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Monitoring and Evaluation of Agricultural Research, Education and Extension for Development [AREE4D]

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Preface

National Agricultural Research and Education System (NARES) has played a commendable role to achieve food security and reduce the poverty levels in the country. The facets of agriculture are constantly changing due to transformation of the socio-economic profile of the country. The economic liberalization and reform process have important implications for agricultural and rural sectors. Market forces sweeping across the globe impact Indian agriculture perceptibly. Competitiveness of agricultural production at the global level is the key in sustaining the agricultural production. Agricultural intensification and population pressure leads to over exploitation of natural resources raising environmental concerns. There is a growing scientific evidence of climate change and its impact on agricultural production. Thus, Indian agriculture, at present, is amidst a complex milieu of factors. In this context, it is important and pertinent to ask ourselves questions like: Are we doing the right things? Are we doing things in an optimal way? Are there better ways of doing it? How to mobilize resources for investments?

Governments and donors are increasingly concerned about the productivity of investments. We need to demonstrate results and capture impacts in both quantitative and qualitative terms to justify the public money invested in agricultural research, education and extension (AREE). In this context, monitoring and evaluation (M&E) of AREE assume greater significance. An effective M&E system would increase the quality of AREE, reduce the cost, facilitate in identifying the weak links in the research-to-impact pathways and make the scientists aware of the broader implications (or lack thereof) of their actions in AREE besides guiding administrators on future AREE investments. ICAR is making best efforts in integrating monitoring and evaluation within the AREE systems. The NAIP projects implemented by the ICAR have a strong component of M&E built into the projects. PME cells and Management Information System (MIS) were created in ICAR institutes to move towards an effective M&E system. In several SAUs, M&E activities are initiated. The challenge ahead is to make the M&E units in the NARS system very professional and sustainable. This call as for effective integration of M&E units with other Directorates/ Departments in the Universities/ Institutes, generation of relevant database and capacity building of M&E professionals.

In this context, the brainstorming session organized by NAAS on “Monitoring and Evaluation of Agricultural Research, Education and Extension for Development (AREE4D)” is relevant and timely. I appreciate the efforts taken by Dr P.G. Chengappa, National Professor of ICAR, Dr K.R. Ashok, Professor of Agricultural Economics, Tamil Nadu Agricultural University and Dr M. Chinnadurai, Director, CARDS, Tamil Nadu Agricultural University for their efforts as Convener and Co conveners of the brainstorming session and bringing out this useful policy paper. I also thank the Director, Institute for Social and Economic Change, Bengaluru for hosting the BSS.

S. Ayyappan
President

Monitoring and Evaluation of Agricultural Research, Education and Extension for Development [AREE4D]

I. INTRODUCTION

In today's world of scarce public funding and greater accountability, governments, donors and research managers are increasingly demanding assessment of the socioeconomic returns to their investments in Agricultural Research, Education and Extension Systems (AREES). This information is needed not only to show that Universities and research organizations have the capacity to help increase agricultural production and alleviate poverty, but also is essential to justify allocation of limited resources to AREES. Research organizations, worldwide, are under increasing pressure to undertake impact assessment of their research activities and to better integrate the social, economic and environmental considerations in research planning and implementation.

The evaluation of scientific research has an extensive and well-structured literature on its objects, motives, methods and procedures, criteria and standards, difficulties, and results (OECD, CGIAR). Impact studies are undertaken with the aim of: (1) helping managers to provide tangible advice on strategic decisions about future AREES investment; (2) making scientists and researchers aware of the broader implications (or lack thereof) of their actions in the domain of AREES; (3) identifying weak links in the research-to-impact pathways; and (4) better informing administrators on the complementarities and trade-offs between different activities within AREES. Most governments around the world recognize that current methods for evaluating research for funding purposes are not appropriate and adequate, and they are now funding efforts to find new and improved methods (Coryn, 2007). Recent concerns about the structure of evaluations stem from several challenges that governments face today. Thus, impact assessment is gaining importance among the donors, research managers and policy maker. Evaluation has become necessary in the present context, mainly from the point of accountability, especially, due to high public investment in welfare and developmental programmes; to arrive at whether the money is effectively spent or not? Impact refers to the broad, long-term economic, social and environmental effects resulting from AREES. Such effects may be or may not be anticipated, positive or negative, at the level of the individuals or the organizations. Evaluation is the judging, appraising, or determining the worth,

value or quality of AREE, in terms of its relevance, effectiveness, efficiency, and impact. High quality monitoring is the foundation of good evaluation and it is also a tool for managing progress on a day to day basis. With latest advances in ICT - devices and applications - real time monitoring is being done in many fields which generates simple to complex data. Evaluation on the other hand tends to be a very separate activity requiring different skills and is carried out by different actors.

