REPORT ON

Master Class on Impact Assessment

Concepts and Tools for Agricultural Research Evaluation and Impact Assessment

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18 – 27 March 2009

Participants in the Impact Assessment Master Class

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Introduction

This Master Class focused on providing participants with the knowledge and skills necessary to undertake robust ex ante and ex post economic impact assessments of agricultural R&D and to make them aware of methodological advances in impact assessment and pathway analysis. The requirements for clarity, transparency, and credible evidence in ex ante and ex post impact assessment were also covered.

It is widely recognised that growth in agricultural production leads to improved economic conditions in both developed and developing countries. Nevertheless, despite high returns to agricultural research, available funds are limited. As such, there is an increasing demand from stakeholders, especially donors, for national and international research organisations to show that they are wisely investing the research dollars that have been entrusted to them. Moreover, given that malnutrition and poverty remain serious problems in Asia and sub-Saharan Africa, and that severe environmental degradation continues to threaten sustainable agricultural growth, R&D organisations working in the developing world are being asked to provide concrete evidence that the benefits of research are reaching the targeted beneficiaries – the poor and disempowered – and that these benefits are likely to be sustainable in the future.

In addition to seeking evidence that past research funds have been invested efficiently and effectively, the onus is on research institutes systematically to apply priority-setting methods to ensure limited resources are directed to those research areas that have the greatest potential to benefit the poor in a sustainable manner. However, use of priority-setting methods as a basis for agricultural research decision-making has been limited. This is because it is not enough just to have a tool kit of evaluation methods that can be readily applied to a diverse research portfolio. Nor will the development of the necessary knowledge and skills ensure the application of priority setting methods at the institute level. It is also necessary to develop an environment where the evaluations are encouraged, relevant and used in strategic planning and priority setting exercises and in the development and implementation of research programs and projects. When an impacts-based evaluation system is seen as an integral part of learning and of improving program and institutional management, the likelihood that the program and institution will reach its ultimate goals is increased.

The Australian Centre for International Agricultural Research has invested significant resources into developing the methodology for impact assessment, and has published many impact studies of its partnership research projects. ICRISAT, like many of its sister Future Harvest research centres has also worked hard to develop and improve methodologies of impact assessment; as indicated above, such assessments are demanded by donors who seek to justify and improve their research investments. For its part, the Crawford Fund seeks to understand and maximise the impacts and benefits of its investments in training, and especially in its Master Classes, as part of its efforts to support international agricultural research.

Outputs

The planned outputs of the Master Class were two-fold: first, to enhance the capacity of the participants to undertake quantitative impact assessment, complemented with qualitative approach;

and second, to develop a collaborative bond between the participants themselves, and between the impact groups of ACIAR and ICRISAT and the participants. It is hoped that this will continue into the future.

The Organisers and Sponsors

The Crawford Fund Master Class program has proven to be an effective means for developing and honing high-level skills of scientists and policy advisers. Master Classes are primarily aimed at mid-career agricultural scientists, senior administrators, senior academic personnel, decision makers and public servants in developing countries. Participants are not diverted from their every day responsibilities, but are lifted to a higher skill level through focused teaching from, and dialogue with, top-level experts. This Impact Assessment Master Class was sponsored and organised by ACIAR, ICRISAT and the Crawford Fund.

The Organising Committee represented ACIAR, ICRISAT and the Crawford Fund which were also the major donors to the Master Class. Participants were nominated by ICRISAT or ACIAR primarily on the basis of their background and continuing involvement in economic impact assessment. The Committee reviewed pre-course survey forms submitted by the participants in order to screen them for their suitability to attend.

Conduct of the Master Class

The participants were met by ICRISAT on arrival in Hyderabad and transferred to the Patancheru campus where they were provided accommodation and meals. The programme of the Master Class is shown in Annex 1. An interactive approach was taken to most of the exercises. Responsibilities assigned to participants for daily review sessions, and for group activities, ensured that each contributed to the programme. Time was allocated to group activities that promoted social and cultural exchange, as well as to visits to sights in the Hyderabad area. The benefit of ICRISAT's training facilities including access to their computing and IT capacity was clearly felt. Each participant received a CD with the presentations, photos and other course materials, as well as pertinent ICRISAT and ACIAR publications.

Participants

The participants were largely drawn from South, East and Southeast Asian countries, although one participant came from Iraq and another from Kenya. The latter participant was one of several scientists based at ICRISAT who joined the programme. A Group photograph of participants is shown on the next page and a full list of participants and their contact details are shown in Annex 2. Resource persons were led by Dr. Cynthia Bantilan and Dr. Debbie Templeton.

Evaluation of the Master Class

On the last day of the Master Class, participants were asked to complete a questionnaire designed to assess its impact. The survey was, in part, an *ex ante* exercise, but provided an evaluation at a time when the Master Class was fresh in the minds of the participants.

The questionnaire is given in Annex 3A. The summary quantitative results are shown in a pie chart in Annex 3B, whereas the comments are given in Annex 3C. The responses to the questionnaire show that 68% of responses agreed or strongly agreed to the questions posed, providing evidence that the Master Class could be adjudged a success. The comments are also largely positive, and comments indicating that some of the participants will pass on the knowledge gained to students and colleagues are particularly encouraging. Comments on how the Master Class can be improved will be considered in the planning of the next Master Class on this topic.

Day 1:

Introduction and setting the scene

Introduction and welcome remarks were provided by David Hoisington, the Deputy Director General of ICRISAT. He pointed out that the Master Class on Impact Assessment will provide tools for priority setting and measuring impact of our work; what we do well, where we failed and when there are faults found, what to do in the future. William D Dar, the Director General of ICRISAT gave the inaugural address. He welcomed the Dr. Eric Craswell (Crawford Fund), Dr.Debbie Templeton (ACIAR), Dr.PK Joshi (NCAEPR), participants from the NARES, and ICRISAT scientists and all partners from 13 countries.

Inaugural address

(William Dar, DG, ICRISAT)

One billion people are estimated to be undernourished – a figure that was aggravated by dramatically-high food prices in 2008. While food prices have fallen since last year's peak, the global food crisis is not over. The situation is compounded by the global financial crisis that limits governments' and individuals' room to manoeuvre. In some places, the quest for food security is breeding neo-colonialists. Poor people spend 50 to 70% of their income on food and have little capacity to adapt as prices rise. The financial crunch lowers the real wages of poor workers, and leads to rising unemployment. And when economic growth declines, investment in agriculture is cut back. In October 2008, Kenyan anthropologist Richard Leakey predicted that the financial crisis would be devastating to science and that not only would companies and governments have less money to spend on research and development, but philanthropists and aid agencies too would cut back support. But science must not be sacrificed as a result of the financial meltdown. With funds becoming hard to come by, research organisations are going to increasingly be asked to provide concrete evidence that the benefits of research are reaching the poor and that these benefits are sustainable in the future.

Impact assessment is used to ensure that projects, programs and policies are economically viable, socially equitable and sustainable. It serves as an important means of improving technology choice. Over the next few days, participants of the Master Class will be exposed to knowledge and skills necessary to undertake robust ex ante and ex post economic impact assessments of agricultural R&D. It will also make them aware of methodological advances in impact assessment and pathway analysis. The requirements for clarity, transparency, and credible evidence in ex ante and ex post impact assessment will also be covered. We basically see impacts-based evaluation as an integral part of learning and of improving program and institutional management. Following this route will ensure that the program and institution reach their ultimate goals. Sound economic and agricultural policies, including significant investments in agriculture, can prevent gruesome outcomes. At the same time, policy and investment decisions in agriculture should be geared toward exploiting new opportunities and building resilience for future challenges. ICRISAT recently went through an External Program and Management Review, in which the panel emphasised that greater attention to strategic planning and research prioritisation is the key to our continued success.
At the end of the Master Class, your skills at undertaking quantitative impact assessment will have been enhanced and a collaborative bond will have developed between all of you. It is hoped that this will continue into the future.

I take this opportunity to thank ACIAR and the Crawford Fund for sponsoring this event. I am sure that the participants from Bangladesh, Cambodia, China, India, Indonesia, Laos, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam will benefit immensely from this exercise. Ultimately, the research that we do has to transform the lives of the poor. Thank you.

Overview and course outline

(Session leader: Cynthia Bantilan)

The overview of the Master Class on “Concepts and tools for agricultural research evaluation and impact assessment” started with a historical perspective of earlier research evaluation initiatives and collaboration among key partners – ICRISAT, ACIAR and the Asian NARS. It featured the events, linkages and lessons learned leading to this Master Class on Impact Assessment. It defined research evaluation and impact assessment in the context of the emerging agricultural research for development paradigm. The main questions posed were: Why have detailed evaluations? How have earlier research evaluation efforts led to this Master Class? What linkages were established? What have we learnt?

The outputs of the ten-day program were expected to a) enhance capacity of participants to undertake quantitative impact assessments, complemented with qualitative approach; and b) nurture a collaborative bond among the participants, and between the impact groups of ICRISAT, ACIAR and the participants. These outputs are intended to lift the participants to a higher skill level through the method of focused teaching.

The interesting features of the Master Class include: a) concepts and tools for agricultural research evaluation and impact assessment, b) imbuing impact culture in R&D organisations; c) a tour of good practice in undertaking impact assessment; d) understanding each participant’s experience and role of IA in their organisations; e) participatory exercises; f) practical evaluation exercises; and finally g) a recap at the beginning of each day.

The highlights of the methodological concepts include the Impact Assessment Model: research process and evaluation framework; economic surplus concepts; measuring the returns to research within the economic surplus framework; effects of elasticities in the distribution of benefits, combining annual benefits, adoption, research costs, net present value and internal rate of return.

Participatory exercises were designed to capture the diverse multi-disciplinary experiences in research evaluation. For example, the participatory approach in explaining impact pathways systematically illustrates the documentation of consequences along the impact pathway. This was elucidated with an example of the coalition approach in innovation systems developed at ICRISAT. These participatory sessions involve social and bio-physical scientists at ICRISAT - CLL Gowda, Belum Subba Reddy, KN Rai, Shyam Nigam, KB Saxena, Pooran Gaur, Srinivas Rao and Ashok Alur. In addition, a field visit in ICRISAT Watershed long-term trials was organised with NRM scientists in the field showing the NRM impact dimensions led by Dr. PK Joshi and others (SP Wani, KL Sahrawat, Piara Singh, P Pathak and Rosana Mula).

The conceptual and methodological issues highlight the following key concepts: the *K shift* (what forms of supply shifts to assume, validating claims on impacts, research depreciation or disadoption, new product or industry situation, post harvest research); benefit-cost analysis; concepts and tools in estimating adoption levels and rate of adoption; the correct counterfactual and attribution issues; and spillover effects and external factors.

The scope of the session on empirical issues cover the minimum data set required and data collection methods for research evaluation, and specifically related to adoption patterns, use of proxy values, discussion on the margin of advantage, research lags, obsolescence and maintenance research and probability of success. The discussion on the use of Delphi technique in eliciting qualitative data from scientists (e.g. the yield gap) involve invited biological and physical scientists.

A special session was conducted on the DREAM (Dynamic Research EvaluAtion for Management) Model including the presentation, setup, hands-on exercises and discussion on strengths and weaknesses of DREAM model. Hands-on exercises using spreadsheets complemented the above sessions.

In addition to the advanced topics in research evaluation including assessing policy orientated research, measuring the returns to capacity building and introducing gender in research evaluation, several sessions gave opportunities for gaining from first-hand experiences of invited experts in addressing special topics including the following: assessment of returns to research on quality change: Case of crop residue; challenges in assessing biofuel research in a changing price scenario: sweet sorghum; NRM research impacts: examining efficiency gains in water resource use through technologies; NRM research impacts: case of surface and ground water irrigation along with hands-on exercise; Empirical application in assessing economic and environmental impacts of NRM technologies using the economic surplus approach; empirical challenges in impact assessment of NRM research: Watershed technology case studies; and meta-analysis approach in assessing NRM technology impacts – the case of Watersheds technology.

The ten-day program concluded with a workshop evaluation with the use of the dartboard approach conducted by Cynthia Bantilan and Debbie Templeton

A day was devoted to institutionalisation issues which covered: Research priority setting – methodological, empirical and institutionalisation issues: case of Karnataka state in India; Institutionalisation of impacts-based evaluation system and research priority setting: ACIAR perspective; Institutionalisation of impacts-based evaluation system and research priority setting: ICRISAT perspective. The day concluded with a discussion on the development of an environment where research evaluations are encouraged and used in strategic planning, learning, and improving program and institutional management.

Practical evaluation exercise

(Session leader: Debbie Templeton)

A competitive team game called ‘Balls Up’ was played to introduce the participants to a number of aspects of evaluation. In this game, the participants were grouped into three competing teams and three evaluation teams. The competing teams were given rules and equipment to play a game in which the competitors had to throw ping pong balls into a box. The competing teams knew that they were being assessed but not the criterion for the assessment.

Each evaluation team was given a different criterion upon which to judge the competing teams – (a) performance (number of balls in the box), (b) adherence to the rules and (c) teamwork. When all the teams finished throwing the balls into the boxes, each evaluation team was asked to describe the criterion they used to judge the performance of the team, and to state which team, based solely on their criterion, performed the best.

After receiving feedback from the evaluation teams, the competitors were also asked to evaluate their own performance by addressing questions such as: What did they do well? What areas could they do better? What would they do differently if they were to play the game again? More than just an energiser, the Balls Up game emphasised the need for the project team to be fully aware of the project requirements, processes and management (rules of the game), the need to understand the evaluation audience (the total number of balls in the box was not the sole criteria upon which the teams were being judged), and the value of self-evaluation.

Participants playing the ‘Balls Up’ game

Hence, from the start of the workshop, the concepts of team learning and improvement were stressed, as well as the benefits of self-evaluation. Moreover, each participant was encouraged to express his or her views throughout the workshop so collectively the workshop participants could gain a shared understanding of the following themes or the steps to evaluation:

1. Understanding the project to be evaluated
2. Planning the evaluation
3. Conducting the evaluation
4. Analysing the results
5. Reporting and using the findings

Throughout the rest of the day these steps were elaborated on.

Defining Research evaluation and impact assessment in the context of the emerging agricultural research for development paradigm

(Session leader: Eric Craswell)

This session presents a definition of impact, explains agricultural progress to date, describes future challenges and declining research investment, and elaborates on reasons why impact assessment should be carried out. Impact is defined as the positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended. These effects can be economic, socio-cultural, institutional, environmental, technological or of other types. The world's farmers are now feeding more people than ever before. Since 1970, the global population has risen from 3.7 billion to 6.6 billion, while the share of undernourished people in developing countries has fallen from 37 percent to 17 percent. Agriculture is contributing 15% and deforestation is contributing to the extent of 11% to greenhouse gas emissions.

The harvest that comes from well-directed and thorough scientific research has no fleeting value, but abides through the years, as the greatest agency for the welfare of mankind (John Wesley Powell). Economic growth itself has been largely determined by the capacity to use new technologies, whether developed at home or abroad (Nathan Rosenberg).

Due to investments in crop genetic improvement research a number of economic and social gains are accrued like: there is around 20% reduction in world food and feed grain prices; world food production increased by 4-5%; around 15 million ha of agricultural land is saved, per capita calorie supply is increased by 5% in poor countries; child malnutrition is reduced by 2% in South Asia; and food imports in developing countries are reduced by 5%.

Estimated returns to investment in agricultural R&D averages to 43% in all the regions. According to IFPRI IMPACT simulations, cereal demand is expected to increase to 350 million mt by 2025 and 410 million mt by 2050 in South Asia; 160 million mt by 2025 and 300 million mt by 2050 in sub-Saharan Africa. Per capita meat consumption is expected to increase 3.5 times in south Asia and more than double in sub-Saharan Africa during the period 2000-2050. Productivity of major cereals like rice, wheat and maize is declining in developing countries.

There are major structural shifts in the funding of agricultural R&D worldwide. During the 1990s, a slowing in growth was observed, especially, in rich countries. In rich countries like US, agricultural R&D is reoriented away from maintaining and enhancing farm productivity. There is limited R & D capacity in many parts of the developing world. It raises the real questions about the prospects of rich to poor country R&D spillovers.

The Master Class is expected to instil an impact assessment culture in all the participants. It will enhance the capability to assess impact, facilitate the use of results of impact studies to deliver accountability to stakeholders, improve research prioritisation and increase returns on research investments.

Capacity building and imbuing an impact culture in R&D organisations

(Session leader: Debbie Templeton)

A presentation2 was given on imbuing an impact culture in a R&D institution. This talk was based on the experiences of the Victorian Department of Primary Industries (VDPI) in Australia. While the VDPI is an advanced research institute (ARI), it has many features common to NARES. For example, it is an agricultural R&D and extension organisation which is largely financed by public funds. It has a strong science research culture, managing large agricultural research projects across differing bio-physical terrain. Finally, like other research organisations around the world, it has to compete for scarce resources and is accountable for its investment decisions in terms of impact.

The main lessons that can be drawn from the VDPI experience are:

- Think big, start small
- Address both supply and demand sides of evaluation
- Using a pincer movement (top-down & bottom-up) when eliciting support for evaluation
- Address different aspects of behaviour to change
- Develop a common program theory
- Build knowledge about what works and what doesn't and why
- Walk the talk – evaluate the components of evaluation including evaluation training.

The benefits of institutionalising an evaluation and impact culture include: (a) the development of well planned projects that demonstrate a logical cause-and-effect chain from inputs through to impacts; (b) staff with the ability to monitor project progress and respond accordingly; (c) an effective communication framework to report progress and final results; (d) a body of evidence that describes results, what worked, what didn't and why; (e) an increased likelihood that goals will be reached; and (f) an increased likelihood of funding.

Participatory exercise on impact pathways

(Session leader: Debbie Templeton)

While the ultimate goal of agricultural research for development is to improve the living standards of the poor in developing countries, it is recognised that not all research projects result in a practical impact because there is no guarantee that the project results will be taken up. This is because there are special challenges to achieving impact. For example, as impacts generally occur numerous years after the project is finished, researchers have little control over the final processes or steps towards impact. Even in case of adaptive and adoptive research projects, which build on earlier work and have relatively short lag periods, persons or organisations outside the research project are responsible for scaling-up and/our scaling out the new technologies. The pathways to change are complex and can depend on a number of factors such as the institutional, cultural, biophysical and political environment.

Given these complexities, developing an impact pathway provides a pragmatic strategy for tackling the seeming intractability of documenting consequences along the impact pathway. This is because it provides a framework for not only identifying outputs, outcomes and impacts of the research project of interest but also a means of mapping the cause-and-effect linkages along the impact pathway. As such, it can be an important prelude to ex post evaluation as it provides a guide to the major focal points of the analysis, and to data needs and sources. Therefore, even if not required, undertaking an ex post impact assessment *within* an impact pathway framework helps to increase the likelihood that all intended and unintended, and positive and negative impacts are identified, and where possible quantified.

A practical exercise where the participants 'walked' the impact pathway was undertaken to reinforce the complexities cause-and-effect relationships and the key stakeholders along the pathway.

Participants walking the impact pathway

Day 2:

A recap of the first day events was provided by Suvanna Praneetvatakul of Thailand.

Undertaking an impact assessment: A tour of good practice

(Session leader: Debbie Templeton)

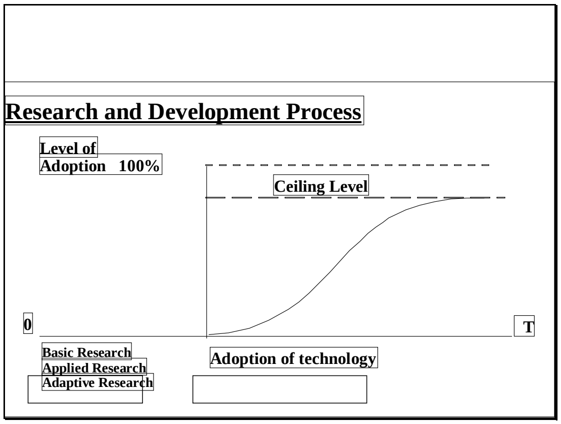
Since the 1950s, there has been a considerable body of literature on assessing the economic impact of agricultural R&D programs. However, not surprisingly, given the broad scope of these assessments and the methodological advances that have been made over the past 50 years, there is a significant degree of variability in methods applied and the credibility of the data and parameters used in the analysis. As a result the profession has examined the issue of 'best practice' when undertaking an impact assessment.

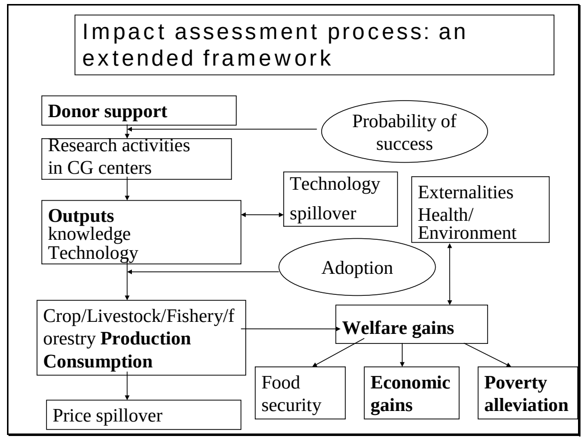
To highlight the importance of best practice procedures and methodologies, a presentation on 'a tour of good practice for impact assessment' was given. The best practice principles, criteria and indicators discussed were heavily drawn from the work of Raitzer (2003), Raitzer and Winkel (2005) and Raitzer and Lindner (2005). In sum, good practice economic impact assessments must be able to present credible evidence of impact. Credibility is established by satisfying the requirements of methodological rigor. An economic impact assessment study demonstrates methodological rigor if it uses a conceptual framework and estimation procedure that are backed by sound economic theory and substantiated by data of high integrity. It is scientific inquiry at its best.

Measuring the returns to research within an economic surplus framework – review of methodology

(Session leader: Cynthia Bantilan)

This session reviewed the basic concepts of the principle of economic surplus by first setting the research and development continuum in the context of an extended framework for impact assessment. Aside from the three dimensions of welfare gains illustrated in the figure (i.e. economic gains, food security and poverty alleviation), other dimensions of impact were also illustrated.





