institutional change, infrastructure facilities and to discussion on operating budgets. The major challenge is to operationalize a sustainable livelihood framework in such a context. We are moving from a simple efficiency analysis using production or yield parameters towards a broader assets and process based analysis for improved technology adoption and greater technology impacts to achieve more complex research goals of reducing vulnerability and poverty. The integration of various economic, social and cultural variables affecting farmers choice of livelihood strategy and decision on technology adoption would require development and use of econometric models of farm household. Such behavioral models would also provide a framework for linking micro-level realties to the macro policy context.

The other issue is quantitative measurement of benefits from technological change, which also incorporates important externalities and spillovers. Efforts are needed to develop micro data based models and dual approaches to measurement of benefits from research to provide a superior estimate over the most commonly used economic surplus model. In a single analytical framework, it will address both equity and efficiency concerns (Pandey, 1990).

Finally, availability of relevant and reliable data has always been an important issue. Efforts are needed to generate and use relevant information (data and model parameters) effectively and efficiently.

References

Adato, M. and R. Meinzen-Dick. 2002. Assessing the Impact of Agricultural Research on Poverty using the Sustainable Livelihood Framework. IFPRI, EPTD Discussion Paper 89.

Carney, D.,ed. 1998. Sustainable rural livelihoods: What contribution can we make? London: Department for International Development.

DFID (Department for International Development). 1999. Background briefing. London.

Hall, A.J, M.V.K. Sivamohan, N.Clark, S. Taylor and G. Bocket. 2001. "Why Research Partnership Really Matter: Innovation Theory, Institutional Arrangements and Implications for Developing New Technology for the Poor". World Development, 29(5)783-797.

Pandey, L.M. 1990. Economics of technical change and the distribution of benefits from adoption of HYVs of rice in Orissa, India. Mimeo. Department of Agricultural Economics and Business Management, La Trobe University, Melbourne, Australia.

Scoones, I. 1998. Sustainable Rural Livelihoods: a framework for analysis. IDS Working Paper 72.