II. RELEVANCE OF MONITORING AND EVALUATION IN AREE

- ✦ AREE involves financial and human resources and its impact is felt over a long period of time. Therefore, the major aim of impact assessment is to apprise research managers, scientists and those who fund AREE of its positive or negative effects.
- ✦ Earlier AREE goal concentrated on increasing production while currently, inter alia, it must consider food security, equity, poverty alleviation and environmental sustainability. This has increased the complexity of estimating the impacts on varied aspects and objectives. Despite these challenges, impact assessment is gaining importance as a tool to support AREE policies among stakeholders.

The Power of Measuring Results

- If you do not measure results, you cannot tell success from failure.
- If you cannot see success, you cannot reward it.
- If you cannot reward success, you are probably rewarding failure.
- If you cannot see success, you cannot learn from it.
- If you cannot recognize failure, you cannot correct it.
- If you can demonstrate results, you can win public support (Osborn and Grabler, 1992).

III. PRINCIPLES OF MONITORING AND EVALUATION

Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) has stipulated Criteria for Evaluating Development Assistance that could be a good guide in developing appropriate criteria for monitoring and evaluating the AREES.

- **OECD/DAC Criteria for Evaluating Development Assistance:**
- **Relevance:** The extent to which objectives are relevant and consistent with the requirements of beneficiaries/stakeholders.
- **Effectiveness:** The extent to which an intervention attains its objectives.
- **Efficiency:** Efficiency measures the outputs—qualitative and quantitative - in relation to the inputs. It tells if the most efficient process has been adopted.
- **Impact:** Positive and negative changes produced by the intervention, directly or indirectly and intended or unintended.
- **Sustainability:** If the benefits of the activity likely to continue after donor funding is withdrawn - resilience to risk as well as environmental and financial sustainability.

IV. TYPOLOGY OF EVALUATION DIMENSIONS

A. Initially the monitoring and evaluation of AREE systems were mostly confined to impact studies with a thrust on accountability. Later on, emphasis shifted to monitoring and evaluation with a thrust on efficiency, efficacy and broader mandates.

Economic Impact Assessment

Economic impact assessment mainly estimates economic benefits and measures economic rates of return (and to some extent the distribution of these returns) associated with innovations coming out of AREE investment. The economic surplus approach is the most commonly used methods for evaluating the impacts of AREE investments, particularly for technologies related to crop improvement.

Environmental Impact Assessment (EIA)

The importance of EIA is increasing in AREE owing to the growing concerns of land degradation, deforestation and loss of biodiversity as well as, water and air pollution around the world.

Social Impact Assessment

Social impact assessment addresses the issues like gender impact, distributional consequences of AREE such as between consumers and producers and between different income-groups of consumers and producers.

Institutional Impact Assessment

Institutional impact assessment involves evaluation of performance of a research organization in research activities such as training, networking, development of methodologies, and advisory services in research and other policies, organization and management.

B. Technical Working Group on Research Impact, Department of Education, Science and Technology (DEST) and Research Quality Framework Development Advisory Group (RQFDAG) of Australia has developed the following impact domains. (Donovan, 2008).

Social Benefit : Improving quality of life; stimulating new approaches to social issues; changes in community attitudes, and influence upon developments or questions in society at large; informed public debate and improved policy-making; enhancing the knowledge and understanding of the nation; improved equity; and improvements in health, safety and security.

Economic Benefit : Improved productivity; adding to economic growth and wealth creation; enhancing the skills base; increased employment; reduced costs; increased innovation capability and global competitiveness; improvements in service delivery; and non-quantifiable returns resulting from social and public policy adjustments.