Measuring research benefits and costs using the economic surplus concept was systematically explained by appealing to the simple concepts of demand and supply.

Measuring benefits to producers: Producers are generally the targeted users of research outputs. To estimate benefits to producers economists rely on the concept of supply curve.

Producer supply curve: The figure shows a simple relationship between the price of a commodity and the quantity producer produce of the commodity. The price (P) is shown on the vertical axis, and the quantity is shown on the horizontal axis. The line I_0S_0 is a supply curve and can be represented by a linear function: $S_0 = a + bP$

The supply curve makes three simple statements:

- If the price is too low, producers will not produce the commodity. This is at point I_0 on the supply curve.
- If the price rises, producers will produce more of the commodity.
- Research which leads to lower per unit cost of producing a commodity will benefit producers because they will make a bigger profit even if prices do not change.

Measuring benefits to consumers: In research evaluation of projects one of the groups affected by research results is the consumer. To estimate benefits to consumers economists rely on the concept of consumer demand.

Consumer demand: The figure above shows a simple relationship between the price a commodity and the quantity consumers buy of the commodity. The price (P) is shown on the vertical axis, and the quantity is shown on the horizontal axis. The line FD is a demand curve, and can be represented by a linear function: $D = c - dP$

The demand curve makes three simple statements:

- If the price is too high consumers will not buy the commodity. This is at point F on the demand curve.
- If the price falls consumers will buy more of the commodity.
- Research which leads to lower prices of a commodity will benefit consumers because they will spend less to get the same amount of the commodity or
  if they spend the same as before research, they will get more of a commodity.

Market equilibrium: In general, if prices are too high producers will want to produce lots of a commodity, but consumers will not want to buy any. However, if prices are lower, then producers will want to produce less but consumers will want to buy more.

In an ideal world, where markets work efficiently, it is possible to find a price where the consumers are maximising their satisfaction and producers are maximising their profits. That price is referred to as the equilibrium price P_0. The equations for demand and supply are

$D = c - dP$ (the consumer demand); and

$S = a + bP$ (the supply curve)

Then it is possible to solve for P_0 by equating D to S and solving for P_0 and the market equilibrium quantity, Q_0

$P_0 = (c - a)/(b + d)$

$Q_0 = (ad + bc)/(b + d)$

Measurement of the impact of improved agricultural technologies considers the shift in the supply curve due to unit cost reduction and/or yield enhancement as research benefits from adoption of new agricultural technologies. Three economic surplus measures were illustrated: producer surplus, consumer surplus, total economic surplus and the corresponding changes in the above economic surplus components.

Producer surplus: Marshall (1893) first introduced the concept of producer surplus in the late 19th Century. He formalised the notion that when a seller makes a sale, the individual generally receives a surplus from that transaction. In other words, by selling a particular commodity, the seller obtains something, which is of greater (direct or indirect) utility to the seller than the utility that the seller would have derived if the commodity had not been sold. The total revenue equals the price of the commodity times the quantity sold, ie, area $\mathbf{P_0aQ_00}$. Now, as the supply curve gives the marginal cost of producing a commodity, the area under the supply gives an estimate of the total cost of production, ie, the area $\mathbf{P_0aQ_00}$. The producer surplus is the difference between these to areas, ie, the area above the supply curve and below the price line, $\mathbf{P_0aI_0}$ (the area shaded in red).

Consumer surplus: The concept of consumer surplus was first defined by Dupuit (1844, p. 29) as 'the difference between the sacrifice which the purchaser would be willing to make and the purchase price he has to pay in exchange'. Following this definition, the consumer is willing to pay the equivalent of area $\mathbf{FaQ_0}$ but only has to pay $\mathbf{P_0aQ_00}$.

Therefore, consumer surplus is the difference between these two areas: that is, the area below the demand curve and above the market price line $\mathbf{FaP_0}$ (the area shaded in green).

Total economic surplus: Total economic surplus is simply the sum of producer surplus ($\mathbf{P_0aI_0}$) and consumer surplus ($\mathbf{FaP_0}$) which is $\mathbf{FaI_0}$. This area gives the economic surplus WITHOUT the research. When results from a project are adopted by producers or consumers, then this leads to a change in the economic surplus. The task in assessing the impact of projects is to devise approaches which estimate that change in the economic surplus.

In addition to providing information on equilibrium prices and quantities and economic welfare, the basic economic surplus model, presented above, can be used to show the impact of a research-induced shift in supply on producer and consumer welfare. As we have just seen, the initial equilibrium price and quantity are P_0 and Q_0, respectively. Consumer surplus is equal to FaP_0 and the producer surplus is equal to P_0AI_0 (total revenue, P_0aQ_00, less the total cost of production, I_0aQ_00). Hence, total welfare is equal to FaI_0.

Cost-reducing (or yield-increasing) research will result in a rightward shift in the supply curve, say from S_0 to S_1, resulting in a new equilibrium price (P_1) and quantity (X_1). Because of the changes in the equilibrium prices and quantities, there will also be changes in the level of welfare accruing to producers and consumers and, therefore, a change in total economic welfare. The change in total economic surplus (DTS) is equal to the area I_0abI_1.

The distribution of the change in total economic surplus can also be derived form the basic supply and demand framework. Given linear supply and demand curves and parallel shift in supply, the change in consumer surplus (DCS) from the research-induced supply shift is equal to the area P_0abP_1. Consumers benefit because they can consume more at a lower price.

The change in producer surplus (DPS) is equal to the area P_1bI_1 minus the area P_0aI_0, which is equal to the area P_1bcd. The change in total economic surplus (DTS) is equal to the area I_0abI_1 that, in the case of a parallel supply shift, is equal to the area P_0abcd. Producers benefit because they can produce the same amount at a lower cost or more at the same cost.

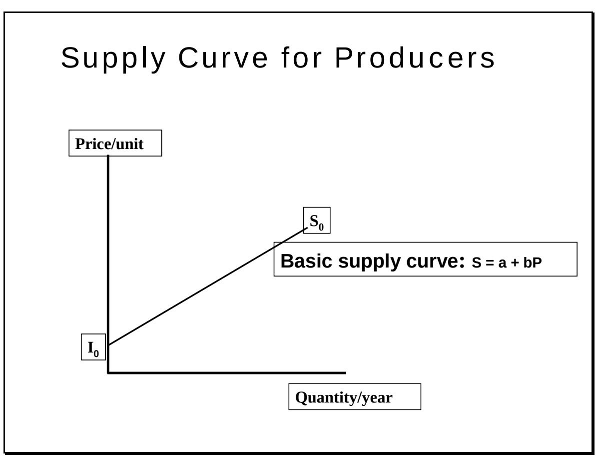
The changes in economic welfare can be expressed algebraically as follows:

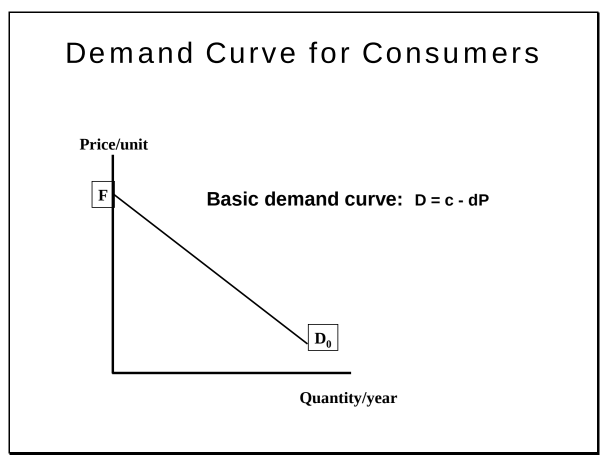
$$\Delta CS = P_0Q_0Z(1+ 0.5Z\eta)$$

$$\Delta PS = P_0Q_0 (K - Z)(1+ 0.5Z \eta)$$

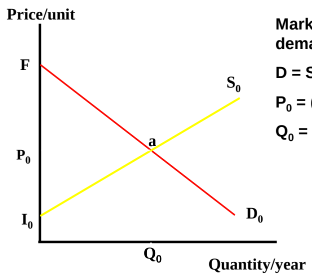
$$\Delta TS = \Delta CS + \Delta PS = P_0X_0K(1+ 0.5Z \eta)$$

where K is equal to the vertical research-induced shift in the supply curve measured as a percent of the initial equilibrium price, $Z = K\varepsilon/(\varepsilon+h)$ and ε and η are the elasticity of supply and the absolute value of the elasticity of demand, respectively (Alston, Norton and Pardey 1995, p. 211).





Market Equilibrium



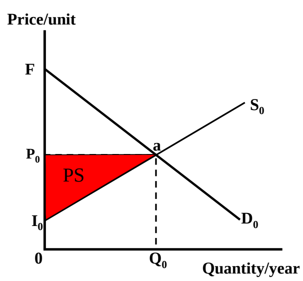
Market equilibrium is where demand and supply intersect:

D = S: c - dP = a + bP

$P_0 = (c - a)/(b + d)$ (Equilibrium Price)

$Q_0 = (ad + bc)/(b + d)$ (Equilibrium Quantity)

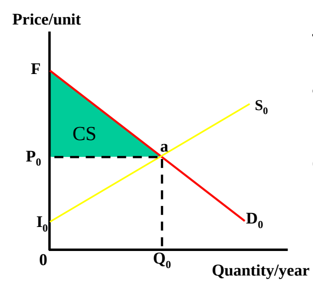
Producer Surplus



The total producer surplus is equal to the triangular area P_0aI_0.

It equals total revenue P_0aQ_00 less total costs of production I_0aQ_00.

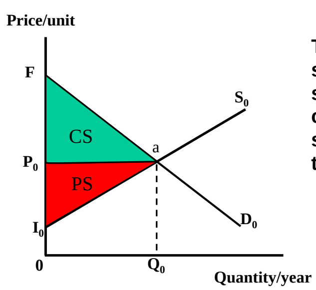
Consumer Surplus



Total consumer surplus is equal to the triangular area FaP_0

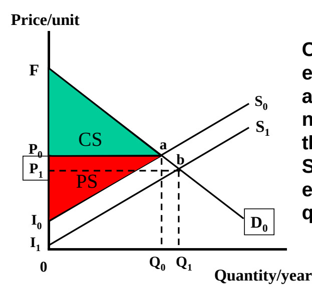
It is the difference between the amount a consumer is willing to pay and the amount that is paid

Total Economic Surplus



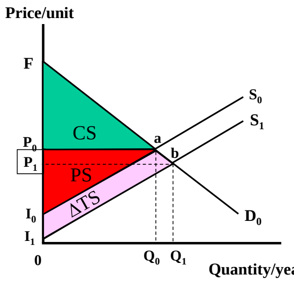
Total economic surplus is equal to the sum of producer and consumer surplus shown by the triangular area FaI_0

Impact of Technology



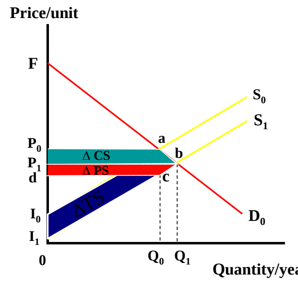
Cost-reducing or yield-enhancing research and adoption of the resulting new technologies shift the supply curve S_0 to S_1, resulting in a new equilibrium price and quantity of P_1, and Q_1

Technological Impact: Change in Total Economic Surplus



Total change in economic surplus is equal to the area I_0abI_1

Technological Impact: Change in Consumer and Producer Surplus



Change in consumer welfare is represented by the area P_0abP_1

Change in producer welfare is represented by the area P_1bI_1 - P_0aI_0

Technological Impact: Algebraic Calculations

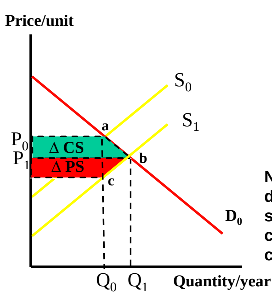
The changes in economic welfare can be expressed algebraically as follows:

- $\Delta CS = P_0Q_0Z(1 + 0.5Z\eta)$
- $\Delta PS = P_0X_0(K - Z)(1 + 0.5Z\eta)$
- $\Delta TS = \Delta CS + \Delta PS = P_0X_0K(1 + 0.5Z\eta)$
  - where K is equal to the vertical shift in supply measured as a percent of the initial equilibrium price
  - $Z = K\varepsilon/(\varepsilon + \eta)$ and ε and η are the elasticity of supply and the absolute value of the elasticity of demand

Underlying Assumptions

- Supply and demand elasticities
- Functional form of the supply and demand curves
- The nature of the research-induced supply shift

Effects of Elasticities on Distribution of Annual Benefits

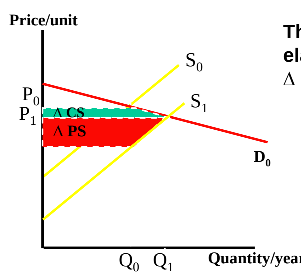


The case of equally elastic supply and demand curves:

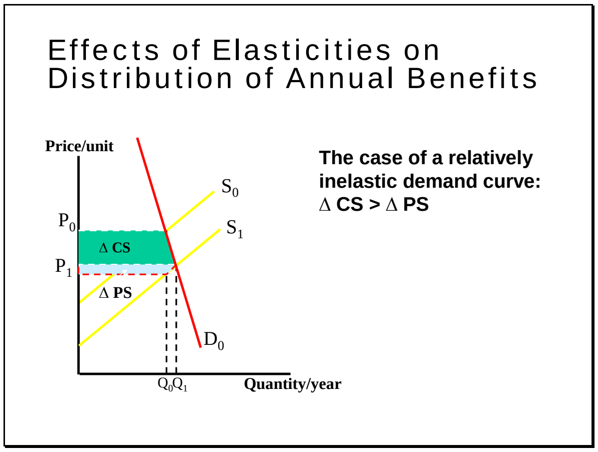
Δ CS = Δ PS

Note: The more inelastic the demand curve relative to the supply curve, the greater the change in CS relative to the change in PS

Effects of Elasticities on Distribution of Annual Benefits



The case of a relatively elastic demand curve:
Δ CS < Δ PS

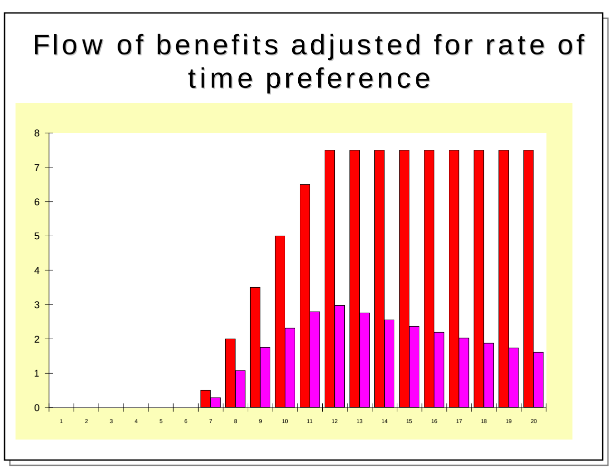


Elasticities and distribution of benefits. The effects in the distribution of benefits among producers and consumers were considered under 3 scenarios:

a) approximately equal supply and demand elasticities
b) demand elasticity >> supply elasticity
c) demand elasticity << supply elasticity

It has been shown that, when the supply shift is measured vertically, the own-price elasticities of demand and supply have limited impact on the estimated total benefits to research (Rose 1980; Mullen and Alston 1990). This is because, as can be seen from the Figure, while the elasticities do affect the triangle abc, they do not affect the rectangle P_0acd. This is because the elasticities are defined at a. As the triangle is generally very small compared with the rectangle, it follows that total research benefits are relatively insensitive to price elasticities. However, elasticity estimates are important in relation to the distribution of research benefits. In particular, the more elastic the demand curve relative to the supply curve, the smaller the consumers' share and the greater the producers' share of total research benefits. Therefore, if assumptions regarding the elasticities have to be made, the analyst needs to be aware that, while these assumptions will not have a significant impact on the total level of benefits, they could have a significant impact on the distribution of these benefits (Alston, Norton and Pardey 1995, p. 59).

When the elasticity of demand is equal to the elasticity of supply, the share of benefits to consumers and the share of benefits to producers are identical. That is change in producer surplus = change in consumer surplus. When the elasticity of demand is higher than the elasticity of supply, the share of benefits to consumers is lower than the share of benefits to producers. When the elasticity of demand is lower than the elasticity of supply, the share of benefits to producers is lower than the share of benefits to consumers.



Flow of benefits. The expected flow of benefits from research depend on patterns of adoption and the final value of the total string of benefits as reckoned from the sum of present values of benefits and cost as illustrated in the figure

The final calculation of the net present value of research and the internal rate of return are calculated as:

Net Present Value (NPV) of research	Internal Rate of Return (IRR)
$NPV_t = \sum_{t=0}^{\infty} \frac{B_t - C_t}{(1+r)^t}$	$0 = \sum_{t=0}^{\infty} \frac{B_t - C_t}{(1+IRR)^t}$
where: NPV = Net Present Value B_t = Research benefit, year t C_t = Research cost, year t r = Discount rate	where: IRR = internal rate of return B_t = research benefits, year t C_t = research costs, year t

Economic surplus computations:

$Q_d = \gamma - \delta P$

$Qs = \alpha + \beta P$

$Qs^1 = \alpha + \beta(P + k)$

$\gamma - \delta P = \alpha + \beta(P + k)$

$= \alpha + \beta P + \beta k$

$\gamma - \alpha - \beta k = \delta P + \beta P$

$= P(\delta + \beta)$

$P_1 = (\gamma - \alpha - \beta k) / (\delta + \beta)$

$P_o = (\gamma - \alpha) / (\delta + \beta)$ when k=0

$P_1 - P_0 = -\beta k/((\delta + \beta) = f$ (slope, k shift)

Defining $Z = (P_0 - P_1) / P_0$

$K = k/P_0$

$K = KP_0$

$\{(\beta KP_{0)/}\ {}_{(}\beta+\delta)\}/ P_0 = \beta K/(\beta+\delta) = \varepsilon k/(\varepsilon+\eta)$

where β = slope of supply curve or change in price/change in quantity
$= \Delta P/\Delta Qs$

δ= slope of demand curve = $\Delta P/\Delta Q_d$

ε = elasticity of supply = $\Delta Qs / \Delta P * P/Q$

η= elasticity of demand = $\Delta Q_P / \Delta P * P/Q$

$Z = \beta k/(\beta+\delta) * P_0/Q_0 / P_0/Q_0$

$= \varepsilon k/(\varepsilon+\eta)$

$$\Delta CS = (P_0-P_1)Q_0 + ½ (P_0-P_1)(Q_1 - Q_0)$$
$$= ZP_0Q_0 + ½ Z P_0 (Q_1-Q_0)$$
$$= ZP_0Q_0 + ½ Z^2 \eta P_0Q_0$$
$$= ZP_0Q_0 [1 + ½ Z \eta]$$

$$\Delta PS = P_0Q_0 (K - Z)(1+ 0.5Z \eta)$$

where

$$Z \eta = - (P_1-P_0)/ P_0 * \Delta Q_d/\Delta P * P/Q_d$$
$$= (Q_1 – Q_0) / Q_0$$

Finanlly, total economic surplus = $\Delta PS + \Delta CS$

$\Delta TS = \Delta CS + \Delta PS = P_0X_0K(1+ 0.5Z \eta)$

Empirical issues – Impact assessment data needs and data collection methods

(Session leader: KPC Rao)

This presentation describes how research projects are selected for impact assessment, various stages of research at which impact assessments can be taken , various methods of data collection, the costs involved in both research and development stages, the possible outputs, outcomes and benefits from the project, margin of advantage, the whole cycle though through which adoption takes place and economic concepts which need to be considered in measuring the benefits from research.

Always there is a tendency to select only successful projects for impact assessments. The various dimensions to consider before selecting projects for assessment are discussed. The total factor productivity and its determinants to give an estimate of returns to research and development investments are discussed. DELPHI technique of data collection for estimating the cost and expenditure or success of the new technology is explained.

In collecting IA data, the researcher is often faced with tough choices because of scarce resources, i.e., limited budget. This can be seen an opportunity for the researcher to be artistic and skilful. Two researchers can produce the same quality and quantity of data using different methods and incur different costs. Data integrity is the completeness, accuracy and precision of the data and sample should be representative of population; etc.

Focus is the extent and depth of analysis – quantitative (statistical), extensive and in-depth analyses may require voluminous data at the expense of integrity. Source of the data is either primary or secondary. High quality data is generally more expensive. Some quantity and quality may be compromised given limited budget. Academic competence of interviewers directly affects accuracy of information. Data collector need to have good skills and training of enumerators is an additional cost. Quantitative data is generally more expensive than qualitative data.

Primary data means first-hand data. It is data in its rawest, unprocessed, pre-analysed form with all the individual observations and variables in great detail and number. The user is usually the collector and/or original owner of the data set. As such the user exerts powerful control over the design and implementation of data collection, but, pays the costs and pains too. If the researcher is lucky, he can inherit or borrow primary data collected by other people at zero collection cost. A common drawback with inherited or borrowed data is that the researcher has to live with unexplained or unaccounted data gaps and discrepancies.

Secondary data means second-hand data or processed, pre-analysed data and often in summarised form such as totals, averages and ranges. These are much cheaper to acquire. Data integrity is the drawback of this data and is based on the integrity of the collecting and publishing agency.

Methodological issues and use of case studies

(Session leader: Debbie Templeton)

Estimating the K-factor: During this session, the importance of obtaining an accurate measure of the k-factor was highlighted. This is because it is a crucial determinant of returns to research. Technical, scientific and economic information is needed to estimate K. As scientist may not know the impact on costs or supply functions, the Economists' role is to translate scientific information to economic information.

The main topics covered were:

- Graphical representation of the K-factor
- Calculating K from J and the size of the supply elasticity
- Farm-level components of K
- Industry-Level component of K
- Components of the research- induced supply shift

A schematic representation of the components attributing to, or compounding, a supply shift is presented in Figure 1. The four supply curves are industry level curves depicting different market and technological conditions.