Environmental Benefit : Improvements in environment and lifestyle; reduced waste and pollution; improved management of natural resources; reduced consumption of fossil fuels; uptake of recycling techniques; reduced environmental risk; preservation initiatives; conservation of biodiversity; enhancement of ecosystem services; improved plant and animal varieties; and adaptation to climate change.

Cultural Benefit : Supporting greater understanding of where we have come from, and who and what we are as a nation and society; understanding how we relate to other societies and cultures; stimulating creativity within the community; contributing to cultural preservation and enrichment; and bringing new ideas and new modes of experience on the nation.

V. METHODOLOGICAL ISSUES IN AREE EVALUATION

Ultimate and Intermediate Goals of AREE

Evaluations of AREE should be designed and carried out within a holistic livelihood framework that includes both farm and non-farm activities. To raise the poor out of

poverty in a sustainable way, all their needs (physical, human, economic, natural and social) must be addressed. Impact assessment and evaluation should examine how AREE products and services are being used and their impact on people's lives, their societies and environment. However, these fundamental goals related to human welfare are several steps away from intermediate goals and objectives of the specific AREE projects/programs. Usually, it is difficult to evaluate impacts in terms of the ultimate broader goals of poverty alleviation and environmental sustainability. Ideally, therefore, there is a need to evaluate whether the research in question resulted in technologies, management strategies and capacity strengthening that lead to more agricultural production per hectare at lower cost per unit of output and in a more sustainable fashion for more people.

The Counterfactual

Constructing a realistic and accurate counterfactual is a far from simple task. Agriculture is a dynamic sector that is influenced by a multitude of exogenous factors, including government policies, conflicts, resource changes, social events, and climate dynamics, in addition to the effects of technical change. Technical change itself is the product of many innovations, and the contribution of any single is difficult to isolate. Each innovation is the product of collaborative efforts among scientists and institutions. It is a considerable challenge to determine what the course of events would be if a single research contribution is removed.

Attribution

Attribution refers to the constructing plausible links between an impact 'generator' and the observed impact. This critically relies on identifying the source of the impact, and quantifying the derived impacts across time and space. It also involves the identification of the specific causal pathway from the specific actions of a particular institution, relative to other drivers of change. The severity of the attribution problem depends on the kind of research activity and outputs and the role of different actors in the innovation process.

Model / concept of innovation

AREE usually impacts on the livelihoods of public through highly complex, dynamic and interactive processes involving many factors and actors. The path from AREE to development is long and winding and it is very difficult to attribute development impact to AREE outputs unambiguously or unchallenged by alternative models of causation. By making the nature of the model or concept of innovation explicit and

superimposing the AREE strategy onto it, helps the users of the studies to understand the internal logic of the impact assessment and to check the completeness of the inquiry.

Lag time

AREE is a cumulative, evolutionary process, in which each new finding is partially a product of all previous findings that laid the foundation for the new discovery. Further, each new discovery through research leads to a “successful” innovation that will take a long and uncertain period of time to be applied fully and widely. Consequently, care must be taken in the temporal attribution of research efforts, as research completed long ago could be partially credited for today’s discoveries. In most studies, previous research investments are taken as sunk costs, and thus rates of return are calculated for the marginal investment of the new research. This may be reasonable if the implicit counterfactual assumption of no alternate provision of the output is valid. This issue of selecting a proper “lag time” and structure has been debated extensively in the impact assessment literature. Metrics of the economic efficiency of research, such as internal rates of return, can vary widely according to assumptions regarding lags. Lag times also present challenges for the timing of ex-post impact assessments, as it may take decades or more before research products are widely adopted and produce widespread benefits.

Level of Aggregation

Impact assessment can be carried out at different levels of aggregation—individual AREE projects, specific AREE programs, or the AREE as a whole—depending on the objectives and the kind of the exercise.

Scope and limitations of the evaluation

It is important to clarify the objectives, scope and limitations of the impact assessment or evaluation to indicate the level of aggregation at which results are examined. Whatever the level at which impacts are assessed, it is important that the limitations of the evaluation be noted, in particular in attempting to bridge the "attribution gap" between results that can in fact be documented and plausible impacts further down the impact pathway.