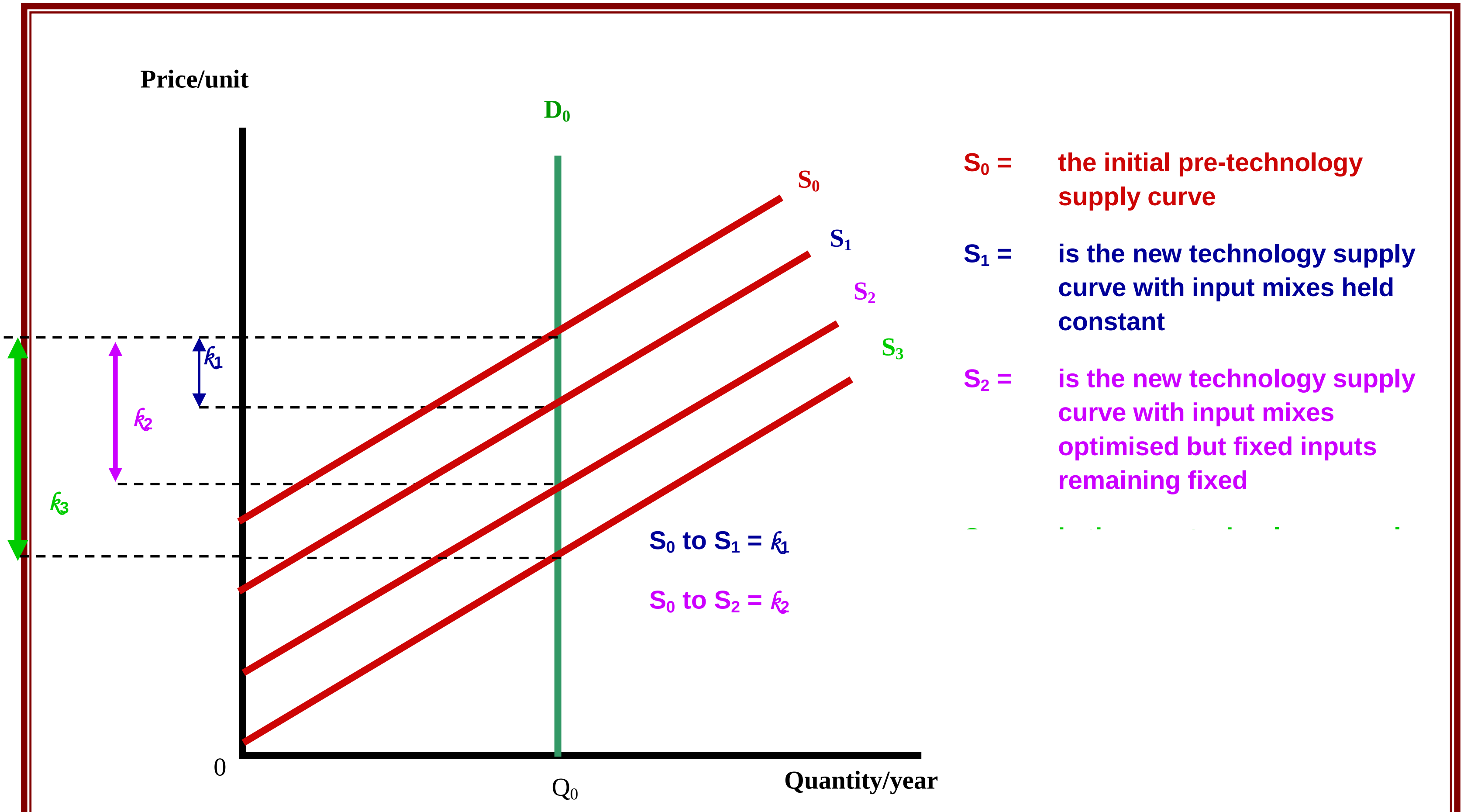
S_0 represents the initial industry supply curve with all inputs being used optimally to produce the initial output of Q_0.

S_1 is the supply curve if a new technology was adopted but the input combinations are the same as under the old technology. For example, it could represent a situation where a new rice variety has been adopted but the farmers are still using the pre-adoption farm management practices.

S_2 is the supply curve representing the situation where the new technology has been adopted *and* the inputs mix is optimal given the new technology. For example, it could represent a situation where the farmers have not only adopted the new rice variety but have also changed their farm-management practice to optimise their input mix assuming that variable input prices are fixed, as are the quantities of fixed inputs – e.g., land. The vertical distance between S_1 and S_2 is the cost savings (per unit of commodity) due to optimising the input mix.

S_3 is the supply curve after all factors of production have been optimised – including quasi-fixed factors drawn in to produced the commodity that has an technology-induced increase in profitability.

Figure 1: Estimating the K Factor



Source: Alston, Norton and Pardey, 1995

Given the three research-induced supply shifts, where S_0 to S_1 equals k_1, S_0 to S_2 equals k_2 and S_0 to S_3 equals k_3, which should we consider the value of 'K' for our assessment?

Clearly, the research-induced cost saving is underestimated by k_1 because it does not allow for optimising the input mix. This could correspond to an experimental data where the input mix is held constant for the sake of the experiment.

Adjusting for the optimal input mix leads to a measure corresponding to k_2. This could correspond to a measure of the supply shift obtained from a cost-function study (where input prices and quasi-fixed inputs are held constant) or from careful analysis and translation of experimental data into industry-level data.

However, k_3 represents the entire research induced supply shift including the component of cost production (or output increases) that is attributable to drawing in quasi-fixed factors. 'The problem is that the measure of *k* here is a measure of a single-commodity changes, some of which have been achieved at the expense of cost increases (decreases in producer surplus) in other commodities, from the production of which quasi-fixed factors have been drawn. The difference between S_2 and S_3 is not a net benefit: it is a gross benefit for which there is a corresponding cost (associated with a leftward shift in the supply of competing products) and the net social benefit is zero …' (Alston, Norton and Pardey 1995, p. 331).

Hence, unless a full general-equilibrium model is developed it is more appropriate to attempt to measure k_2 than k_3.

Underlying assumptions and possible limitations of these assumptions

The participants were provided information on the assumptions underlying the economic surplus approach to research evaluation and the possible limitations of these assumptions paraphrases Alston, Norton and Pardey (1995, pp. 58-65). In Figure 1, measures of producer, consumer and total economic surplus changes associated with a research-induced supply shift were depicted schematically. However, it is necessary to define explicit mathematical functions to represent supply-and-demand equations and the nature and extent of the supply shift in order to obtain a measure of these areas. As this is not always possible, assumptions regarding these functions may need to be made. But economic surplus measures are sensitive to assumptions about supply and demand elasticities, the functional forms of supply and demand and the nature of the research-induced supply shift (Alston, Norton and Pardey 1995, p. 58). Each of these assumptions will affect the estimated level and distribution of benefits from the introduction of a new technology.

- **Supply and demand elasticities:** It has been shown that, when the supply shift is measured vertically, the own-price elasticities of demand and supply have limited impact on the estimated total benefits to research (Rose 1980; Mullen and Alston 1990). This is because, as can be seen from Figure 1, while the elasticities do affect the triangle ABC, they do not affect the rectangle P_0ACD because the elasticities are defined at A. As the triangle is generally very small compared with the rectangle, it follows that total research benefits are relatively insensitive to price elasticities. However, elasticity estimates are important in relation to the distribution of research benefits. In particular, the more elastic the demand curve relative to the supply curve, the smaller the consumers' share and the greater the producers' share of total research benefits. Therefore, if assumptions regarding the elasticities have to be made, the analyst needs to be aware that, while these assumptions will not have a significant impact on the total level of benefits, they could have a significant impact on the distribution of these benefits (Alston, Norton and Pardey 1995, p. 59).

- **Functional form of the supply and demand curves:** In the majority of studies, linear functional forms have been used primarily because it is easier to calculate the geometric areas of surplus change using simple algebra. Fortunately, empirical measures of the level and distribution of research gains are quite insensitive to choices of functional form. They are much more sensitive to the related but separate choices of the nature of the research-induced supply shift (Alston, Norton and Pardey 1995, p. 63).

- **The nature of the research-induced supply shift:** The choice of the functional form of the supply shift is crucially important as the total level of benefits from the adoption of a new technology is significantly affected by the nature of the research-induced supply shift (Lindner and Jarrett 1978). For example, given a linear supply function, total benefits from a parallel shift are around twice the size of total benefits from a pivotal shift of equal size at the pre-research equilibrium (Rose 1980; Alston, Norton and Pardey 1995, pp. 63-4). When supply shifts in parallel, producers will always benefit from research unless supply is perfectly elastic or demand is perfectly inelastic. Even in these extreme cases, producers are no worse off. With a pivotal shift, while overall producers will be better off if the demand curve is elastic at around the initial equilibrium; they may actually lose if the demand curve is inelastic at the initial equilibrium point.

Uncritical assumptions regarding the functional form of the supply and demand curves and the nature of the supply shift can substantially bias estimates of the level and distribution of benefits from research. However, economic theory rarely provides a clear indication of the most appropriate assumptions to be made. As a result, Wohlgenant (1997) suggests that the best option would be to obtain information on the cost structure of the technology-adopting firms, the distribution of marginal and infra-marginal firms within the industry and the way in which the technology will shift the firms' marginal cost curves. However, because of data limitations, it is not always possible to obtain the necessary firm-level information to determine the functional form of either the industry supply curve or the nature of the research-induced supply shift. In the absence of this information, the preferred approach is to assume either linear or locally linear supply curves or parallel shifts in supply, but to be aware that the supply curve and shift in supply may actually take some other functional form (Rose 1980; Alston, Norton and Pardey 1995, p. 63).

Day 3:

Recap of day 2 activities was provided by K Suhasini of India.

Data and Adoption

(Session leader: Debbie Templeton)

Data sources and data gaps: A brief presentation on minimum data requirements to undertake an impact assessment (see Box 1) was given.

Box 1: Minimum Data Set

- Crop production (and consumption levels for a trade economy)
- Market prices: farmgate price (and world price for a trade economy)
- Elasticities of demand and supply
- Research and adoption lags
- Total area planted to variety
- Year of first adoption
- Ceiling level of adoption
- Unit cost reduction due to technology change
- Input and management changes due to technology change
- Research and extension cost

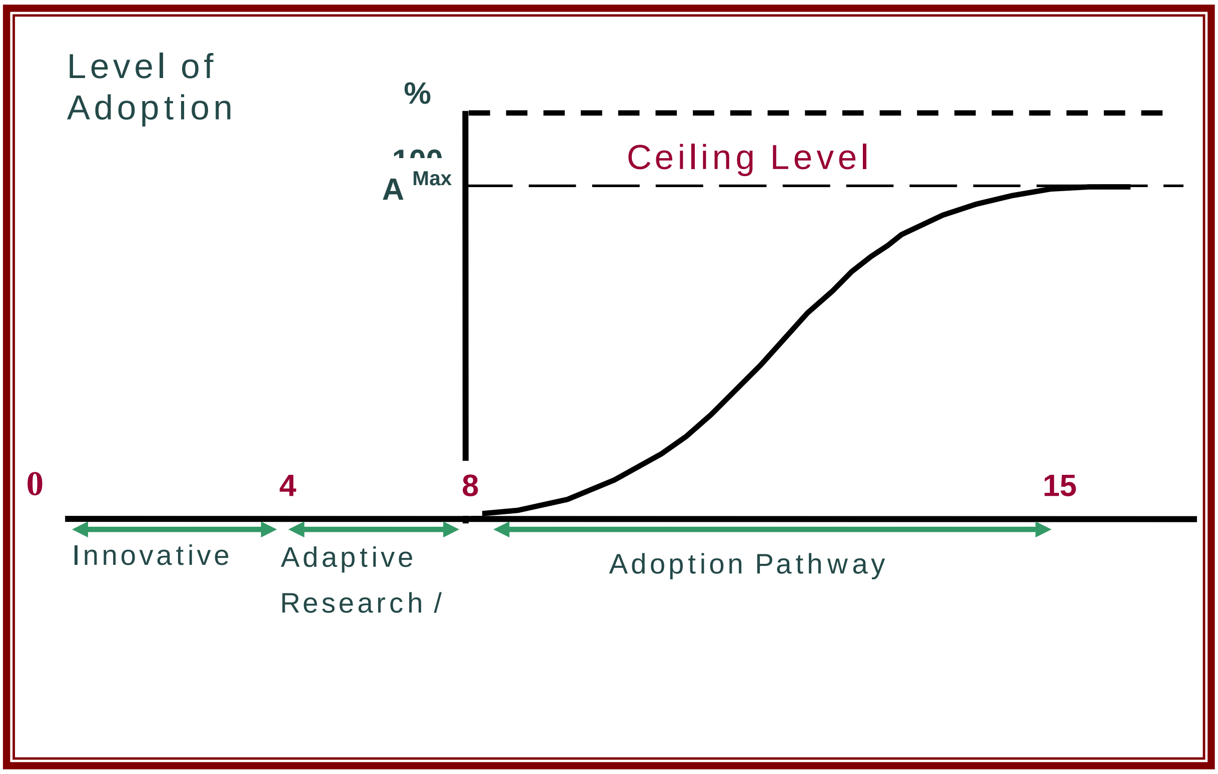
After the presentation, the participants were asked to share their knowledge and experiences on the following issues/questions:

- What are the main data sources you draw upon?
- What data limitations do you face?
- How do you go about overcoming data gaps?
- What data collection methods do you use?

Time lags, probability of success, spill-overs and external factors
A number of important empirical and practical issues surrounding adoption were also presented.

Research, development and adoption time lags
This session provided participants with a very brief overview of different ways to illustrate adoption levels, such as proportions or absolute numbers, which may vary according to the commodity of interest (e.g., livestock, perennial crops or trees). Data collection methods were also mentioned. Finally, the different functional forms of the adoption pathway, used in measuring the returns to agricultural research, were presented.
The relationship between the time after the initial investment in the research project and adoption of the new technology was presented (Figure 2).

Figure 2: Research, Development and Adoption Lags



It was pointed out that lags of several years can occur between the time when the research commences to the time when the effects on production and productivity are realised. Depending on the nature of the R&D project, research, development and adoption lags may be short or long. Accounting for these time lags, particularly *ex ante*, can be quite challenging. In general, adaptive and adoptive projects build on earlier work and have relatively short lag periods. On the other hand, more basic or applied research can have extremely long lags. For example, it may take four to six years to develop a disease-resistant breeding line. This line will then be distributed to NARES to be incorporated into their research and breeding programs. It may take another two to four years to develop and field test a variety suited to local agro-ecological and socio-economic conditions. So it could be eight to 10 years from the start of the research project until the variety is ready for release to farmers.

Even if the technology is successful in terms of meeting farmer needs, it can still take many years before uptake of the technology reaches a maximum level. The rate and level of adoption will depend on many factors such as the strength of the countries extension system, the willingness of farmers to follow the practice of early adopters, and the availability of substitute technologies. In addition, the shape of the adoption curve is difficult to determine precisely even in *ex post* studies. The adoption curve in Figure 2 is drawn as an S-shape curve following Griliches (1958). The underlining assumption is that adoption starts slowly and then speeds up as more farmers become aware of the benefits of the research and then slows down as adoption reaches ceiling level. Other functional forms include linear (Edwards and Freebairn 1981), polynomial lags (Cline 1975) and trapezoidal lags (Huffman and Evenson 1992). The ceiling level, Amax is below 100%. While not shown schematically above, the adoption curve could eventually turn down as the new technology is replaced or becomes obsolete.

External factors

Even when the best planned and implemented projects result in highly adoptive technologies, the uptake of these by the next and final users could be inhibited by factors external to the project itself. Alternatively, the adoption of some other technologies can far exceed expectations. The four main categories of external factors are social, economic, government policies, and eco-climatic. The importance of these factors can vary from place to place and overtime. Regardless of the uncertainty surrounding the likely effect of the external factors on the adoption pathway, when undertaking an *ex ante* or *ex post* impact assessment, these factors should be considered and the underlying assumptions should be made explicit.

Estimating adoption levels: Empirical issues

(Session leader: Cynthia Bantilan)

A simple frame work for research evaluation includes the interplay of four factors namely research effort, research output, commodity production/consumption and finally welfare change with two conditions - probability of success and adoption of research products. This simple framework is modified to include more factors, conditions and also broaden the impact dimensions to include welfare changes to both consumers and producers as well as factor the externalities. Based the simple framework the minimum data for impact assessment that is required for research evaluation analysis is identified and presented in Box 1. The farm-level feedback data needed for this analysis includes data on cropping patterns, other varieties adopted and proportion of land sown, source of seed and seed replacement rate, sources of information regarding new technology, crop/varieties replaced, desirable features of new technology, differential characteristics compared to new technology, constraints to adoption and post harvest crop utilisation.

The different ways to show adoption levels was also discussed and examples were shared with the participants of the Master class on how this can be done for different cases. For example in the case of livestock say sheep, the adoption levels can be assessed taking the proportion of number of animals affected by the total number targeted. In the case of crops it could be the area planted under a variety over the total area available. Similarly the different ways to collect the adoption data were discussed. Adoption levels change over time but the shape of adoption path can take any form like step function, S-shape, or bell shape. It is difficult to predict the shape of the path in ex-ante assessment.

Adoption is a condition for impact to occur. The concept of adoption was discussed in detail and the parameters of adoption were also discussed namely ceiling level of adoption, adoption lag and rate and pattern of adoption. The data sources for estimating adoption levels can be objective data (survey, literature) or elicited data (expert's opinion and or reconnaissance data). After compiling the relevant data sets, adoption tracking can be done following the five essential steps – Identifying the R&D adoption-impact domain, following an estimation procedure, data generation, data analysis and presentation format. The tools required for tracking adoption were also presented and examples were shared to clarify the concepts. Similarly using examples how to represent disadoption or research depreciation were also illustrated.

The development and adoption of any technology has 6 distinct phases.
Phase 1: Basic research
Phase 2: Applied research
Phase 3: Adaptive research
Phase 4: Low adoption of technology or information
Phase 5: Increasing rate in uptake of technology or information
Phase 6: Ceiling adoption of technology or information.
Some empirical issues like research lags, probability of success and research spillovers were also discussed.

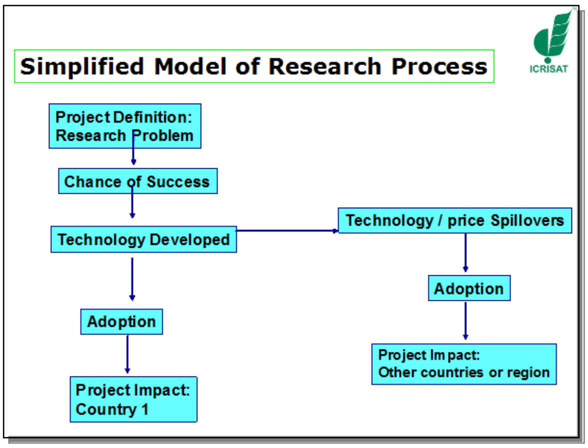
Price and technical spillovers of research

(Session leader: Cynthia Bantilan)

The session on price and technical spillovers covered the following topics:

- How do spillovers fit in research process?
- Why should research spillovers be considered?
- Desirable features of a model of spillovers
- Price spillovers in open economy model
- Technical spillovers in open economy model

The consideration of this component on research evaluation is motivated by the following
- Necessary (but not sufficient) condition for Government intervention
- Need spillover analysis to be able to quantify more accurately
- Input to support research management
- Can generate data regarding production   environment research strategies
- Enhancement of research evaluation methodology eg. it is necessary to disaggregate to solve the supply shift debate

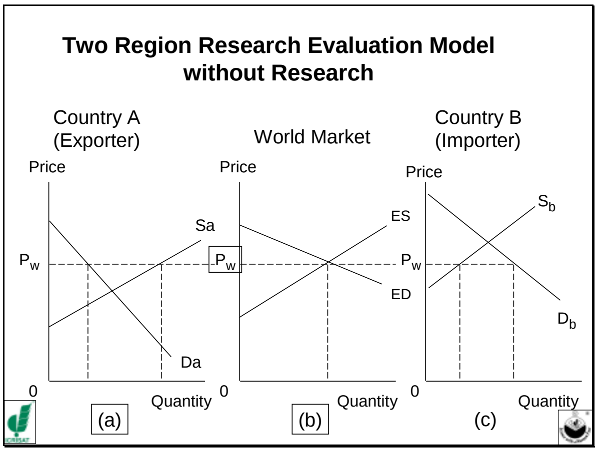


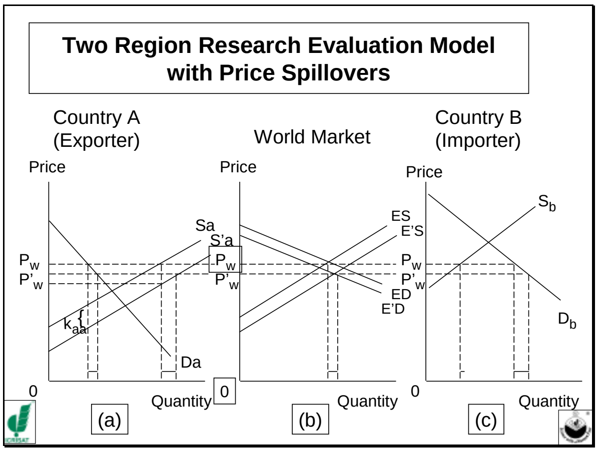
The outputs of agricultural research can have two types of spatial 'spillover' effects – technology and price spillovers. First, new technologies developed for a target region can spillover to another region.

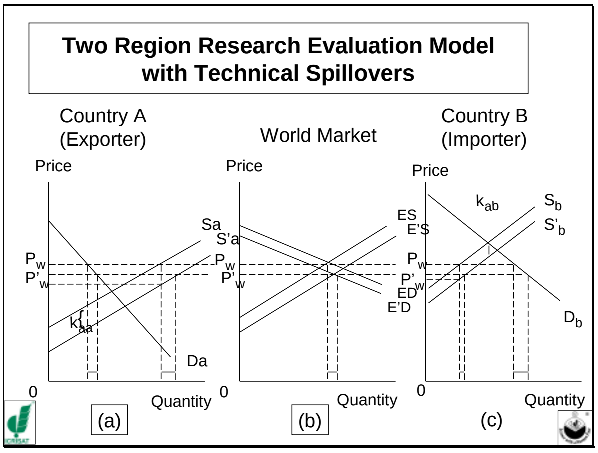
A graphical representation of technology spillovers was presented in the section on horizontal disaggregation.

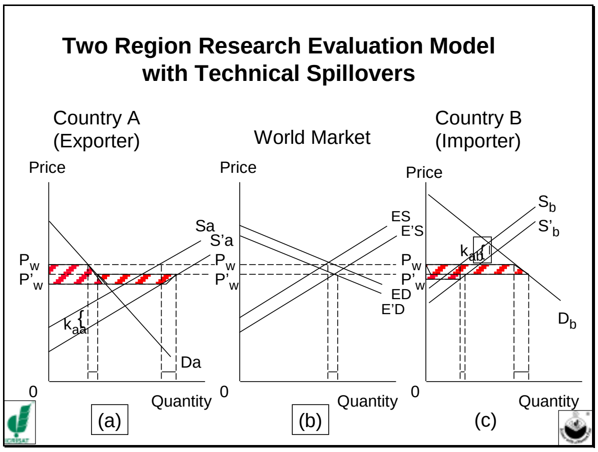
However, the ease of transfer across geographical boundaries depends on many factors:
- Climatic and resource differences between regions
- The ecological sensitivity of the technology
- Artificial boundaries to transfer (restrictions on biological control, pesticides etc)
- The cost of adaptive research.

Second, price spillovers will occur if a large country in a tradable market adopts a supply increasing technology. A research-induced increase in the supply of a tradeable commodity in a large country will lead to fall in the price of that commodity. As a result, adopting producers will gain but non-adopters will lose. Consumers in both the adopting and the non-adopting countries will gain.









Calculating the returns to research to the world as a whole requires the consideration of technology and price spillovers.

This presentation covers the effects of spillovers of exporting country A on world market price and in turn to an importing country B in different situations:

- Two countries have international trade but there is no on-going research
- Two countries have international trade, country A has its own research program but country B has none.
- Two countries have international trade, country A has no research program but country B has its own research program.
- Two countries have international trade, country A has no research program but country B has its own research program.
- If the technology generated in one country is applicable in another ie. there is technology spillovers as well as price spillovers.

The desirable features of the model are:

- Compatibility with existing research evaluation methodology
- Use as basic reference point ‘Homogeneous’ production environments
- Should facilitate consideration of at least some research strategies

Economic impact assessment: Measuring economic impact using spreadsheets

(Session leaders: GV Anupama and MCS Bantilan)

The computation of economic assessments of two technologies, 1) groundnut production technology (GNPT) with ICGS 21 improved variety, 2) wilt resistant medium duration pigeonpea - ICP 8863 developed by ICRISAT were illustrated in this session:

The background information (area, production and prices) is given in the form given below:

Table 1. Background Information: Wilt Endemic Regions in Central and Peninsular India (ICRISAT IAC Production System 7)

Year	Total Area ('000 ha)		Maharashtra Total Production ('000 Met Ton)		Price (Rupees / Metric Ton)	
1970	166.8		92.6		1580.00	
1971	131.3		70.2		1453.00	
1972	133.5		29.5		2196.00	
1973	118.0		74.3		2743.00	
1974	132.1		82.2		2581.00	
1975	146.9		99.5		2014.00	
1976	161.9		90.8		2705.00	
1977	148.5		86.8		2565.00	
1978	142.5		75.8		2417.00	
1979	130.8		85.2		3093.00	
1980	145.8		91.7		3873.00	
1981	144.2		104.2		3901.00	
1982	125.2		82.6		4217.00	
1983	141.8		121.1		4068.00	
1984	129.0		109.6		4029.00	
1985	116.1		70.3		4239.00	
1986	114.4		65.3		4683.00	
1987	114.5		92.7		5179.00	
1988	160.6		150.8		4996.00	
1989	149.5	154.76	154.3	151275.00	6560.00	6533.67
1990	154.2		148.7		8045.00	

Source: District Level Data, Center of Economics and Statistics, Hyderabad, India.
*** Should inquire during elicitation about the regions where wilt disease has spread and the extent to which spread is likely by district.**

The cost analysis information is presented as given the following table:

COST ANALYSIS FOR ICGS 21 RESEARCH

Table 2: Cost Analysis of Research Impacts for ICGS 21 in Central and Peninsular India.

Output/Cost Item STATE : Maharashtra	Unit	Unit Price (Rs)	Best Cultivar Used Before ICGS 21 Quantity	Cost (Rs)	ICGS 21 Unit Price (Rs)	Quantity	Cost (Rs)
COST INFORMATION per hectare per year							
VARIABLE COSTS :							
Male Labor							
. Land Preparation	Days	20.00	7.00	140.00		8.00	160.00
. FYM application	Days	20.00	2.47	49.40		0.64	12.80
. Planting	Days	30.00	1.85	55.50		1.25	37.50
. Weeding	Days	20.00	0.82	16.40		-	-
. Fertilizer	Days	20.00	0.41	8.20		-	-
. Interculture	Days	20.00	4.00	80.00		5.40	108.00
. Irrigation	Days	20.00	1.24	24.80		3.00	60.00
. Spraying	Days	25.00	6.00	150.00		7.00	175.00
. Harvesting	Days	25.00	5.35	133.75		7.00	175.00
. Threshing	Days	25.00	6.18	154.50		3.82	95.50
Female Labor							
. Land Preparation	Days	12.00	6.00	72.00		8.00	96.00
. FYM application	Days	12.00	3.29	39.48		0.55	6.60
. Planting	Days	13.50	2.00	27.00		3.35	45.23
. Weeding	Days	13.50	17.00	229.50		17.40	234.90
. Fertilizer	Days	12.00	1.44	17.28		2.71	32.52
. Interculture	Days	-	-	-		-	-
. Irrigation	Days	-	-	-		-	-
. Spraying	Days	-	-	-		-	-
. Harvesting	Days	13.50	3.29	44.42		1.10	14.85
. Threshing	Days	13.50	12.30	166.05		11.25	151.88
Bullock Labor							
. Land Preparation	Days	50.00	6.00	300.00		6.00	300.00
. FYM application	Days	50.00	3.00	150.00		0.46	23.00
. Planting	Days	65.00	1.65	107.25		1.18	76.70
. Fertilizer	Days	-	-	-		-	-
. Interculture	Days	50.00	2.00	100.00		4.00	200.00
. Spraying	Days	50.00	-	-		0.46	23.00
. Harvesting	Days	60.00	-	-		-	-
. Threshing	Days	60.00	0.82	49.20		1.14	68.40
Seeds	Kgs.	15.00	12.35	185.25	18.00	9.50	171.00
Farm Yard Manure	Qtl.	15.00	52.69	790.35		8.23	123.45

Fertilizer							
. Urea	Kgs	2.70	-	-		36.36	98.17
. DAP	Kgs	6.50	70.00	455.00		53.06	344.89
. SSP	Kgs	3.00	-	-		3.43	10.29
. 20:20:0	Kgs	5.40	-	-		30.87	166.70
. 15:15:15	Kgs	5.20	20.58	107.02		-	-
Chemicals (pesticide)	Lts.	240.00	1.65	396.00		1.70	408.00
Equipment							
. Land Preparation	Days	800.00	-	-		0.07	56.00
. Irrigation	Days	16.00	1.03	16.48		2.15	34.40
Miscellaneous				203.24			175.49
TOTAL VARIABLE COSTS				4268.06			3685.26
FIXED COSTS:							
. Owned land : tax				60.00			60.00
. Land rent				1200.00			1200.00
. Depreciation & interest on Capital				810.00			810.00
Total Fixed Costs				2070.00			2070.00
TOTAL COST				6338.06			5755.26
Output per hectare per year							
. Grain	Kgs	11.50	700.00	8050	11.00	1099.61	12095.71
. By-product	Qtl	120.00	5	600	120	7.25	870.00
. Stalk	Qtl	20.00	15	300	20	19	380.00
Total value of output	Rs			8950			13345.71
Percentage Change							1627.96
. Grain							50.26
. By-product							45.00
. Stalk							26.67
UNIT COST ASSESSMENT							
Unit Variable cost	Rs/ton			6097.23			3351.42
Unit Fixed Cost	Rs/ton			2957.14			1882.49
Unit Total Cost	Rs/ton			9054.37			5233.91
UNIT COST REDUCTION							
Unit Variable Cost Reduction	Rs/ton						2745.81
Unit Fixed Cost Reduction	Rs/ton						1074.66
Unit Total Cost Reduction	Rs/ton						3820.47
Percentage Unit Cost Reduction							42.19

The farm level cost of production data both in the case of the improved technology (ICGS 21) and before the technology is adopted tabulated and the unit cost reduction of the improved technology considering the higher yields are computed.

The summary data for benefit assessment is tabulated in the form given below:

Table 3.
Summary Data for Benefit Assessment

Base Level of production	**151275.00**	**Metric Ton**
Yield Change due to desease	**50.26**	**percent**
Base Price Level	**6533.67**	**Rs/ton**
Supply Elasticity	**0.10**	
Demand Elasticity	**0.50**	

Benefit Assessment		
Discount Rate	**0.08**	
IRR Guess	**0.08**	

Intermediate Data:		
Total Unit Cost Reduction	**270.00**	**Rs/ton**
Slope of Supply Curve	**2.32**	
Slope of Demand Curve	**11.58**	
Exchange Rate	**30.90**	

Three different cases of GNPT were illustrated in this exercise:

a) with raised bed and furrow (RBF) use
b) with management practices only
c) with full package of GNPT ie. RBF, improved variety and management practices

In the second case of ICP 8863 variety, the benefits are accrued to other regions which are under similar agro-economic conditions. In this case, gains to research are the sum of the benefits both producers and consumers in the all the regions where benefits are accrued.

The details of benefits and research costs are computed in the following spreadsheet:

Table 4. Analysis For Groundnuts (ICGS 21) Researc| Maharashtra

Year	Net Benefits ($US)	Research Costs ($US) Total	ICRISAT	ICAR/ Oth Institutions	Research Gains ($US) Total	Adoptic Level	Annual Gains	Gains to ısumers	(%)	Gains to ɔducers	(%)
Present Val	736,943	396427	######	#####	#######			513,723		######	
Total	5437166	693400	######	#####	#######			#######		######	
1974	(50,160)	50,160	45600	4,560							
1975	(50,160)	50,160	45600	4,560							
1976	(50,160)	50,160	45600	4,560	0						
1977	(50,160)	50,160	45600	4,560	0						
1978	(50,160)	50,160	45600	4,560	0						
1979	(50,160)	50,160	45600	4,560	0						
1980	(50,160)	50,160	45600	4,560	0	0					
1981	(50,160)	50,160	45600	4,560	0	0					
1982	(50,160)	50,160	45600	4,560	0	0	0				
1983	(50,160)	50,160	45600	4,560	0	0	0				
1984	(50,160)	50,160	45600	4,560	0	0	0				
1985	(50,160)	50,160	45600	4,560		0					
1986	(28,560)	28,560	24000	4,560	0	0	0				
1987	(24,560)	24,560	20000	4,560	0	0	0				
1988	(24,560)	24,560	20000	4,560	0	0	0				
1989	23,107	24,560	20000	4,560	47,667	0.036	#######	7,945	16.67	39,723	83.33
1990	120,498	14,560	10000	4,560	135,058	0.102	#######	22,510	16.67	######	83.33

1991	183,170	7,500	0	7,500	190,670	0.144	#######	31,778	16.67	######	83.33
1992	330,145	7,500	0	7,500	337,645	0.255	#######	56,274	16.67	######	83.33
1993	352,654	7,500	0	7,500	360,154	0.272	#######	60,026	16.67	######	83.33
1994	404,294	7,500	0	7,500	411,794	0.311	#######	68,632	16.67	######	83.33
1995	455,934	7,500	0	7,500	463,434	0.35	#######	77,239	16.67	######	83.33
1996	482,416	7,500	0	7,500	489,916	0.37	#######	81,653	16.67	######	83.33
1997	508,898	7,500	0	7,500	516,398	0.39	#######	86,066	16.67	######	83.33
1998	522,139	7,500	0	7,500	529,639	0.4	#######	88,273	16.67	######	83.33
1999	522,139	7,500	0	7,500	529,639	0.4	#######	88,273	16.67	######	83.33
2000	522,139	7,500	0	7,500	529,639	0.4	#######	88,273	16.67	######	83.33
2001	529,639	0	0	0	529,639	0.4	#######	88,273	16.67	######	83.33
2002	529,639	0	0	0	529,639	0.4	#######	88,273	16.67	######	83.33
2003	529,639	0	0	0	529,639	0.4	#######	88,273	16.67	######	83.33
2004	529,639	0	0	0	529,639	0.4	#######	88,273	16.67	######	83.33
2005	529,639	0	0	0	529,639	0.4	#######	88,273	16.67	######	83.33

IRR = 0.157

Spreadsheet exercise to measure economic impact

At the request of the participants, Excel© spreadsheet exercises were designed to enable the participants to estimate the returns to two hypothetical research scenarios. The examples showed how to estimate the economic benefits of yield-increasing research in a small-open economy and in a closed economy. While these examples were relatively simple, the participants had to put into practice much of what they had already learnt – including how to estimate a counterfactual scenario of lagged benefit flows.

Day 4:

Economic Impact Assessment: The DREAM Model

(Session leaders: Naveen Singh and Debbie Templeton)

The DREAM model (presentation and set-up)

(Session leader: Naveen Singh*)*

DREAM is designed to evaluate the economic impacts of agricultural research & development (R&D) for a broad range of policy, market, technology, and adoption conditions. The objective is to provide R&D analysts with a practical means of generating relevant and structured information to support strategic decision making. Typically, these decisions relate to agricultural R&D policy formulation, priority setting, and resource allocation. DREAM focuses primarily on the evaluation of new technologies or practices applicable at the farm level. But while the immediate impacts of R&D often arise from technology-induced changes in yield potential and production costs at the farm level, the broader economic effects also depend upon a range of biophysical, social, and market factors, for which DREAM requires the user to provide quantitative estimates. The process of obtaining information on technology and adoption scenarios from scientists, extension workers, and others is critical to the success and reliability of the analysis.

The DREAM is based upon the economic surplus method with the following assumptions:

- multiple regions
- producing a homogeneous product
- with linear supply and demand in each region
- with exponential (parallel) exogenous growth of linear supply and demand
- with a parallel research-induced supply shift in one region (or multiple regions)
- with a consequent parallel research-induced supply shift in other regions
- with a range of market-distorting policies
- with zero transport costs (at least initially)
- with a research lag followed by a linear adoption curve up to a maximum
- with an eventual linear decline

DREAM can handle very simple to quite complex problems using a standardised interface. Analytical options include multiple regions, supply and demand dynamics, and a range of options to represent technology transfer and adoption. Thus, DREAM provides a framework for exploring various kinds of policy, technology, extension, and trade issues, and, the challenge for the analyst is to develop a clear understanding of the model's capabilities, assumptions, and limitations. It is a significant contribution to the long-term effort of improving the tools available to research analysts for exploring and explaining the socioeconomic and environmental impacts of agricultural research investments.

The process of Installation of DREAM software is simple. Either it can be downloaded from IFPRIs website (http://www.ifpri.cgiar.org/dream.htm). Insert the DREAM CD into your CD drive. Windows should detect the DREAM CD and the same will appear on screen. After clicking INSTALL, installation will begin. Before running this specialised software, it's Structure and logic of the interface needs to be understood. When DREAM is running, a bar menu is displayed at the top of the screen as well as a Data Editor window in the center of the screen. The Data Editor window is divided into "data pages" that can be selected simply by clicking on their title tab.

Some fields or pages (scenario, markets, technology, adoption, costs and dynamics) are color-coded. Fields with white background are optional. Colored fields highlight the minimum data that must be provided in order for a DREAM analysis to run correctly. For instance, on the Market data page, the user can provide information to characterise production, consumption or both. If production (or consumption) data is provided, it is necessary to fill out at least the three colored fields Quantity, Price, and Elasticity. However it is also possible that a region contains neither production nor consumption (if the region has been defined only to represent a technology source). In that case, the entire Market page remains blank.

Operational guidelines for using DREAM

A new database is not empty. By default, a new database contains one study (*Study 1*) which includes one scenario (*Scenario 1*) that, in turn, contains a single region, *Region 1*). Colored fields indicate the minimum data that needs to be provided in order to complete a data- entry page (noting that, depending on the type of the region, some pages may be optional). In many cases, it is possible to create, rename, and delete data using a menu activated by right clicking the mouse.

Steps:

1. *Language*: Start the DREAM program and click to select the preferred language.

2. *Discount Rule*: Change the discount rule option if the default (cost at the start of a time period and benefit at the end) differs from your normal practice. This can be done by selecting Discount Rule in the Tool menu. This only needs to be done the first time you use DREAM.

3. *Study*: Select an existing study from the study selection list box or create a new study (by right-clicking with the mouse cursor located in the field "Study").

4. *Scenario*: Select the Scenario page by left-clicking on the Scenario page tab. Then, enter the data on name, commodity, market, region, base year, simulation period and discount rate.

5. *Market:* Enter, region by region, the appropriate market data for the defined base year. If elasticities, growth rates, taxes, or subsidies are expected to change over time the user must select (a) a constant increment every year; (b) a final value at the end of the simulation period; or (c) the Manual option, that allows the users to specify unique value for each year using Dynamics page.

6. *Technology:* For regions that will generate new technology during the simulation period, select the Technology data. Enter the number of years required to perform the R&D, the probability of R&D success, and the anticipated change in the unit cost of production (relative to the base year) if the R&D is successful and the resulting technology fully adopted.

7. *Adoption*: For production regions in which new technologies will be adopted, select the Adoption data page. As a minimum, the user must define the time expected to elapse from the release of a new technology until the maximum adoption level is attained (the adoption lag), and the expected maximum adoption level itself, expressed as a percentage of the production within the region that will be produced using the new technology.

8. *Costs:* If data are available on the costs of research, development, and dissemination of the new technology can be entered in the Costs data page for each region. If no cost data are available, DREAM is only able to calculate the gross benefits of R&D.

9. *Dynamics:* The Dynamics data page shows the values of the specified market parameters in each year of the simulation period: elasticities, autonomous growth rates, technology-induced supply shifts (K's), and policy distortions (taxes and subsidies). These values can change over time if the user has specified such changes in the Market data page.

10. *Spillover:* By default, spillover does not take place and the user need to specify whether or not the scenario includes region-to-region technology spillover. If the scenario is to include a consideration of technology spillover, the user must click on the Spillover check box, and then enter a technology transfer coefficient (0,1) for each pair of regions, and 1inside the same region), and the lag time needed for the technology transfer to occur.

11. *Results:* To analyze a DREAM scenario, the user must click the Run button, on either the Scenario or the Results pages in a preferred format. In the Table format (default) the simulation results are added to a table containing the results of all scenarios for all studies. Users can access any results stored in the table using the scenario drop-down box. Every time a scenario simulation is made with output specified as Table, the new results replace (overwrite) the existing results for that scenario. The alternative output format is a single text (ASCII) file, which can be reviewed on-screen, named, and saved on the hard disk. This format is useful for examining the detailed scenario results, viewing all the results in a single file, and for passing those data to other packages, e.g., spreadsheet or word processor.

The DREAM model (hands-on exercise)

(Session leader: Debbie Templeton)

The hands-on presentation on the DREAM model was given to provide the participants with an overview (Box 2) of the structure of the DREAM software.

Box 2: DREAM

The software package called DREAM (Dynamic Research EvaluAtion for Managers) is designed to evaluate the economic impacts of agricultural R&D for a broad range of policy, market, technology, and adoption conditions. It is based upon economic surplus concepts and methods described in Alston, Norton and Pardey (1995).The objective is to provide R&D analysts with a practical means of generating information to support strategic decision making. DREAM is available from the International Food Policy Research Institute web site (http://www.ifpri.cgiar.org/dream.htm) free of charge.

DREAM focuses primarily on the evaluation of new technologies or practices applicable at the farm level. But while the immediate impacts of R&D often arise from technology-induced changes in outputs and costs at the farm level, the broader economic effects also depend upon a range of biophysical, social, and market factors, for which DREAM requires the user to provide quantitative estimates. Like any model, the results obtained from DREAM will only be as good as the data put in. (For a good discussion on data-collection methods see Alston, Norton and Pardey 1995.) DREAM can handle very simple to quite complex problems. Analytical options include multiple regions, supply and demand dynamics, and a range of options to represent technology transfer and adoption. Thus DREAM provides a framework for exploring various kinds of policy, technology, extension, and trade issues. The challenge for the analyst is to develop a clear understanding of the model's capabilities, assumptions, and limitations. Without such an understanding it is difficult to formulate real-world problems in relevant analytical terms and to properly interpret the resulting outputs.

During the remainder of the day, interactive sessions on DREAM were undertaken to give the participants some hands-on experience. Two practical examples were provided. In the first, a closed economy was assumed. However, the interactive session was more than just a data entry and implementation exercise. The participants were divided into five groups – four groups of scientists and one funding institute. Three groups of scientists (Cockatoos, Kangaroos and Wombats) had distinguishing features that influenced their assumptions about the research-induced yield changes and adoption rates, which in turn affected the size of estimated research benefits. A fourth group, the Platypus, had the same yield-change and adoption-rate assumptions as the Cockatoos, but forgot to ensure that the elasticity of demand was negative. As a consequence, the results were spurious, with producers being made significantly worse off after adopting the new technology. Now, the fifth group, the Kookaburras, was from the Ministry of Finance. It was their job to decide which group of scientist they would fund based on the potential economic returns and the validity of these returns. Hence, in addition to learning how to enter data into and run the DREAM model, the participants also learn the importance of ensuring the data is credible and, where possible verifiable, and how to undertake sensitivity analyses when some of the parameter values are uncertain.