Common Measurement Errors

- **Poor quality data:** Reliable agricultural statistics are often difficult to obtain, especially on a wider scale. AREE programs must balance data needs between the ideal (and costly) and the practical, and must draw data from various sources. Use of the advances in information communication technology and its applications for collection, analysis, storage, retrieving and dissemination of data will be quite useful in monitoring and evaluation.

- **Externalities:** Impact assessments rarely try to capture external effects in quantitative terms. As a result, certain estimates may be biased by the fact that associated environmental costs (or benefits) are ignored, or that government expenditures associated with agricultural production (such as subsidies) are excluded.

- **Unrealistic or unspecified Counterfactuals:** The counterfactual should identify the "next best" technologies or policies that would have been developed and adopted without the assessed AREE program. This is because farmers dynamically respond to available production possibilities, and adapt to remain technically efficient given their production frontier. Counterfactuals must take account of this and try to capture true "next best" options for farmers, including the adoption of alternative innovations that would be produced by other institutions in the absence of the given assessed research.

VI. IMPACT STUDIES IN AREES

Monitoring and evaluation in AREE started with impact studies that observe the effects of new technology such as the spread of modern plant varieties on farm productivity and farmers' welfare. Economic impact assessments generally estimate the economic benefits realized through research towards associated costs and estimate a rate of return to research investments (IAEG, 2000). The Agricultural Learning and Impacts Network (ALINe) creates innovative, robust and user-oriented Monitoring Learning and Evaluation systems in the agricultural sector. One of its core competencies is its unique role in developing opportunities to include Farmer Voice in Monitoring, Learning and Evaluation (MLE) by bringing stakeholders and farmers closer together to balance their perspectives and enable a focus on people-centred performance and impacts in the sector.

Adoption studies: Adoption studies generally analyze the underlying patterns of adoption and the use of new practices using statistical and econometric tools. Adoption

surveys are frequently used to see if farmers (or other research clients) are using (or not using) improved technology and observe its effects on farm production, to measure client satisfaction (or dissatisfaction) of research results, and to determine how research activities can be reoriented to make the technologies more useful. The literature on the theoretical concepts and factors underlying adoption of improved technology and the process of innovation has been put together by Kuby (1999). There is extensive literature on adoption studies (Herdt and Capule 1983, Sain and Martinez 1999, Morris et al. 1999, Singh and Morris 1997, Sperling and Loevinsohn 1993, Smale et al. 1991, Feder and Umali 1995; CIMMYT 1993). The adoption and diffusion studies form the first step towards building an institutional capacity to undertake comprehensive impact assessments (and therefore sometimes referred as pre-impact studies). The data and results of adoption studies provide the baseline data for the evaluation of technology impacts on productivity, income, environment, equity and other goals.

Economic studies: Economic studies relate to estimation of economic benefits and measure economic rates of return associated with innovations coming out of research investment. The economic impact studies also include a wide range of levels of impact analysis, from aggregate, national level to program and project level.

Agricultural Education: Evaluation of agricultural education system are not as frequent as agricultural research. The evaluation of agricultural education at the broader level should look into its relevance in terms of: enhancing agricultural production and productivity, improving the quality of agricultural research and education, meeting manpower needs, institution-building and institutional relevance, developing university systems or agricultural support services.

Agricultural Extension: Evaluating contribution of extension mainly in terms of technology transfer requires a new perspective as to how extension relates to technology validation and its transfer. The value of extension in stimulating the adoption and diffusion of new technologies is related to, if and how extension has worked with research, the private sector, and farmer organizations to analyse, test, validate and adapt new technologies to farmers' needs and market demands (GFRAS, 2012). Rajalahti et al (2005) described the monitoring and evaluation challenges in agricultural research and extension (ARE) systems together and no attempt was made for evaluation of research and extension separately. Global Forum for Rural Advisory Services (GFRAS, 2012) provides a normative framework for evaluation of extension in five key areas: best-fit approaches, pluralism, and accountability to rural clients, developing human resources and ensuring sustainability.

Extension monitoring and evaluation need to reflect the diversity of extension systems, which are driven by a mix of goals of farmers, governments, private firms, researchers, and others in the innovation system and within broader rural development. But extension is often a low key intermediary institution that does not directly produce tangible outputs, but if it is absent or ineffective, can result in systemic failures. Evaluations need to highlight this 'missing middle' by keeping in mind that the objectives of extension interventions are usually multiple and include outcomes which are not easily quantifiable, such as changes in behaviour and attitude, learning and ownership (GFRAS, 2012).

VII. TEN STEPS TO BUILDING A RESULTS-BASED M&E SYSTEM

Linda and Rist (2008) outlined ten steps in building and sustaining effective monitoring and evaluation for development evaluation training which is equally applicable for AREE programmes. These steps are deliberated here under:

Conducting a Readiness Assessment: It is a way of determining the capacity and willingness of universities and research institutes to construct a result- based M&E system.

Agreeing on Performance Outcomes to Monitor and Evaluate: It is important to generate an interest in assessing the outcomes and impacts the organization or government is trying to achieve, rather than simply focusing on implementation issues (inputs, activities, and outputs).

Developing Key Indicators to Monitor inputs, Outputs, Outcomes and Impact: Indicator development is a core activity in building an M&E system and drives all subsequent data collection, analysis and reporting. The methodological issues in creating credible and appropriate indicators are not to be under estimated.

Gathering Baseline Data on Indicators: The measurement of progress (or a lack of it) towards outcomes begins with the description and measurement of initial conditions being addressed by the outcomes. Collecting baseline data essentially means taking the first measurements of the indicators to find out "where are we today?" A performance baseline is information (qualitative or quantitative) about performance on the chosen indicators at the beginning of (or immediately prior to) the intervention.

Planning for Improvements Setting Realistic Targets: It is the final step in building the performance framework and establish targets. Most outcomes and nearly all impacts in international development are long term, complex, and not quickly achieved. Thus, there is a need to establish interim targets that specify how much progress towards an outcome is to be achieved, in what time frame, and with what level of resource allocation. Measuring performance against these targets can involve both direct and proxy indicators as well as the use of both quantitative and qualitative data.

Monitoring for Results: As mentioned, a results based monitoring system tracks both implementation (inputs, activities, and outputs) and results (outcomes and impacts). Each outcome will have a number of indicators, each of which will have a target. In order to achieve those targets, there are a series of activities and strategies that need to be coordinated and managed. To be successful, every monitoring system needs to have ownership, management, maintenance and credibility.

Role of Evaluations: Although monitoring systems are important, it is to be emphasized that the role evaluation plays is vital in supplementing information on progress toward outcomes and impacts. Whereas, a monitoring will tell us what we are doing relative to indicators, targets, and outcomes; evaluation will tell us whether: Are we doing the right things (strategy)? Are we doing things right (operations)? Are there better ways of doing it (learning)? Evaluation can address many important issues that go beyond a simple monitoring system.

Reporting Findings: Analysis and reporting of M&E findings is a crucial step in this process, as it determines what findings are reported to whom, in what format, and at what intervals. Thinking carefully about the demand for information at each level of the organization, as well as the form in which that information will be most useful, and at what stage(s) of the project/program, the findings need to be reported is crucial.

Using Findings: The crux of an M&E system is not in simply generating results based information, but in getting that information to the appropriate users in the system in a timely fashion so that they can take it into account (as they choose) in the management of the projects, programs, or policies. Development partners and civil society have important roles in using the information to strengthen accountability, transparency, and resource allocation procedures.

Sustaining the M&E System within Organization: There are six critical components crucial to the construction of a sustainable M&E System: (1) Demand for M&E information (2) Clear roles and responsibilities for collecting, analyzing and reporting performance information (3) Trustworthy and credible information (4) Accountability (5) Capacity of the organization in terms of technical and managerial skill to perform M&E and (6) Incentives to encourage the use of performance information. Each of these components needs continued attention over time to ensure the viability and sustainability of the system.