The second example was based on a horizontal-market scenario which allowed for technology spillovers. This example showed the participants how easily DREAM can handle complex market scenarios. It also showed how important spillovers can be when measuring the returns to research.

Feedback from the participants indicated that they found the DREAM sessions very useful and would have liked an additional day. This could be accommodated in future workshops. While, DREAM is a very user-friendly software package that requires minimal training, to ensure that it is implemented correctly, the analyst needs to be aware of the economic principals that underlie the DREAM model, the importance of inputting credible data, the assumptions made in the face of uncertainty, and the value of undertaking sensitivity analysis. These issues were highlighted throughout the workshop providing a sound basis for future evaluation.

Day 5:

TGIF and Sunday break

Day 6:

Gaining from first-hand experiences

Several sessions were conducted to give opportunities for gaining from first-hand experiences of invited experts in addressing special topics including the following:

- Assessment of returns to research on quality change: Case of crop residue
- Challenges in assessing biofuel research in a changing price scenario
- NRM research impacts: examining efficiency gains in water resource use through technologies
- NRM research impacts: case of surface and ground water irrigation along with hands-on exercise
- Empirical application in assessing economic and environmental impacts of NRM technologies using the economic surplus approach; empirical challenges in impact assessment of NRM research
- Watershed technology case studies; and meta-analysis approach in assessing NRM technology impacts – the case of Watersheds technology.

Assessment of returns to research on quality change: Genetic enhancement of crop residues fed to ruminants

(Session leader: VR Kiresur)

This ex-ante impact assessment measures the potential economic impact of, and returns to, investment in a proposed collaborative ILRI-ICRISAT-NARS research project on genetic improvement of dual-purpose (i.e., grain and fodder) sorghum and pearl millet in India. Sorghum and millet crop residues play a major role in meeting the feed requirements of cattle and buffalo in the mixed crop-livestock farming systems practiced by the vast majority of smallholders in India's semi-arid tropics. These cattle and buffalo provide milk and meat and act as a bank account for many of India's 630 million rural dwellers, three-quarters of whom are estimated to own livestock. The manure is used to fertilise crops and, despite the increasing use of tractors, cattle and buffalo continues to provide traction for most small farmers, and thus play a crucial role in food production for the rural poor. While several constraints to increasing livestock productivity in this region exist, the major ones are insufficient quantity and poor quality of livestock feed. This genetic research is expected to result in increased quantity and more digestible feed available to ruminants that will in turn convert the improved diet into more milk, meat, manure, and draught power.

At the current relatively low cereal and fodder yields being achieved by most farmers, and with the genetic diversity available after 20 years of breeding for increased grain yields, there is considerable opportunity for genetically increasing both stover and grain biomass simultaneously. The evidence of genetically controlled differences in changes of digestible components during maturation, and the weak correlation between yield and digestibility already obtained for forage grasses, implies that improvement in quality should be possible without sacrificing biomass yield.

Using GIS, 104 districts of India were identified as the 'recommendation domain', or zone targeted for likely adoption of such improved dual-purpose genotypes. This is because in these districts, sorghum and pearl millet residues are important sources of animal feed, contributing up to one-half of total roughages available. The recommendation domain covers 33% of India's land area, supporting 24% of the human, 25% of the bovine, and 35% of the country's small ruminant populations. These districts also account for 16 million t, or around 29%, of India's annual milk production.

Breeders and ruminant nutritionists estimate that this research could potentially lead to increases in digestibility of sorghum and millet residues ranging from 1 to 5%. A feed simulation model was used to estimate potential increases in milk yield, animal growth, and draught capacity with such improvements in feed quality/digestibility. The results suggest that a 1% increase in digestibility would result in increases in milk, meat, and draught power outputs ranging from 3.2 to 10.7%.

An economic surplus model was used to value such impacts. The net present value of the research on genetic enhancement of feed quality of sorghum and millet crop residues was estimated to be $42 million, with an internal rate of return of 28%, and a benefit-cost ratio of 15:1. The estimated returns to this research are attractive, even with the cautious assumptions made on likely adoption rates (10% of farmers within the recommendation domain) and the scope of the benefits (only meat and milk production in buffalo and cattle). If we include the potential benefits of the improved sorghum and millet varieties to farmers in the semi-arid zones of sub-Saharan Africa and Latin America, along with possible increases in crop output associated with more manure and traction, it is likely that these returns would be even higher.

Challenges in assessing biofuel research in a changing price scenario: An ex-ante evaluation using the case of sweet sorghum research

(Session leader: KPC Rao)

The challenges in undertaking the assessment for bio-fuels research was illustrated using the case of sweet sorghum as an example. The presentation covered links to processing industry, the viability of crop and industry, constraints, competing crops, alternative models, policy support and price uncertainty.

The National Research Centre on Sorghum (NRCS) and International Crops Research Institute for the Semi-arid Tropics (ICRISAT) have been working on development of sweet sorghum varieties and hybrids for more than a decade. The present cultivars suitable for sweet sorghum purpose involve trade-offs between grain and stalk yield. But the hybrids currently under development at ICRISAT hold promise to minimise this trade-off. The establishment of Rusni Distilleries Ltd in Medak district has made it possible to try an integrated business model to realise the potential of sweet sorghum, particularly after the recent increases in the crude oil prices. The initial trials of NTJ-2 variety in 2006-07 yielded only 7.7 tons of stalk per hectare in the kharif and 6.6 tons of stalk per hectare in rabi. During 2007 kharif, Rusni Distilleries has promoted sweet sorghum in Medak district through its own extension team and with the help of Agricultural Associates of India (AAI) and Agri-Business Incubator (ABI) at ICRISAT. 791 farmers raised the crop in a total area of 538 ha. Agricultural Knowledge Centers (AKC) at Daulathabad, Jogipet, Sadasivapet and Jarasangham provided the technical guidance and supplied inputs worth Rs.2000 to Rs.2500 per hectare to the farmers on credit, along with agreements to procure the stalk at Rs.600 per ton.

A random sample of 200 farmers was chosen using probability proportional to size method of sampling. Information on the costs, returns, perceptions and experience was collected using a structured questionnaire between 15th October and 2nd November. At the time of data collection, only 50 sample farmers harvested the crop due to delayed procurement of the stalk by Rusni factory. In case of the remaining 150 sample farmers, expected yields were recorded. In case of farmers taking the intercrop of pigeonpea, expected yields of pigeonpea were noted in all cases because none of the farmers harvested pigeonpea by the dates of interview. 171 sample farmers grew sole crop of sweet sorghum under rainfed condition, while 28 farmers took pigeonpea as an intercrop along with sweet sorghum under rainfed condition. The analysis of data yielded the following conclusions: First, the time of sowing did not influence the stalk yield of sweet sorghum much except when it is delayed beyond 15th July. There was significant response for both the basal dose as well as topdressing of fertiliser but the application of farm yard manure did not influence the stalk yield of sweet sorghum significantly. Application of weedicide and one hand weeding gave significant increases in stalk yield but the second hand weeding did not increase the returns over variable costs. Second, interculture helped in increasing the stalk yields and returns significantly whereas thinning did not increase the returns over variable costs. Intercropping with pigeon pea gave better yields and returns than the sole crop of sweet sorghum. Early and timely procurement resulted in higher yields which dropped drastically as the procurement got delayed. Third, there was significant response to technical advice in terms of higher yields and returns but quite a good number of farmers did not get technical advice on time. The profitability of sweet sorghum was better on black soils and red soils when compared with that in sandy and mixed soils. The costs of cultivation were higher in case of sandy and mixed soils, particularly for manure and fertiliser application and watching and harvesting on account of higher wage rates.

Among the four knowledge centers, Jara sangham area performed best, followed by Jogipet and Sadasivapet areas. Daulathabad area where sandy and mixed soils are predominant, the losses were the highest. Since the area under sweet sorghum was highest in Daulathabad area, it has pulled down the average yields and returns from the crop. The break-even yield of sweet sorghum stalk was 21. 8 tons per hectare at the price of Rs. 600 per ton. Only 26 farmers or 13 per cent of the farmers reported yields higher than that. The average yield of sweet sorghum stalk for the entire sample is only 14. 85 tons per hectare. The break-even price worked out to Rs.880 per ton. The average yield of sweet sorghum which was procured on time was 19.57 tons per hectare. At this yield, the break-even price worked out to Rs.668 per ton.

All the competing crops, green gram, maize, grain sorghum and pigeon pea gave much higher returns than sweet sorghum during 2007 kharif. The farmers did not face any major constraints in the cultivation of sweet sorghum but they had a horrid time with the delays in procurement of stalk by Rusni Distilleries Ltd.

Farmers perceived the short duration, easy manageability of the crop and less problem of wild boars as the important advantages of sweet sorghum. Farmers also perceived low price of stalk, lower yield obtained relative to the promised yield, delayed procurement and poor grain yield of NTJ-2 as the important disadvantages of sweet sorghum crop. In addition farmers perceived that better yields of sweet sorghum stalk can be obtained with adequate and timely supply of inputs, timely technical advice, timely procurement and better distribution of rainfall. Farmers were, in general, happy with the supply of inputs by the factory. But they were disappointed with the delays in procurement and payments by the factory. Only one-third of the respondents opined that they received sufficient technical advice from the extension teams.

Farmers said that they will grow the crop only if the procurement price is increased and the stalk is procured on time. They demanded that full compensation should be paid by the factory for the losses sustained by them. Better yielding varieties, timely technical advice and higher price were emphasised by them for putting more area under sweet sorghum by diverting area from maize, grain sorghum, pigeon pea, green gram and castor. The respondents said that the impact of sweet sorghum on women is beneficial, mainly by raising demand for women labor in the non-peak season and by providing more employment opportunities to them. However, they could not give any opinion on the environmental effects of sweet sorghum.

The respondents perceived that shifting of area from grain sorghum to sweet sorghum will lead to a shortage of both sorghum grain and fodder and that can have adverse impact on food security. The sweet sorghum growers in kharif opined that the prospects of their growing sweet sorghum in rabi are limited due to the constraint of irrigation water. Farmers opined that an average yield of 37.5 tons per ha at the procurement price of Rs.1000 per ton are needed for the sweet sorghum crop to be more profitable than other competing crops. Among the different components of technology, improved seed, granular application of pest control, harvesters and weedicide application are perceived to be having higher benefit-cost ratios than other components. Because of lack of anticipatory planning and due to mechanical and labor problems, the processor failed to procure the crop on time. Only about 15 per cent of the stalk was procured at the right time. Nearly 45 per cent of the stalk was procured with delay and about 40 per cent of the crop was never procured. Farmers lost heavily due to weight loss in case of delayed procurement and value loss in case of non-procured stalk. Processor also lost heavily due to degradation of stalk caused by delays in procurement, transportation and crushing. A good part of the stalk procured had to be sold as fodder at a much lower price. In case of farmers from whom the stalk was not procured, the processor had to forego the cost of inputs supplied. In view of the short sowing window and likelihood of sowings clustering around one or two dates in case of the rain fed crop, processor has to look for alternate strategies to improve the capacity utilisation of the factory.

Tapping sweet sorghum from different areas with different sowing dates should be planned through decentralised crushing units where syrup or jaggery will be produced and bringing them later to the central unit for the processing. The processor should try to obtain permission to crush sugarcane juice for ethanol production along with sweet sorghum juice to increase the capacity utilisation and viability of the factory. Since the depreciation and interest costs are higher in case of ethanol producing units, the processor should revamp the strategy to fully utilise the capacity and to improve the viability of ethanol production. The key interventions needed are introducing better yielding varieties of sweet sorghum and increasing the procurement price of stalk to sustain the interest of farmers in sweet sorghum cultivation.

Several alternate models like entrepreneur model, agent model, co-operative model could be tried along with the de-centralised procurement by the factory as the up scaling of sweet sorghum takes place. The success of sweet sorghum and its up scaling is contingent up on increasing the stalk yield to 35 tons per hectare under rain fed conditions and to 50 tons per hectare under irrigated conditions and raising the procurement price at least to Rs.900 per ton. If the above necessary conditions are fulfilled, good management and timely procurement are needed to make sweet sorghum cultivation viable and attractive to farmers. The processor has to add value to ethanol by producing extra neutral alcohol and pharma grade ethanol in order to pay an attractive procurement price to the farmers.

As there is rising demand for petro-products and limited availability of sources, there is increasing demand for using food crops for bio-fuels. The discussion featured

- Early assessment of research results
- Indicated the importance of bio-fuels
- Research potential was indicated
- Research methods were explained
- Dual type of sorghum – for grain, for stalks

To make the industry viable

- Answer to the limited sowing period
- Conducive policy environment
- Decentralised model
- value added by-products (brickets)
- examine the comparative advantages with sugar industrial by products

The important parameters are research lag, adoption lag and k shift in the supply curve. In order for this technology to be feasible a) price of crude oil has to be gone up b) supply of sorghum stalks should be high c) however, it is a fuel to the next impact class.

NRM research impacts: examining efficiency gains in water resource use through technologies

(Session leader: K Palanisami)

The presentation covered methods for examining efficiency gains in resource utilisation through improved technologies. The concept was demonstrated using selected impact methodologies, using the case of surface and groundwater irrigation, derived from research already done at the International Water Management Institute (IWMI).

Important concepts in assessing the impact of irrigation include

- Adjusted tank performance
- Yield gaps, optimum pumping and pricing
- Multiple uses in tank system of Tamil Nadu
- Ranking of tanks for modernisation
- Technical and irrigation efficiency
- Stabilisation value of ground water in tank irrigation systems

Key highlights of the presentation are:

1. Tank performance is assessed by considering number of wells per unit area it serves and adjusting for factors like farmers' participation, operation and maintenance expenses, resources mobilised for maintenance and encroachment in the tank water spread.
2. Although tank irrigation plays an important role in closing yield gaps, the share of yield contributed by additional applications diminishes after two supplemental irrigations. Contribution of other factors like soil fertility, labor and crop management practices also need to be taken into account while computing yield differences.
3. Tanks provide multiple uses and analysis of revenue generation should take into account these types of uses. Actual revenue realisation is however much limited and most tanks suffer because of lack of funds for maintenance.
4. Since funds for tank modernisation are limited, appropriate criteria are required for prioritisation which may include depth of water, tank type, farm size variation, command area, location, age of tank, water users’ organisation, rainfall, encroachment etc.
5. Operational efficiencies differ both at farm level and in specific input use e.g. water.

1.Adjusted Tank Performance (ATP)

$$ATP = \frac{[\text{Total area irrigated in the tank command} - \text{Area irrigated by those number of wells above the threshold number}]}{[\text{Total command area of the tank}]}$$

$$ATP = a + b_1\ FPART + b_2\ OME + b_3\ REV + b_4\ ENC + b_5\ WELL$$

where,

ATP = adjusted tank performance in percent,
FPART = farmers' participation in tank maintenance works (five years’ mean in mandays/year),
OME = operation and maintenance expenditure (five years’ mean in Rs./ha.),
REV = resource mobilized for tank maintenance (five years’ mean in Rs./ha.),
ENC = encroachment in tank water spread and foreshore area (percent),
WELL = number of wells per ha. of command area.

Yield differences via the differential equation:

$$DY6 = \sum(\partial Y6/\partial Yi)\ DYi + R$$

Where,
DY6 = Rice yield differential in t/.ha
DYi = Difference in input level between high yielding and low yielding farms
R = Residual (difference between the calculated and observed yield difference)

Overall Tank Performance by use share (OTP_{US}):

$$\mathbf{OTP_{US}} = \left[\frac{\sum_{i=1}^{m}[PF_i][PR_i]\left[\frac{AC_i}{PO_i}\right] + \sum_{i=m+1}^{n}[PF_i][PR_i]\left[\frac{CN_i}{PC_i}\right]}{n\sum_{i=1}^{n}[PF_i]}\right] * 100$$

where,
PF_i = Scoring given based on the villagers’ perceptions regarding the preference for the i^{th} multiple use
PR_i = Probability of occurrence of i^{th} multiple use
AC_i = Mean Actual use units occurred in a tank, for the i^{th} multiple use
PO_i = Potential use units possible in a tank, for the i^{th} multiple use
CN_i = Mean capacity used by the villagers with regard to the i^{th} multiple use
PC_i = Potential capacity available for the villagers of the tank command with regard to the i^{th} multiple use
i = 1 to m = Number of multiple uses (agricultural and other productive uses, excluding livestock)
i = (m+1) to n = number of multiple uses (domestic and livestock uses)

4. Ranking tanks for Modernization

Key issues

- Tanks are in a bad state and modernization is needed
- Budget is limited and more tanks needed to be addressed
- Appropriate criteria are needed to prioritize the tank selection

5.Technical And Input (Irrigation) Efficiencies

Key Issues:

1. Farms are operating with different levels of efficiency
2. Scope to increase the farm level as well as specific input use efficiency

6.Stabilization value of groundwater in tank (surface) irrigation systems

Key Issues:

- Tank water is not sufficient for one full rice season
- Groundwater is used during the last stage of rice production
- Value of groundwater is not known for making further investment in
- ground water.
- Value of groundwater is important in pricing by the well owners

Participants were given illustrations on:

- Derivation of the demand curve for water
- Important parameters in the computation of k-shift
- Benefits of technology change based on comparison of improved irrigation technology over the traditional irrigation

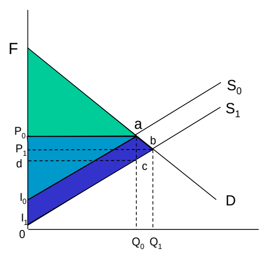
In particular, participants were taken through an illustration of calculating the stabilisation value of groundwater in surface tank irrigation systems. From the discussion it was clear that measurement of impacts for crop and resource management technologies is complex and requires a broader range of indicators, both qualitative and quantitative. Since these impacts are at the household, farm and community level, there is also a challenge in aggregating the measurements to gauge the overall impact.

Assessing economic and environmental impacts of NRM technologies: empirical application using the economic surplus approach

(Session leaders: MCS Bantilan and GV Anupama)

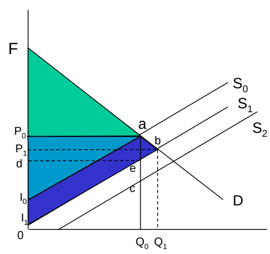
This session illustrated an empirical estimation of economic surplus using the case of the Groundnut Production Technology (GNPT) developed by ICRISAT and its partners in 8 states in India's semi-arid tropics. This example illustrates the critical importance and use of qualitative information in understanding the additional environmental and long-term effects due to the adoption of NRM technologies.

Impact of standard cost reducing technology

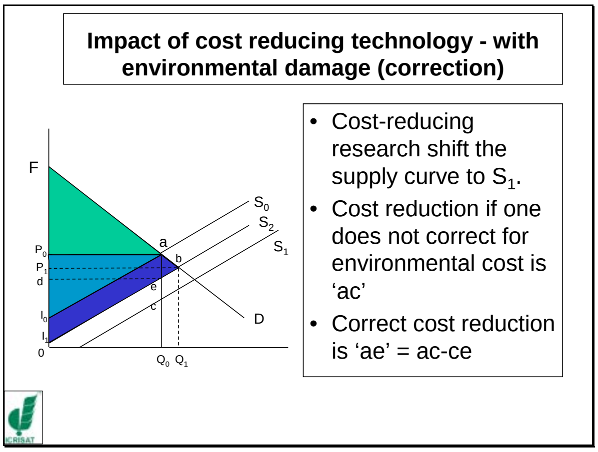


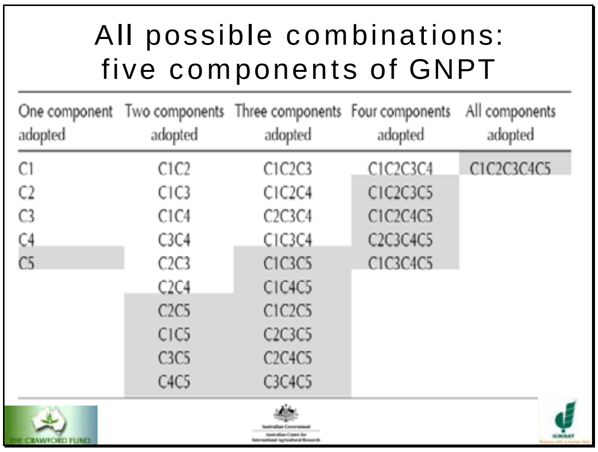
- Cost-reducing or yield-enhancing research and adoption of the resulting new technologies
- shift the supply curve to S_1, resulting in a new equilibrium price and quantity of P_1, and Q_1

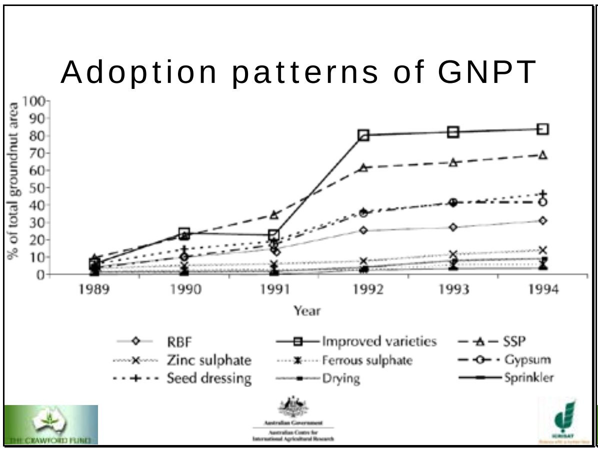
Impact of cost reducing technology - reducing environmental damage (correction)

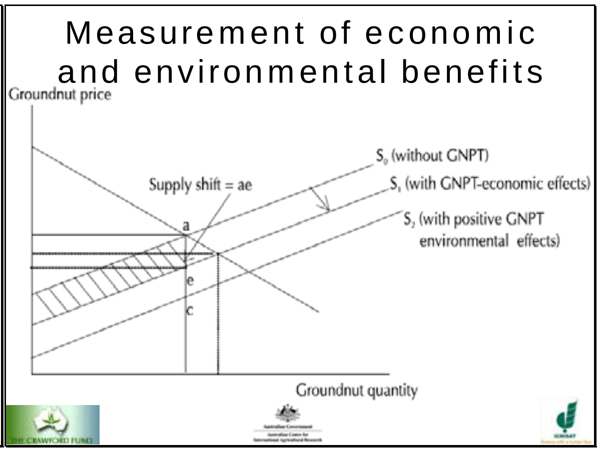


- Cost-reducing research shift the supply curve to S_1.
- Cost reduction if one does not correct for environmental cost is 'ae'
- Correct cost reduction is 'ac' = ae +ec









To quantify the investment on research and technology exchange, three aspects were examined:

- Benefits (both economic and environmental) accruing from the research and technology exchange programme;
- Adoption rates and the spread of the different components of the GNPT
- Research and technology exchange cost involving research partnerships among international and national research programmes as the extension sector.