VIII. RECOMMENDATIONS

M&E of AREE is becoming a significant challenge as donors and funding agencies are keen on outcomes and impacts of the funding. This has resulted in increased demand for expertise in M&E. The participants of the brainstorming session representing various organizations deliberated and are in favor of constituting M&E in NARES to promote accountability, improvement in the quality and rating of the institutions. The recommendations emerged at the BSS are presented below:

- ✦ All the stakeholders need to be sensitized on the benefit of M&E relating to strategic planning, implementation and assessment of technical/ scientific contribution mainly from the point of improvement of mandated activities.
- ✦ All the activities such as prioritizing, planning, monitoring and evaluation of programmes and projects should be addressed cumulatively at University/Institute level as well as at the individual project level, through the M&E cell. It is ideal that M&E Cell is chaired by Vice-Chancellor/Director and apart from others should include representatives from faculty, students and Alumni.
- ✦ M&E unit should be a multidisciplinary team inclusive of social scientists. At present, most personnel of M&E cell are not exposed to the theory and principles of M&E. Their capacity building is necessary.
- ✦ M&E should use both qualitative and quantitative indicators to measure the outputs, outcomes and impacts. Hence, for an effective monitoring and evaluation a Management Information System (MIS) is needed. Accordingly, depth and quality of data need to be improved.
- ✦ Impact assessments should not be directly limited to measurable impacts; but should also seek to capture the complexity and non-linear nature of agricultural

AREE. It should be integrated into complex social, economic and political dimensions.

- In M&E, we need to clearly understand the weak links in the research-to-impact pathways; between priority setting, targeting, outputs, outcomes, and impact. AREE outputs are cumulative and evolutionary- new finding is partially a product of all previous findings. Also, AREE outputs have lag periods that will take several years – capturing the temporal attribution of AREE is a challenge.
- The model adopted for CGIAR research programmes is apt for NARES as well.
- M&E cell should undertake periodic surveys to assess and document status of technological advances, its adoption and mapping of emerging trends in technology.
- It is necessary that environmental impacts form a part of the assessment. The outcomes in the case of environmental projects can be classified into immediate outcomes, intermediate outcomes and ultimate outcomes.
- Valuation of natural resources and environmental impacts of agricultural technologies has been a challenge since often market failure and imperfect markets, which lead to distorted prices / returns, fail to capture the true total economic value. In such a context, non-market valuation techniques need to be popularized in M&E framework.
- Impacts of environmental projects are lagged (temporal and/or spatial), that can lead to either positive or negative externalities. There is a need to identify over time and space, the tangible and intangible costs and benefits of the environmental project/s. Within each of the environmental research areas there are output, outcome and impact indicators, including cross-cutting ones such as employment and technological advances.
- The social impacts including ethical and cultural aspects need to be captured and accounted in the evaluation.
- M&E should capture improvement in the quality of teaching, increase in the employability of the graduates and the rating of the institutions on well defined and accepted norms.
- Steps need to be initiated for development and institutionalization of indicators to measure quality of education and extension.

- ✦ A composite of indicators such as evaluation by superiors, peer evaluation, student evaluation and self-evaluation should be well developed and included in the M&E efforts.
- ✦ For the Frontline extension system (mainly KVK system), Annual Review Workshop conducted by the Zonal Project Directorate, and Scientific Advisory Committee by the KVKs are much useful to review the work performance and to plan the next year technical programme.

IX. EPILOGUE

The primary motivation for undertaking impact assessments and evaluations should be to enhance the probability that the investments in agricultural research, education and extension will improve the livelihoods of farming community and other stakeholders. Other important uses include informing donors on the returns on their investments, deriving strategic and programmatic lessons for future investments and providing material for public awareness campaigns. Agricultural research and education managers and policymakers tend to be skeptical of the data and methods used in impact assessment; they may also find the reports difficult to understand interpret and apply. This highlights the need to plan impact studies in terms of real information needs (more than peer interests), to pay close attention to data quality, and to make special efforts to summarize the findings and present them in simple, lucid and intelligible manner. It is extremely important that the results and recommendations are presented in a meaningful way to policymakers, managers, and scientists. A practitioner's perspective is to be attempted by differentiating what is desirable and what is possible, keeping in view acceptance, data, skills, etc., in a time sequence. Considering the evolution of theory and methods to evaluate agricultural research, education and extension; today we have much better set of tools available than a couple of decades ago. Moreover, considerable efforts are being made to operate these tools and bring them in the mainstream of research, education and extension review and assessment process in the universities and ICAR institutes.

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