Economic surplus and the distribution of welfare gains were estimated by assuming a parallel shift in supply function due to investment in technology development. Internal rates of return, net present values and benefit-cost ratios were computed under three options:

- Full adoption of the GNPT package
- Adoption of only management practices
- Adoption of only land management (RBF) with other practices remaining the same.

Because environmental effects were not measured in monetary terms, two sensitivity analyses were carried out under scenarios related to net positive and negative environmental effects.

The survey show that farmers initially adopted parts of the crop and resource management package, and adopted the technology options according to their needs, convenience and resource endowments. Logistic growth functions were estimated to describe the rate of adoption of each GNPT component. The adoption analysis illustrates the nature and dynamics of adoption of NRM technologies.

The estimation of benefits accruing from GNPT involved computations of welfare gains based on yield gains and/or reduction in unit production costs. The inclusion of qualitative environmental effects encompassed impact dimensions not captured via the measurable reduction in unit cost or yield gains due to lack of quantifiable or long-term data. The difficulty of quantifying may environmental costs and benefits challenged the approach to incorporating these effects into cost-benefit analysis. The environmental effects were characterised by systematically tracking both individual and interaction effects of GNPT components. Thorough analysis is based on a systematic documentation coupled with reasonable estimates of economic effects.

Environmental effects can have a large overall impact. The results show that if the environmental effects reduced fully accounted unit costs by just 10% more than market effects, the net present value of the GNPT would increase by US$0.4 and the IRR would increase by 1%.   Clearly, environmental effects in the assessment of NRM options cannot be ignored. As cited in the original publication, the environment is not free, even though there may not be a conventional market for its services. In the context of decisions based on cost-benefit analysis, it is important to understand the source of the impact, the nature of the impact, and the relationship between an impact and those variables that can affect current, potential and future consumers and producers. This means that valuing as many effects as possible and plausible, narrows the field remaining for pure judgement.

Day 7

Field visit in ICRISAT watershed long-term trials: session with NRM scientists in the field on NRM impact dimensions

The participants were briefed on various concepts on NRM research impacts, particularly providing illustrations using technologies embedded in the integrated watersheds initiative by NRM scientists SP Wani, KL Sahrawat, Piara Singh, P Pathak and Rosana Mula. The following points were covered:

- NRM research impacts
- Concept of micro watershed
    - Black watershed

    - Semi arid watershed system
- Treatments differences based on types of soil, crop management and climate
- Some results and discussion on
    - social aspect - better livelihood of farmer
    - institutional aspect – collective action
    - economic aspect – income increase
    - physical aspect
    - technology spillover

Empirical challenges in impact assessment of NRM research: Watershed technology case studies

(Session leader: PK Joshi)

Quantification of adoption and impact of crop and resource management technologies is complex, although this area of research shares a significant proportion of research resources. The session discussed some methodological complexities in assessing the impact of crop and resource management technologies.

The resource management technologies illustrated consist of package of practices, nutrient management, water management, integrated pest management, integrated crop and nutrient management; technologies addressing farming systems and resource conservation technologies (zero tillage and raised bed). The problems in assessment of these technologies vary as farmers have differential adoption pattern. The common problems encountered in assessing resource management technologies are – a) adoption of several technology options b) modification of the technology components c) step-wise adoption of different components d) invisible benefits of technologies related to specific resource management practices, e.g. arresting land degradation and climate change. e) delayed benefits from conservation of soil and water resources and f) interaction effects of technology components.

Different types of tangible and intangible benefits of the resource management technologies were discussed followed by the impact indicators at different levels such as farm, regional, national and global level

- Farm level indicators: Efficiency (profit, cost reduction), household food security (nutritional security), poverty reduction, risk management, cropping intensity (eg. Timely sowing), gender related issues (empowerment of farm women) and conservation of natural resources (soil and water)

- Regional level indicators: Agricultural production, food security, employment issues, equity issues, poverty, biodiversity, trade, inter-sectoral linkages and sustainability of natural resources.

- National level indicators: Production, prices, biodiversity, trade, export, import, spill-over effect and sustainability of natural resources.

- Global level indicators: Prices of food commodities, cross border diseases, poverty alleviation, mitigation of global warming

Methods of analysis of these indicators are benefit-cost analysis, total factor productivity, econometric approach, changes in marginal productivity, decomposition of neutral and non-neutral changes economic surplus approach. Two case studies:

a) groundnut production technology; and

b) vertisol technology

were discussed in detailing the estimation of the impact and spread of various components of a particular package of technologies.

For case 1, collaborative research by ICRISAT and the Indian NARS resulted in the development of this technology was used to illustrate both methodological and empirical points. The technology was developed in 1986, and widely tested on farmers' fields during 1987-91. The technology integrates various crop and resource management options, which includes land management, nutrient management, insect pest and disease management, seed management, and water management. Based on a survey conducted in Maharashtra, India, the study observed partial and step-wise adoption of different components of the technology that range between 31% for raised-bed and furrow method of land management to 84% for improved varieties. In comparison to the prevailing technology, the groundnut production technology gives 38% higher yields, generates 71% more income, and reduces unit cost by 16%. The technology also contributes in improving the natural resource base, and eases certain women specific agricultural operations. The total net present value of benefits from collaborative research and technology transfer is more than US$ 3 million, representing an internal rate of return of 25%. The study suggested important lessons for research and technology transfer policies, and for development of future research priorities. Some components of this GNPT are now also used in Indonesia and Vietnam.

Describing case study 2, research on vertisol technology as a package of options began at ICRISAT in 1974, which aimed to benefit 12 million hectares of the vertisol areas in India and Africa. The technology was first tested and demonstrated on farmers' fields in Andhra Pradesh. Later, on-farm trials were conducted in five states — Andhra Pradesh, Karnataka, Gujarat, Maharashtra, and Madhya Pradesh — to understand the dynamics of adoption of various components of the technology, such as summer cultivation, dry seeding, crop protection, improved varieties, proper placement of seed and fertiliser, etc. The survey was conducted in 27 villages, where 500 farmers from low-, medium-, and high-rainfall regions were interviewed using a well-designed questionnaire. This study assessed the extent of adoption of the various components of vertisol technology, identified the constraints to their adoption, examined farmers' perceptions of the sustainability benefits from it, estimated the on-farm benefits, and detailed the relative significance of the various components.

Meta-analysis to Assess Impact of Watershed Program and People's Participation

(Session leader: PK Joshi)

Meta analysis is a statistical procedure that integrates and upscales numerous spatially and temporally distributed combinable micro-level studies to distil logical macro-level policy inferences. The inferences drawn, based on meta analysis, are often more objective and authentic. Based on an exhaustive review of 311 case studies (published and unpublished) on watershed programs in India, the session discussed the procedure used in documenting efficiency, equity and sustainability benefits. These studies covered wide range of ecoregions, size, type, source of funding and extent of people's participation.

The objectives of this particular meta analysis are to document the benefits accrued to people in different regions due to watershed programs and assess people's role in the success of the watershed program and study the conditions for higher participation. The summary of benefits from these watersheds was presented. It was noted that the mean benefit-cost ratio of a watershed program in the country was quite modest at 2.14. The internal rate of return was 22 percent, which is comparable with many rural developmental programs. The watershed programs generated enormous employment opportunities, augmented irrigated area and cropping intensity and conserved soil and water resources. The performance of the watershed program was at its best in areas that targeted the low and medium income groups, which was jointly implemented by the state and central government, and where there was effective people's participation and a rainfall ranging between 700–1,000 mm. The study concluded that the watershed program is silently rejuvenating and revolutionising rain-fed areas. Lack of appropriate institutional support is impeding the tapping of potential benefits associated with these programs.

The conditions for people's participation were studied at length. Assessing the needs of people around the watershed area, involvement of all the stakeholders were prerequisites for the success of the watersheds. It was concluded that the best results were obtained from a wide range of 750-1700 mm rainfall areas. It is essential to train the stakeholders on watershed maintenance etc. The conclusions of this meta-analysis were that watershed programs significantly contributed in raising income of farmers, generating employment and conserving soil and water. It was inferred that the higher the participation of people, the higher the benefits.

Day 8:

Assessing policy-orientated research

(Session leader: Debbie Templeton)

An example of an impact assessment of policy-orientated research was presented. The example was the study undertaken by Dr Deborah Templeton and Ms Nelissa Jamora. The main aim of their study is to estimate the economic value of the private health costs saved due to the 1992 to 1996 pesticide policy package. Additionally, the study examines those factors that brought about or influenced the government's decision to change the policies on pesticides and pest control practices and, where possible and justified, to attribute the policy-induced benefits to the key players, with a focus on relevant research undertaken by the International Rice Research Institute (IRRI).

Several methodological-type issues were highlighted in the presentation. First, given the difficulties in assessing the impact of policy-oriented research, the policy component of the research being assessed and the policy and regulatory changes that occurred need to be clearly defined. Second, explicitly mapping out the components of the path from inputs to impact helps to clarify the essential elements of a robust policy-orientated research impact assessment. Third, a detailed media/Internet search and comprehensive interviews with key informants are essential to unraveling the complex nature of the policy process and compliance. Fifth, as attribution and influence are difficult to quantify, the analyst may need to rely heavily on subjective assessment to determine the likelihood and extent of influence. Finally, given that the effects of a policy can be far-reaching, it may not be possible to quantity the full impact of a policy change, both within the targeted country and abroad.

Introducing gender in research evaluation: ICRISAT experience

(Session leaders: Cynthia Bantilan and R Padmaja)

International agricultural research has increasingly recognised the important role of women in agriculture and their particular needs as resource users and managers. Women participation, knowledge and involvement has become a key to ensuring that development is sustainable, technologies are appropriate and adopted, and that environment is safeguarded for future generations. ICRISAT's gender perspective in technology development promotes greater social equity in the process of accelerating agricultural development. The focus on women cultivates benefits for the future, because women are the primary caretakers of the children who will shape it. ICRISAT also assumes that gender provides an important basis for targeting technologies that would improve food security and household welfare and hence, concerns itself with the impact of change in agricultural technology on the welfare of women.

The basic objective of ICRISAT research is to develop technologies that improve the well being of agricultural households. It is essential to understand, more clearly than we have done so far, the interests of both males and females in households in order to develop technologies that have greater possibility of being accepted by the households. ICRISAT developed its research strategy to put emphasis on people rather than "things", to decentralise, empower people, to value and work on what matters to people (subjective perspective), and to learn from the beneficiaries rather than to teach them. This "people centred" approach led to participatory technology development and evaluation at ICRISAT in the early 1990s and adoption of research strategy reflecting "science with a human face".

Several steps have been taken by ICRISAT to raise awareness within the institute and to begin a program that would lead to the incorporation of a gender perspective in its work. Notably, ICRISAT incorporated a gender dimension in its priority setting exercise by making use of gender parameters (female illiteracy). In 1991, ICRISAT included in its research information monitoring system, questions for each project on the implication for sustainability and gender of the expected research results. This monitoring exercise noted specific and thoughtful responses; but other responses were cursory. In 1996, some of these statements were used as working hypotheses for impact and adoption studies conducted jointly by biological scientists, social scientists, and partners from the national programs. ICRISAT was the first and is one of only two centers who were using this device to stress their desire that scientists direct attention to this issue. The other is CIP.

With the aim of providing feedback to scientists for designing appropriate technologies which incorporates a 'gender perspective', ICRISAT has incorporated gender dimensions in a range of research areas including participatory varietal selection: consumer preferences for alternative variety traits, welfare impacts of groundnut technologies, farm investment priorities and gender-related indicators for targeting nutrition interventions. The line of research progressed from a. learning farmer preferences (both men and women) of agricultural technologies; b. production system constraints to technology development and uptake processes; and c. ex-post and ex-ante technology assessments which go beyond economic assessments to include social and environmental factors. The technology assessments were also used as a means of specifying hypotheses about gender with respect to impact and collecting basic gender indicators in the course of research. A clear understanding about whether the technologies for women will be aimed to increase the productivity of women within the existing gender division of labor in agriculture or they are aimed to mitigate the gender differences in the labor allocation itself is to be developed. The question then would be - 'what technologies for whom'. Also the likely implications of mechanisation, globalisation, climate change, socio-cultural-institutional changes and technology itself should be carefully considered before presenting the technology to the users.

Instruments in gender analysis and case study illustrating sequential analysis in monitoring gender impacts (qualitative and quantitative)

(Session leaders: R Padmaja and Cynthia Bantilan)

This session is a continuation of the previous session on integrating gender in research evaluation and impact assessment. The focus is on the different instruments and tools that were used in the case study described below, in addition to the questionnaire survey. Some of the instruments/tools that were discussed include:

- Matrix ranking for varietal evaluation of groundnut technologies by men and women groups of farmers
- Focus group meeting to elicit information on preferred varietal traits of groundnut by men and women groups
- Rapid rural appraisals to get the user preferences on groundnut production technology
- Participatory rural appraisals to ascertain the preferences and specific needs of men and women – farmers and labourers- from different social groups after experiencing technology intervention.

- Participatory Exercise to analyse the degree of women's confidence and empowerment.

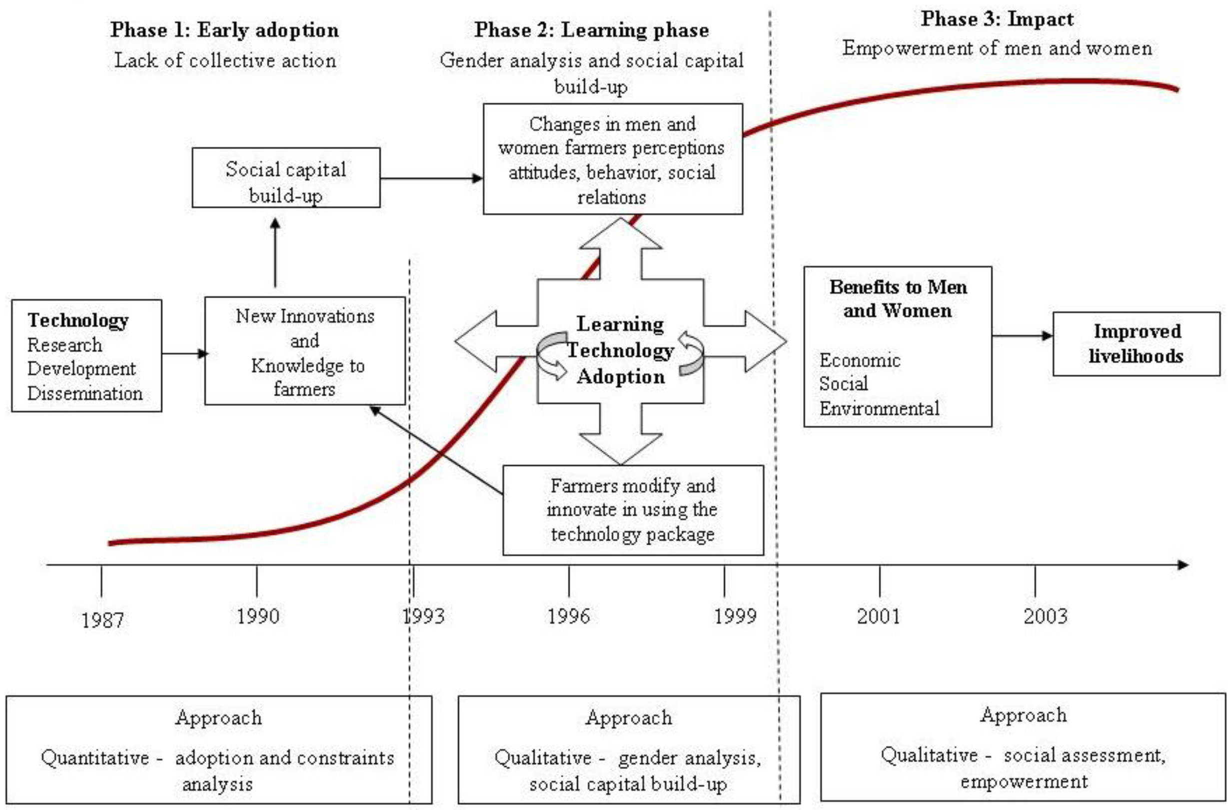
Highlighting lessons learnt from technology adoption and impact this session also features a case study from among several studies at ICRISAT which involved analysis of the uptake process of agricultural technologies and their impacts. This case study on ICRISAT's Groundnut Production Technology analysed the process of technology uptake by systematically probing through the various stages of the adoption–empowerment pathway using a social lens focusing on gender dimensions and social capital as depicted in the Figure 3. The process stimulating gender-equitable change and empowerment is examined through a sequential analysis of quantitative and qualitative assessment in the study village.

Phase 1: in the early stage of technology adoption where lack of collective action is a constraining factor in technology uptake;

Phase 2: a subsequent stage, a learning phase looking at the gender dimensions of technology uptake when the constraint is lifted through social capital build-up and is seen as a mediating factor effectively facilitating technology adoption;

Phase 3: ultimate stage of individual and community empowerment achieved through social capital build-up as a result of technology innovation, whereby even marginalised groups gain

Figure 3. Adoption-empowerment pathway incorporating gender dimensions



better access to resources, information, knowledge and some opportunities for political participation

The data gathered through the various participatory methods helped to examine the process of technology adoption in relation to gender. For example, as a part of an analysis of considering gender in the development of groundnut varietal and management technology, differences in the priorities which men and women attach to alternative grain and plant traits were evaluated. The results indicated that women in the two survey villages prefer varieties which are easier to uproot and shell; that offer high grain yields and good taste. Men seemed to prefer varieties with better fodder yield and larger seeds attracting better market prices. This infers that the distinct needs of both men and women need to be considered when setting varietal selection priorities. These differences may also affect varietal adoption patterns and seed marketing strategies. It also implies understanding the complex socio-cultural-economic context in which technology is adapted, adopted or rejected, and the interactions between the technology and the resource users, owners and controllers.

The session ended with discussion and conclusions on the integrating of gender in research evaluation and impact assessment. The pointers for discussion include:; ii) compare and evaluate current and new approaches to synthesise a set of best practices for participatory research and gender analysis in technology evaluation and uptake; iii) to empower women in agriculture it is important to look at new alternatives in the global economy and the requirements for gender-differentiated needs for technology, skills and knowledge/information. Together with mainstreaming gender into the existing research agenda, it is vital to take into account the livelihood options and the assets that women in poor households depend on; iv) the effects of globalisation which is creating a pressing need to find alternative sources of income in situations where traditional means are no longer economically viable, require us to go beyond adjusting technology to fit with the traditional responsibilities and constraints faced by poor men and women farmers, with linkages established to focus on strong interactions between technology designers, technology producers and technology users; v)an identification of diverse and new livelihood opportunities and pathways for development for the poor farmers in relation to a changing demand for agricultural technology should analyze and delineate the needs of both men and women; and last but most important vi) build the capacity of the researchers as wells as the client groups to bring about changes in current research practice.

Day 9:

Impact assessment of capacity building and training: assessment framework

(Session leader: Cynthia Bantilan)

Research on the assessment of capacity building was motivated by the lack of evidence to support the strongly held convictions that improving human capacity is inherently valuable and absolutely necessary for the achievement of development objectives.

Pathways from capacity building to impacts. Capacity-building activities contribute to improved economic, environmental and social outcomes through four main pathways. Individual human capital raises the productivity and hence the earning capacity of the individual, reflected in higher lifetime income. The efficiency of the organisation as it captures part of the returns from the individual improvement in productivity, and due to the echo effect improving the productivity of other workers via complementarity—for example, extension of their learning and adding to the local stock of knowledge. This is reflected in improved levels and/or reduced cost of services or outputs delivered by the organisation to customers. Innovation in the organisation as the culture and mindset changes, new and better ways of doing things are introduced and new products and services are developed. This is reflected in the changes in the services or outputs the organisation delivers to customers. Effectiveness of the organisation within the policy environment, improving targeting to areas of need, attracting more resources and engaging more effectively on policy, due to the networks and enhanced perceptions of the views of the organisation, as well as its competency. This is reflected in the contribution the organisation makes to the enabling environment for adoption of the organisation's outputs and enhances the value added of the organisation.

These 'changes in practice or behaviour' reflect capacity used by the individual and the organisation they work for. The potential to utilise capacity depends in part on the capacity that has been built by the training activities. This depends, in turn, on the relevance and quality of the training or other capacity-building activity provided, as well as the degree to which the organisation uses the skills, knowledge, networks and other capacity developed by the activities.

The ultimate beneficiaries, apart from individuals who may receive both financial and intrinsic benefits from the training, are the customers of the organisations. For agricultural research and development (R&D) these customers are primarily the farmers and communities in which they live. Thus, impact is ultimately derived through the delivery of lower-cost and/or better-quality goods and services. Impact can also come through a better enabling environment that enhances farmers' access to resources and markets and allows them to reap the rewards of their own labour.

A framework for evaluating capacity-building activities

The methodology outlined here was developed following an extensive review of the literature on capacity-building evaluation and the impact of educational training. This review found that most evaluation approaches do not measure impact, citing attribution as a key challenge. The framework described aims to elucidate and substantiate the linkages between the training provided and the intended or observed benefits, thus facilitating the attribution of benefits to specific capacity-building investments.

Mapping to impact: Three types of capacity-building situations are identified, with different implications for the evaluation approach. Gap filling—where the activity fills a gap that enables progress to be made towards a broader set of outputs and outcomes. In this case the capacity built may be sufficient to result in a change in practice or behaviour at the organisational level (as set out above). Integrated—where the training activities are identified as a component in a broader set of technical or other investments. In this case, the capacity-building activity is usually necessary but not by itself sufficient for the desired change in practice or behaviour. Diffuse—where the training activity adds to the stock of human resources but cannot be linked directly with specific change in practice or behaviour. In this case, it is the quantum of capacity built that leads, over time, to changes rather than any one contribution to this capacity.

Measuring impact and benefit: The value of the capacity building depends on the value of the impact resulting from the change in practice and behaviour of organisations. In the case of agricultural R&D, these changes are often: new varieties of plants or breeds of animal with specific genetic characteristics that endow them with greater range, higher yields or disease resistance better management practices that are more sustainable, resilient, improve yields or lower costs of production lower costs of production, transport and marketing due to improvements in the business, regulatory or policy environment resulting from better informed decision-making improved food safety or other quality assurances that reduce consumption risks to households, attract premiums or facilitate market access more-effective supply-chain management, such as cold-chain integrity, reduced time to market and wider distribution options.

In estimating the impact, the adoption profile and the transferability of trial results to practice must be known. These will depend on the relevance of the outputs to farmers in different regions (or, for policy changes, the regulators) and implementation costs, as well as the farmers' awareness of the option and their capacity to exercise it. The estimation of the benefits arising from these impacts follows normal benefit–cost rules.

Attribution: Once the benefits are estimated, the issue is the share of the benefits that can be attributed to the capacity building activity. Three broad scenarios have emerged, based on whether the capacity built is sufficient, or necessary but not sufficient, or would have otherwise been achieved over time (or an alternative that would achieve the change in practice or behaviour found). The framework outlines five approaches to attribution and the scenarios under which they are applicable.

Where capacity building is necessary but not sufficient:

1. The cost-share approach apportions the share of the benefits (net of implementation costs) to capacity building based on the share of the expenditure going to the capacity-building activities.
2. The relative-importance approach apportions the share of benefits on the basis of a subjective assessment (triangulated) of the contribution (percentage) of the capacity-building activity to the outputs achieved. This can be used if the training would have been sufficient to get some but not all of the outputs, with an assessment made of how much. It can also be used when the training is necessary but not sufficient, but a strong case must be made as to why the training components were worth more than the other components. Where capacity building is neither necessary nor sufficient, but improves outcomes.
3. The bring-forward approach is used where the changes would have come about through normal processes, but the investment in capacity building brought forward the changes and hence the impact. The focus of measurement is on the time to impact without the capacity-building activities, compared to the time with.
4. The marginal-gain approach is similar to the bring-forward approach, but applies when the investment in capacity building raised the quality of the changes and hence the magnitude of the impact. The focus of measurement is on the effect that higher quality has on the size of the impact.

Where capacity building alone, given the context, is sufficient:

5. Normal impact assessment should be undertaken, with full attribution to the capacity-building activity. Where this activity filled a gap that was critical to achieving the outcome, and without the activity would not otherwise have been filled, the other investments can be regarded as sunk costs. The returns to capacity building tend to be highest where training or other capacity building is critical to achieving a change. However, care must be taken not to ignore other investments when it has always been recognised that the capacity-building activity is needed. The impact of a capacity-building activity is the same no matter who funds it. Thus, the argument that someone else would have funded it does not devalue the impact of the activity. It does, however, require caution in treating other investments as sunk costs.

Rules of thumb

Several rules of thumb about the return on training also emerged: a worker's lifetime income is higher, on average, by around 10% for each additional year spent in formal education the firm captures around half of the benefits of their investment in specific training for their workers, the workers capturing the other half, and the individuals trained around a third improvements in human capital explain around 30% of the increase in total factor productivity 50% of increases in (agricultural) productivity are due to interstate or international R&D spillovers.

Case-study results

The method was applied to two case studies that demonstrated the value of the capacity-building activities in an integrated context, with the following findings. A 3-year postdoctoral fellowship, funded by ACIAR as an integral component of their pigeonpea improvement projects and undertaken in Australia by a plant scientist from ICRISAT, India, resulted in estimated benefits of A$70 million at an estimated cost of A$2.5 million. This evaluation was based on the relative importance of the training activity to achieving the project impacts and expert opinion about the number of years the ACIAR projects brought forward the adoption of improved pigeonpea genotypes.

A 3-week intensive geographic information systems (GIS) capacity-building exercise, funded by a Crawford Fund award and undertaken in Australia by a Vietnamese GIS specialist, provided estimated benefits of A$82,837 at an estimated cost of A$6,723. This evaluation was based on the cost-share approach because the GIS training was regarded as a vital ingredient in achieving the project impacts of more efficient water usage in irrigation systems. The trainee's enhanced GIS skills enabled the creation of site-specific water management models that played a crucial role in demonstrating to the irrigation companies the benefits of adopting improved operational rules for water management.

This presentation is on assessment of capacity building impacts and illustrating the concepts using two case studies.   Conceptually, the framework by Bolger, that considers capacity development at 4 levels, is a useful approach. Capacity needs can be analysed and interventions developed at each level – the individual, organisation, sector and environment The 4 levels also helps describe the pathways through which capacity building achieves results.

The empirical evidence for pathways leading from capacity development to impact was sufficiently strong to lead Gordon and Chadwick to propose some 'rules of thumb' each extra year's education increases a worker's lifetime income by about 10%. The organisation captures about half of the benefits of their investment in specific training for their workers, the workers together capture the other half, and the individuals trained about a third. Improvements in human capital explain around 30% of the increase in total factor productivity. Half the increases in (agricultural) productivity can be attributed to interstate or international R&D spillovers.

Effect of capacity building in some specific cases: The project supported capacity development for 3 ICRISAT scientists – Dr K.B. Saxena did 3 yrs as a postdoctoral fellow at the University of Queensland, Dr Gupta trained for 1 year, and another scientist for 1 month. Project based course training was also given. Queensland U scientists became long term mentors to the ICRISAT staff who, individually, gained the capacity to test and select pigeonpea varieties, an understanding basic plant biological linked to production and the discipline of keeping up with scientific developments. In aggregate, the scientists gained an understanding of trait inheritance and formed a cadre of scientists to carry forward research.

ICRISAT was able to retain the talented staff for over 30 years, and achieved the organisational benefits from them. Dr Saxena now heads ICRISAT's pigeonpea program. ICRISAT's innovation was enhanced by their applied new skills to breeding. A major screening campaign of Indian pigeonpea materials for biological characters such as photo-insensitivity, to produce successful new varieties, and subsequent to the ACIAR project, continued investment led to many varietal releases. Importantly, the projects, including the capacity building, created a big shift in ICRISAT's focus to short duration pigeonpea.

Continued investment by ICRISAT, India and donors led to excellent adoption rates for the new varieties. In 1986, short duration pigeonpea varieties were released; in 1998, extra short duration pigeonpeas were released and in 2012 it is expected that a hybrid pigeonpea will be released to farmers. The new pigeonpeas have taken it from being and 'orphan' to a commercial crop and the private sector is now funding the hybrid pigeonpea program at ICRISAT.

The capacity development effect was to bring this development forward by 3 years, thus speeding up pigeonpea production efficiency, enabling more production on fallow/cereal land, lower fertiliser costs thru nitrogen fixation and reducing poverty use of marginal land, low cost protein and greater environmental sustainability.

All up, the total pigeonpea R&D investment contributed hundreds of million dollars of benefit. Of that total benefit, ACIAR's capacity building activities components cost A$2.5 m (2005 $) and yielded a very respectable A$70.1m benefits, with an internal rate of return of 23%. The capacity built had long term benefits far beyond the completion of the project and each of the 4 levels of capacity played a necessary role in achieving the impacts.

Additional Lectures

In response to participants requests a couple of additional presentations were provided where technology change is occurring in more complex market scenarios.

Surplus measures – horizontal and vertical disaggregation

Surplus measures – horizontal disaggregation. When there is no or minimal trade in the commodity of interest, then the market scenario can be described as a closed market. The lack of trade may be due to the type of commodity being produced (subsistence and/or highly perishable), lack of access to markets (poor transport infrastructure), or because of government intervention (subsidies and taxes). In essence, the closed market scenario is a special example of a horizontal market with only one region. In this case, the basic model is a suitable framework to measure research-induced changes in prices, quantities and welfare. As shown above, under this market scenario, a new technology that leads to an increase in the supply of the commodity (because of higher yields, reduced costs of production or both) will lead to a fall in the price of the commodity with the distribution of the benefits being shared between producers and consumers (according to the relative size of the supply and demand elasticities).

The majority of agricultural products are sold on the international market. When commodities are traded, the initial country's research can affect world prices in one of two ways. First, if the innovative country is a 'large country'[1] exporter (or importer) on the world market, such as in the case of Australia with regard to wool exports, a research-induced increase in domestic supplies will lower the world price for that commodity (referred to as 'price spillovers'). Second, even if the initial country is a 'small country'[2], if the new technology can be adopted by competing countries, this could lead to a change in world production of the commodity in question which will lower the world price for that commodity (referred to as 'technology spillovers'). The technology spillovers will augment the price spillovers if the country undertaking the research is both large-in-trade and large-in-research. These research-induced changes in world prices and quantities will result in part of the gains or losses from domestic research being realised in other countries.

The literature contains several models that have been used to assess research gains for a traded good. Some studies have allowed for either price spillovers when the country is a large country exporter or importer, for technology spillovers when the technology is transferable to other countries, or for both (Edwards and Freebairn 1982, 1984; Davis, Oram and Ryan 1987; Brennan, Godyn and Johnston 1989; Voon 1992; Voon and Edwards 1992).

Modelling price and technology spillovers can be done by developing a commodity model that consists of either (a) two sets of equations, one that represents the home country and one that represents the rest-of-the-world in aggregate (e.g., Voon 1992; Voon and Edwards 1992), (b) a set of equations that represents the home country in aggregate and a set of equations for each of the major trading partners or regions (e.g., Davis, Oram and Ryan 1987) or (c) a set of equations for two or more regions in the home country and a set of equations for the rest-of-the-world in aggregate (Edwards and Freebairn 1982; Brennan, Godyn and Johnston 1989), or (d) a set of equations that represent two or more regions in the home country and a set of equations for each of the trading partners.

This approach, shown in Figure 4, models the distribution of research benefits in the context of trade where there are price spillovers. The scenario depicts commodity equations representing the home country (Country A) as a large country exporter, and all other countries (rest-of-the-world [ROW]) in aggregate.

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[1] A country is referred to as a 'large country' (or large-in-trade) if it is a large enough producer or consumer of a particular commodity that a change in that country's production or consumption of that commodity will affect the world price for that commodity.

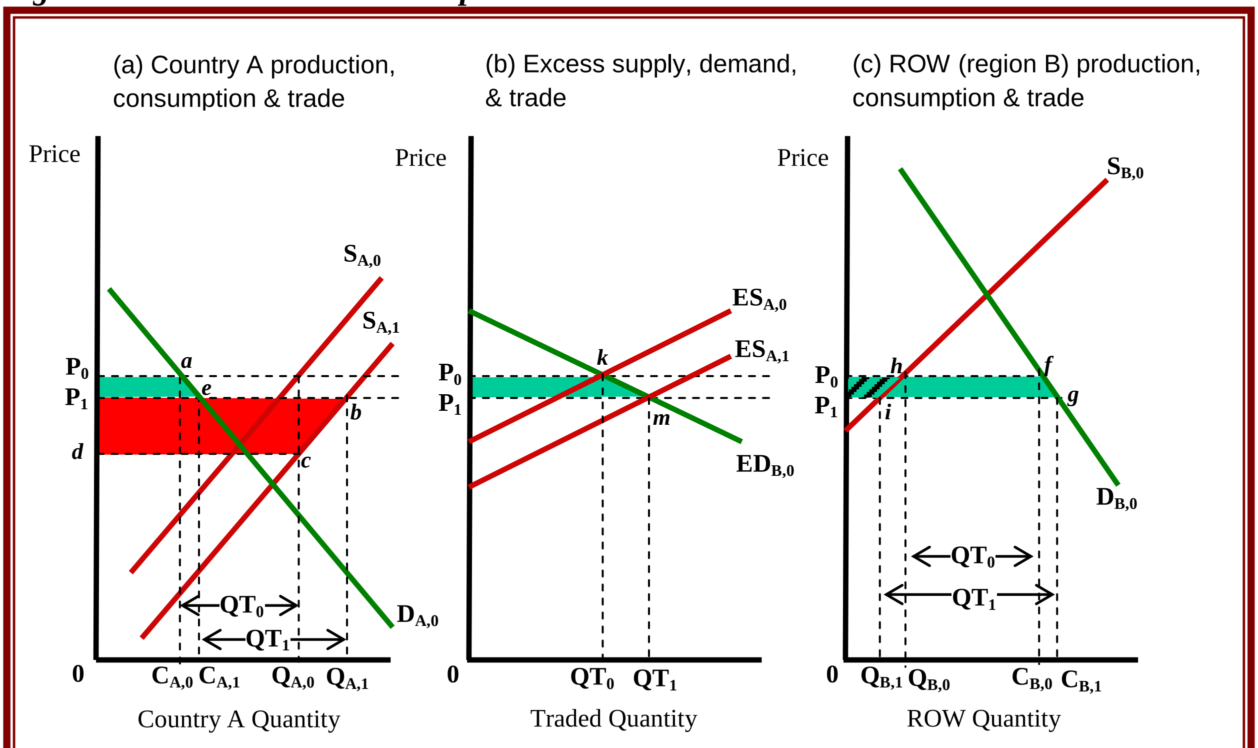
[2] A country is referred to as a 'small country' (or small-in-trade) if it is a small enough producer or consumer of a particular commodity that a change in its production or consumption of that commodity will not affect the world price for that commodity.

Following Alston, Norton and Pardey (2005), Panel (a) of Figure 4 represents the supply and demand in Country A, and panel (c) represents the aggregated supply and demand in the ROW. Panel (b) shows the excess (export) supply in country A ($ES_{A,0}$) calculated as the horizontal difference between domestic supply (initially $S_{A,0}$) and demand ($D_{A,0}$). While the initial excess (or import) demand from the ROW ($ED_{B,0}$) is calculated as the horizontal difference between the ROW demand ($D_{B,0}$) and supply ($S_{B,0}$). The intersection of excess supply and demand represents the international market equilibrium at a price P_0. Corresponding domestic quantities at price P_0 are shown as consumption ($C_{A,0}$), production ($Q_{A,0}$), and exports ($Q_{T,0}$). On the other hand, ROW quantities are shown as consumption ($C_{B,0}$), production ($Q_{B,0}$), and imports ($Q_{T,0}$).

Research innovation in country A causes a parallel shift of domestic supply from $S_{A,0}$ to $S_{A,1}$ leading to a shift in the excess supply from $ES_{A,0}$ to $ES_{A,1}$. Given the shifts in the supply curves, a new equilibrium price at P_1 is established with corresponding new domestic (consumption, $C_{A,1}$, production, $Q_{A,1}$, and exports, $Q_{T,1}$) and ROW quantities (consumption, $C_{B,1}$, production, $Q_{B,1}$, and imports, $Q_{T,1}$).

The research-induced supply shift in country A causes the fall in the world price. Both consumers in country A and the ROW gain as well as the producers in country A, while the ROW producers lose.

Figure 4: Horizontal Market – Exporter Innovates



Source: Alston, Norton and Pardey, 1995 p. 215

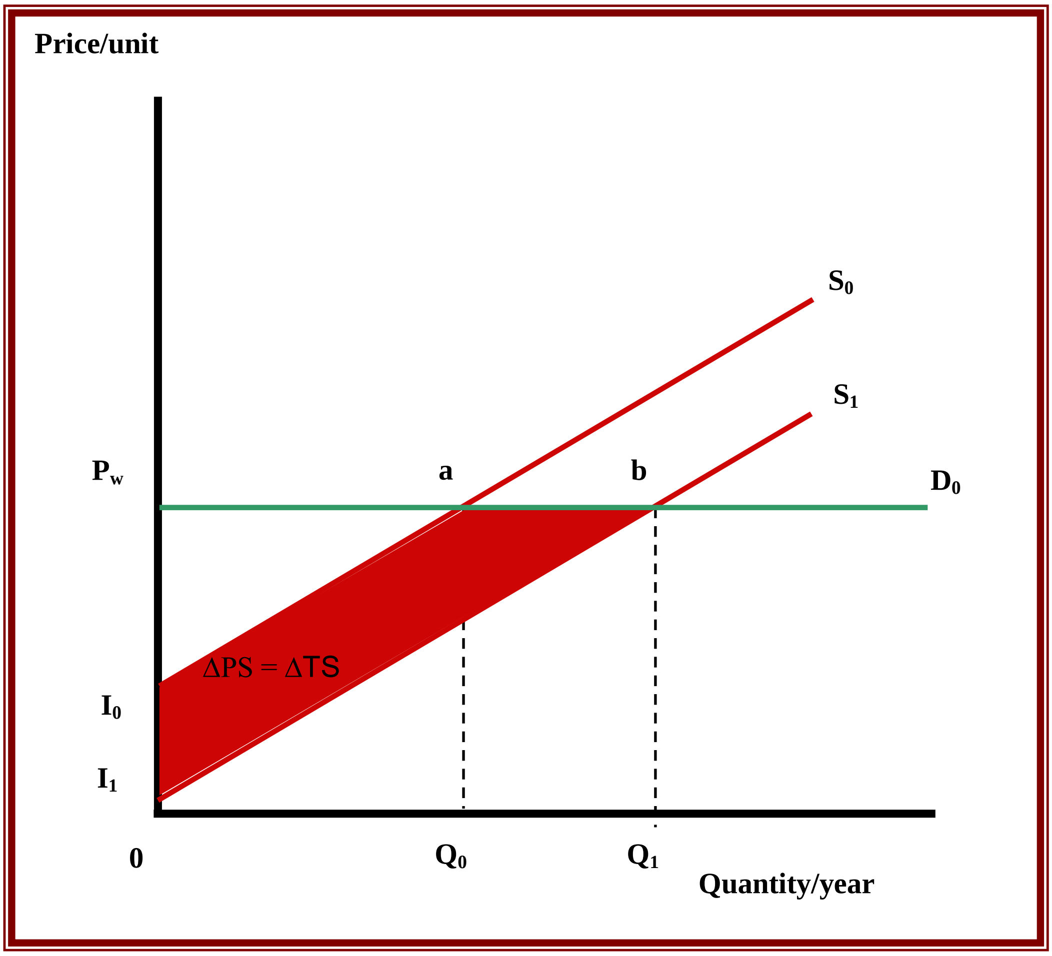
The distribution of benefits is as follows:

- Country A consumer benefits: area P_0aeP_1 – measured by the change in consumer surplus
- Country A producer benefits: area P_1bcd – determined by the size of the research-induced supply shift, the resulting decline in price and the initial quantity. The relevant demand elasticity is that for the total demand (i.e., domestic plus ROW).
- ROW consumer benefits: area P_0fgP_1
- ROW producer losses: area P_0hiP_1
- ROW excess demand: area P_0kmP_1 in panel (b), which equals net ROW benefit (consumer benefit less producer loss): area fghi in panel (c).

Therefore, a research-induced technical change in a large exporting country must benefit both countries (domestic and the ROW).

In sum, the multiple-market framework provides three important and intuitively appealing insights. First, a supply or demand shift in any one country or region can affect the price, quantity and economic surplus in every other region. Second, consumers in all affected regions will benefit regardless of which group of producers adopts a new technology. Third, so long as the technology-induced fall in costs is greater than the technology-induced fall in price, the technology adopters will gain, while non-adopters will necessarily lose (because they can't offset the fall in output price with the fall in costs). The general multiple-market approach, therefore, provides a relatively simple way of accounting for these spillover effects across different markets *for a single product*.
A third market scenario is that of a small open economy (Figure 5). In this scenario, the target country or region is only a very small player in terms of world trade. Hence, any changes to domestic supply will not affect the world price of the commodity. Also in this scenario, it is assumed that there are no significant technology spillovers. Under these assumptions, the price remains constant at P_w while quantity increases from Q_0 to Q_1. As a result, the total change in economic surplus (I_0abI_1) accrues to the producers. A number of studies have considered the case where the country that is undertaking the research is a small country importer or exporter (Akino and Hayami 1975; Nguyen 1977; de Castro and Schuh 1977; Hertford and Schmitz 1977; Flores-Moya, Evenson and Hayami 1978; Norton, Ganoza and Pomareda 1987).

Figure 5: Small Open Market



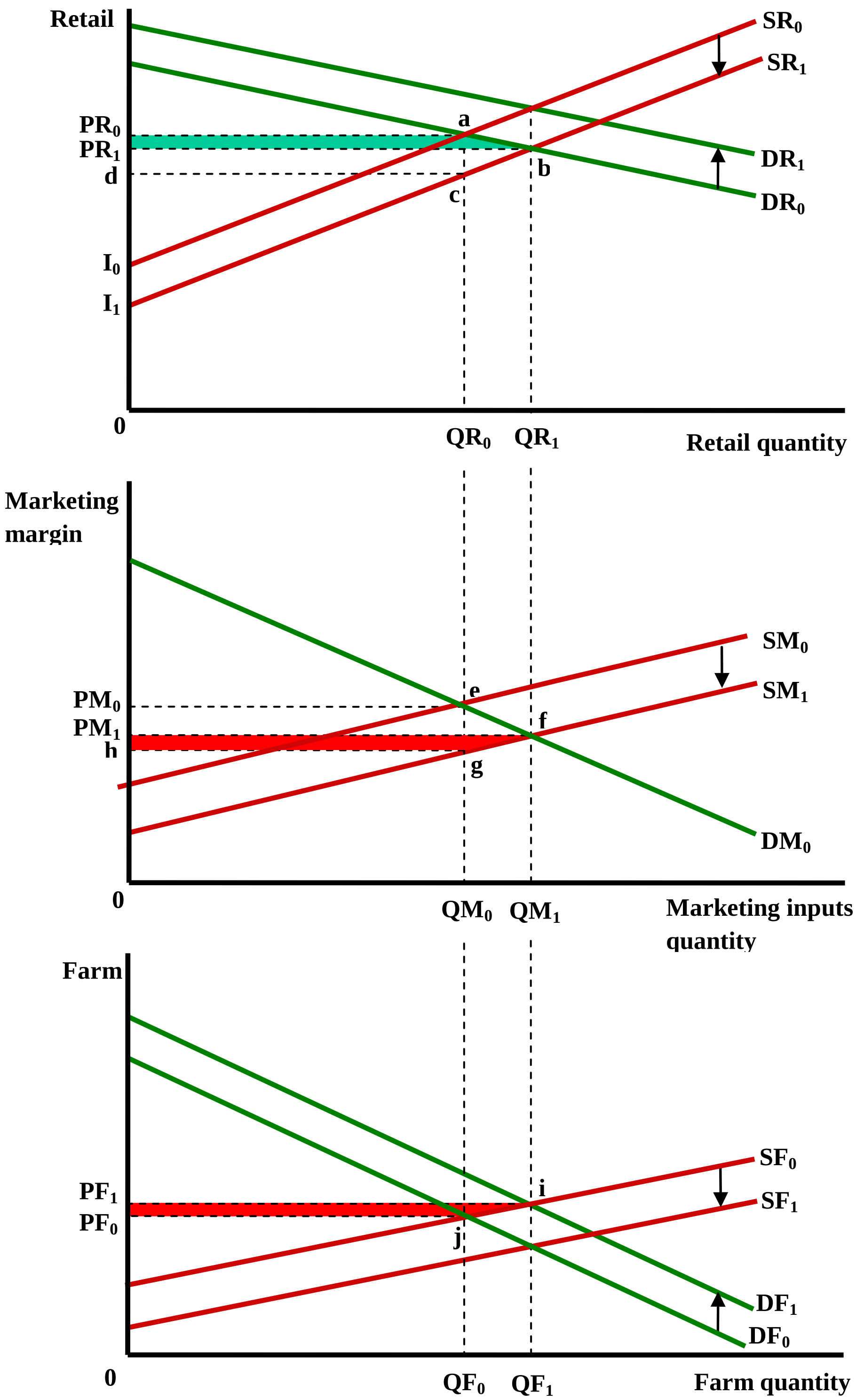
Surplus measures – vertical disaggregation. The vertical market allows the analyst to assess the distribution of return to research between farmers, service providers and consumers. It is particularly useful when assessing the returns to postharvest technologies. However, a number of assumptions underlie the vertical market relationships in multistage production systems:

- Different stages of production are occurring at one time
- Participants in the different stages are represented as input suppliers
- The participants' welfare is reflected in the distribution of economic surplus among inputs.

Following Alston, Norton and Pardey (1995), Figure 6 represent the markets for a farm product and a marketing input (which is a combination of all marketing inputs represented as one component) that are used in fixed proportions to produce a retail food product. The determinants of this market situation are the technology of production (i.e., the fixed amounts of the two factors used to produce a unit of the retail product), the supply conditions for the factors of production and the demand function for the retail product.

In Figure 6, SF_0 is farm product supply curve and SM_0 is the marketing inputs supply curve where the units of the factor quantities are defined as per unit of the retail product. At the retail level, DR_0 is retail product demand curve. Now given that the factors are used in fixed proportions, the retail supply and factor demand equations are derived as follows:

Figure 6: Vertical Market



Source: Alston, Norton and Pardey, 1995 p. 248

The retail supply function (SR_0) is the vertical sum of the farm product and marketing inputs supply curves. The farm product demand curve (DF_0) is the vertical difference between the retail product demand curve and the marketing inputs supply curve. Finally, the marketing inputs demand function (DM_0) is the vertical difference between the retail product demand curve and farm product supply curve.

In equilibrium, the retail price and quantity are PR_0 and QR_0 respectively. Similarly, the equilibrium marketing inputs price and quantity are PM_0 and QM_0 and the farm product equilibrium price and quantity are PF_0 and QF_0.

Measuring the returns to research

First, let's assume that the research is undertaken at the marketing level. The adoption of a marketing technology (for example a new grain drying and/or storage system) will result in a parallel downward shift in the supply function for marketing inputs (from SM_0 to SM_1). As a result, the supply curve of the retail product will also shift down (by the same absolute amount per unit) from SR_0 to SR_1 while the demand for the farm product shifts up in parallel from DF_0 to DF_1. This leads to a proportional increase in quantities (to QR_1, QM_1, and QF_1), decrease in prices of the marketing input and the retail product (to PM_1 and PR_1 respectively), and an increase of the farm product price (to PF_1).

These changes cause a total welfare gain of I_0abI_1 which comprise of a change in consumer surplus ($\Delta CS = PR_0abPR_1$), and a change in producer surplus ($\Delta PS = PR_1bcd$). The change in producer surplus is equal to a change in surplus to suppliers of marketing inputs ($\Delta MS = PM_1fgh$) plus a change in surplus to suppliers of the farm product ($\Delta FS = PF_1ijPF_0$).

Equivalently, the total benefits could be measured in the market for marketing inputs comprises of "producer surplus" ($\Delta MS = PM_1fgh$) and "consumer surplus" (PM_0efPM_1 – which includes ΔCS to final consumers and ΔFS to suppliers of the farm product). Total benefits and their distribution could also be measured in the market for the farm product. "Producer surplus" (ΔFS) reflects benefits to producers of the farm product, and the "consumer surplus" manifests benefits to final consumers (ΔCS) and suppliers of marketing inputs (ΔMS).

This set of results hold true and maybe extended to more than two factors of production where in any factor market the "producer surplus" refers to surplus of suppliers of that factor while the "consumer surplus" refers to surplus of both final consumers and suppliers of all other factors.

Now let's assume that the research is directed at the farm level. The adoption of a new farm technology (for example a new high yielding variety) will cause the farm product supply curve to shift downward to SF_1 by the same amount per unit. In this case, the total benefit and distribution of benefits will remain the same so long as the shifts are parallel. The same applies with a shift upward of the final demand curve by the same amount per unit to DR_1 (which could be due to promotion campaign). '*Thus, in this setting, farmers could afford to be indifferent both about where new technology applies in the production and marketing system and about where a levy to fund research is collected; maximising total benefits will maximise farmer benefits*' (Alston, Norton and Pardey, 1995 pp. 246-250).

It should be noted, however, that the results of this analysis only hold true when:

- There are no market distortions
- The efficiency with which each research dollar spent is equal at each of the market levels.

Institutionalisation

One session was devoted to institutionalisation issues which covered the following relevant topics:: Research priority setting – methodological, empirical and institutionalisation issues: case of Karnataka state in India; Institutionalisation of impacts-based evaluation system and research priority setting: ACIAR perspective; Institutionalisation of impacts-based evaluation system and research priority setting: ICRISAT perspective. With these experiences shared, the day concluded with a discussion on the development of an environment where research evaluations are encouraged and used in strategic planning, learning, and improving program and institutional management.

Research Priority Setting - Methodological, Empirical and Institutionalisation Issues: A Case of Karnataka State, India

(Session leader: VR Kiresur)

Research Prioritisation is a systematic and transparent method of allocation of limited research resources across regions, commodities/enterprises and problems within a research system more efficiently. It aims at optimal resource allocation (constrained optimisation). During the process, relative importance of regions, commodities and problems in the context of development objectives is explicitly brought to the fore. The need for prioritising research investment in Karnataka, for that matter all over the country, arises primarily due to (a) resource limitations in CGIAR, NARS or private sector; (b) very wide and competing end uses of resources; (c) multiple and often conflicting developmental goals such as efficiency, equity, sustainability, exports, etc; (d) decision makers often desire information on research pay-offs to assess alternative uses of funds for maximisation of returns to research investment; (e) professional interest – in the context of growing complexity of research prioritisation in terms of funding sources, investment options and developmental goals.

For macro (region/commodity) level study, congruence model was employed. The steps involved in congruence model are: (a) identification of goals of the organisation, research objectives and extensity parameters; (b) selection of weights of extensity parameters; (c) selection of research priority dimensions; (d) construction of initial baseline (IBL); (e) modification of IBL; (f) derivation of final baseline (FBL); and (g) priority setting by agro-ecological zones and commodities. For prioritisation of research problem areas, the Value of Production Loss (VPL) method was used. VPL indicates potential gross gains from research, the basis for priority setting across research problem areas. The procedure used in studies by Hardt & Ricly [1987], Evenson *et al*. (1996) and Ramaswamy *et al*. (1997) is adopted in the present study. The socio-economic constraints were analyzed by zones and commodities with the help of composite score obtained from farmers' ranking of constraints. The sample of households selected for the study spread across 102 talukas of 19 districts in Karnataka state.

Agricultural Research System in Karnataka is largely a public funded domain [GOK & ICAR]. Bulk of the research activities are undertaken by the state agricultural universities, while the rest is shouldered by general universities, ICAR, IISc, CSIR, ICSSR, DST, DBT, Pvt. Sector & NGOs. The stage agricultural universities have a massive network of research stations spread across all ten agro-climatic zones focusing on all major field crops (including horticulture), livestock and fisheries with a strong multi-disciplinary scientific manpower of over 1500 scientists/academicians. There exists a wide variation in agro-ecology/bio-diversity across 10 agro-climatic zones, and hence, highly diversified cropping/farming systems, and so diversified farmers' needs. All the 10 agro-climatic zones in the State, 10 major crops and all horticultural commodities were selected for the study. The zones, which had values greater than one, were EDZ, NEDZ, NETZ, CDZ, and HZ. In terms of research investment allocation this could be interpreted that these zones need more than their proportionate share in terms of VOP. That is if these zones were to be developed agriculturally, there is a need for investing more research funds in these zones. Thus, when other concerns are weighed against efficiency (VOP), these zones need higher allocation for achieving desired objectives of development plans. Then moot question is from where the additional resources will have to come from to meet the increased research funds for these zones. Obviously this should be from the zones, which have values less than one, which means funds from these zones have to be reallocated to zones, which have values greater than one. Zones, which have less than one, were SDZ, NTZ, and NDZ. The rationality for such reallocation is that these zones have already attained higher level of efficiency; hence, there is an equity dimension in diverting funds from these to the other zone whose values are greater than unity. Then a debatable point is whether reallocation of funds from one zone to another zone is justified. Let us consider the two extremes, reduction and expansion of research funds based on this criterion. According to the results, it calls for 11.98 per cent reduction in the research allocation from SDZ to other zones in the state and increase allocation by 8.47 per cent to EDZ obviously from other zones. Is such reallocation of funds plausible on political economics considerations as well since political and other local organisations and compulsions strongly oppose any such move for reallocation of funds from one zone to another? Thus from operational point of view such reallocation of funds appears to be non-pragmatic. Moreover, when equity in the development takes priority due to vast under development of some of the zones in the state, then such reallocation funds across the zones seems to be highly implausible in the state. Nevertheless, the ratios reveal likely path that research administrators need to adopt in their approach for allocation of research funds despite some operational problems in the implementation of recommended priority settings across the zones in the state. These results clearly demonstrate that when research administration goals are taken into account, the research priorities will drastically change as depicted by the divergence between the research priorities identified with only extensity parameters and those with intensity parameters along with the trade-offs.

The FBL/VOP ratios for commodities across the zones reveal that in most of the zones, research allocations of traditional crops have to be diverted to develop non-traditional crops, which emerged as a result of new priorities that take into account various goals other than efficiency. For instance in the case of NDZ, traditional crops of the zone particularly cereals, pulses and to some extent commercial crops need to sacrifice research funds for the development of non traditional crops of the zone such as coconut, mango, turmeric, ragi, sapota, guava etc as revealed by FBL/VOP ratios for these crops. This implies that based on the revised final estimates which take into account the concerns of sustainability, equity and export trade in addition to efficiency, a part of research funds meant for traditional crops of the zone need to be invested on the non-traditional crops for achieving the concerns reflected in the form of the three goals in addition to efficiency.

A distinguishing feature of the results of the commodity analysis is that in all the zones, traditional crops loose out to other crops in the zone in terms of allocation of research funds on the basis of trade-off between various crops. However, a debatable point is that whether diversion of research funds from traditional to non-traditional crops is justified particularly when the goal is to enhance productivity and aggregate production in the country/state. Another argument that may come in the way of such a possibility is that for each goal a specific crop group should emerge. In some of the zones this trend is evident particularly in the dry zones, where commercial and horticultural crops emerge as strong commodity groups when we incorporate the concerns. As discussed previously, reallocation of funds across commodities may invite ire of interested groups and lobbies. For instance, in northern zones of the state pulse crops are major crops. If we put these recommendations in to practices perhaps there might be strong resistance particularly when we attempt to divert research funds meant for say, red gram to say a fruit crop. Further, such reallocation of funds in the short run may influence negatively regional food supply and security. Hence, before implementing such research priorities perhaps a detailed simulation exercise may be in order to assess the impact on the region.

The VPL method of prioritising research problem areas in selected four important crops revealed that in sorghum, for example, black grin smut was the most serious yield constraint in Zone-VIII followed by army worm, weeds, downy mildew and midge, while it was *Heliothis* (pod borer), weed

(*Comalena bengalensis*) and parthenium in Tur in Zone-III, thrips, non-suitability of soil, bud necrosis and root rot in groundnut in Zone-X, and leaf spot, wilting and boll worm in cotton in Zone-I.

Thus, this paper provides the research planner an objective research prioritisation frame work which tries to ensure that research funds are allocated in such a way that the scientific judgements will result in highest pay off.

Day 10

Wrap up and Close

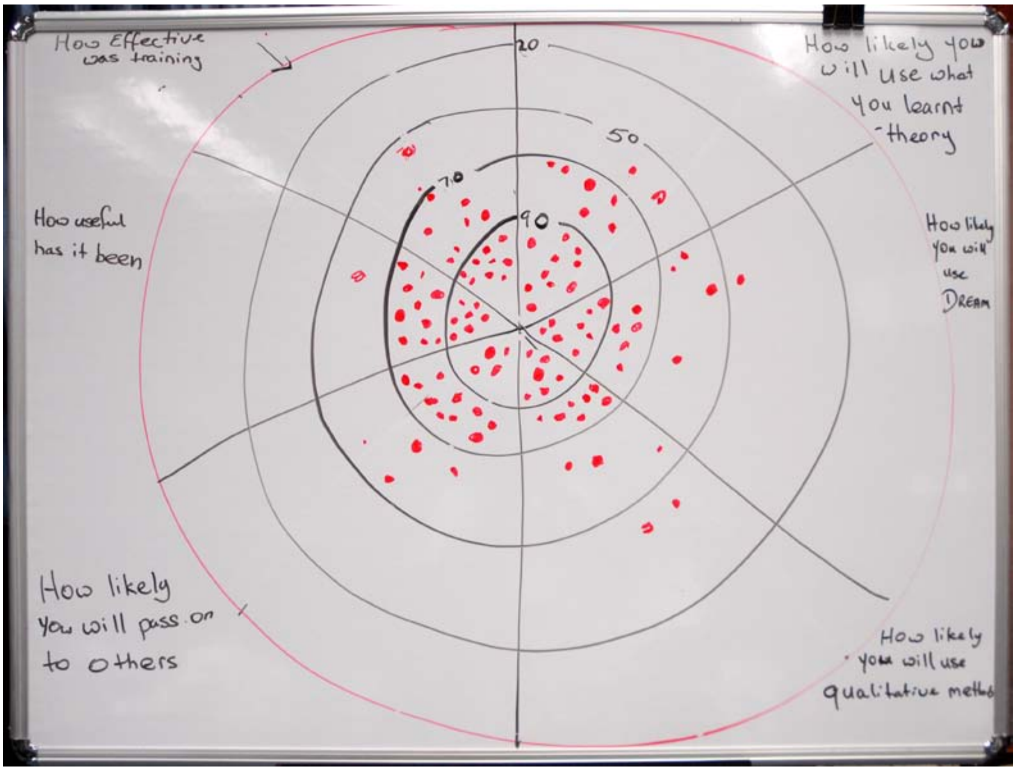
Like all other previous 9 days, the session in day 10 commenced with a recap on the previous day's activities, which was presented by selected participants.

The participants were asked to fill up a questionnaire on "Follow-up course participants survey." This survey focused on the participants' opinions of the Crawford fund training programs. The essential points of this questionnaire (Annex 3) are:

- application of the knowledge/skills acquired during the Master Class.
- impact of the training course which is assessed at two levels: personal and institutional level.

In addition, the wrap up session was further enhanced by using the "dartboard approach" to elicit feedback on questions which particularly assessed the effectiveness of the Master Class on Impact Assessment. The dartboard approach was another interesting exercise conducted by the two main resource persons Cynthia Bantilan and Debbie Templeton.

Dartboard Evaluation conducted on 27 March 2009



It covered the following questions:

- How effective were the training activities?

- How useful has this training been?
- How likely is it that you will use within project research evaluation (research-to-impact pathway, program logic, etc.)?
- How likely is it that you will use qualitative methods and analysis (social and environmental impacts)?
- How likely is it that you will use the DREAM model and/or economic impact assessment spreadsheet?
- How likely is it that you will continue to be in touch with the others workshop participants?

In general, the participants gave an encouraging positive response as depicted by the chart below. In summary, the responses reflected:

- Based from the participants' responses, the training has been very effective.
- The participants find the training to be very useful for their projects.
- Based from the responses, almost everybody agreed that it is likely that they will use within project evaluation in their respective projects.
- Similarly, there is a high likelihood that they will use qualitative methods and analysis.
- The participants said that it is very likely that they will use the DREAM software.
- The participants had a positive response and are very likely to keep in touch with each other.

Closing ceremony and awarding of certificates

The closing ceremony and the certificates were awarded by Eric Craswell, Cynthia Bantilan, Debbie Templeton, and V Balaji, ICRISAT Global Leader for Knowledge Management and Sharing.

Official certificates and report cards

Annex 1 PROGRAM Master Class on Impact Assessment

Concepts and Tools for Agricultural Research Evaluation and Impact Assessment

18-27 March 2009

Venue: Fred Bentley Conference Centre

Wednesday, March18

Day 1: Introduction: Setting the Scene

0830 – 0900	Registration
0900 – 0915	Introduction and welcome remarks – David Hoisington, Deputy Director General, ICRISAT
0915 – 0935	Inaugural address - William D. Dar, Director General, ICRISAT
0935 – 1000	Introduction and outline of the course: What we hope to achieve (This session will include overview and historical perspective)
	Session leader: Cynthia Bantilan
1000 – 1030	Photo session and tea/coffee break
1030 –1100	Practical evaluation exercise
	Session leaders: Debbie Templeton and Cynthia Bantilan
1100 – 1200	Defining research evaluation and impact assessment in the context of the emerging agricultural research for development paradigm
	Session leader: Eric Craswell
1200 – 1300	Lunch break
1300 – 1400	Capacity building and imbuing an impact culture in R&D organisations
	Session leader: Debbie Templeton
1400 – 1500	Group discussion led by Debbie Templeton and Cynthia Bantilan – *Understanding participants' level of experience and the role impact assessment plays in their organisation*
1500 – 1515	Tea/coffee break

1515 – 1600	The concept and examples of impact pathways – Cynthia Bantilan to lead discussion; P Parthasarathy Rao/ Pratap B Singh to illustrate the documentation of consequences along the impact pathway illustrating the case of the coalition approach and diversification research. Biological scientists will be invited to participate in this participatory session
1600 – 1700	Participatory exercise on impact pathways – Debbie Templeton
1700 – 1830	Break
1830 – 2100	Workshop dinner

<u>Thursday, March 19</u>

Day 2: Impact Assessment Model

0830 – 0900	Recap on yesterday's activities (selected participant to lead - Suwanna Praneetvatakul, Thailand)
0900 – 1000	Undertaking an impact assessment: A tour of good practice Session leader: Debbie Templeton
1000 – 1015	Tea/coffee break
1015 – 1200	Measuring the returns to research within an economic surplus framework - review of methodology Session leader: Cynthia Bantilan *(*This training session will include the research process and evaluation framework, economic surplus concepts, effects of elasticities in the distribution of benefits, adoption, combining annual benefits, adoption, research costs, net present value and internal rate of return)
1200 – 1300	Lunch
1300 – 1430	Empirical issues - impact assessment data needs and data collection methods Session leader: KPC Rao (This training session will deal with minimum data set required and data collection methods for research evaluation, adoption patterns-empirical issues and estimation including use of proxy values, margin of advantage, obsolescence and maintenance research, research costs in project level evaluation, research lags and probability of success)
1430 – 1515	Group discussion to be led by KPC Rao: *Data sources and data gaps; eliciting information from scientists, e.g. the yield gap, use of Delphi technique in eliciting qualitative data*

	(Discussion among participants to involve invited biological and physical scientists)
1515 – 1530	Tea/coffee break
1530 – 1730	Methodological issues and use of case studies
	Session leader: Debbie Templeton
	*(The K shif*t **-** what forms of supply shifts to assume, validating claims on impacts, research depreciation or disadoption, new product or industry situation, post harvest research)

<u>Friday, March 20</u>

Day 3: Economic Impact Assessment: Some Conceptual Issues

0830 – 0900	Recap on yesterday's activities (Selected participant to lead – K Suhasini, India)
0900 – 1000	Data and adoption including hands-on exercise
	Session leader: Debbie Templeton
1000 – 1030	Tea/coffee break
1030 - 1115	Estimating adoption levels and rate of adoption: concepts and tools Session leader: Cynthia Bantilan
1115 -1200	Estimating spillover effects and external factors
	Session leaders: Cynthia Bantilan and PA Babu
1200 – 1300	Lunch
1300 – 1400	The correct counterfactual and attribution issues
	Hands-on exercise on k-shift
	Session leader: Debbie Templeton
1400 – 1500	Economic Impact Assessment: Measuring Economic Impact Using Spreadsheets
	Session leaders: GV Anupama and Cynthia Bantilan
1500 – 1530	Tea/coffee break
1530 – 1630	Spreadsheet exercise to measure economic impact

	Session leaders: GV Anupama and Cynthia Bantilan
	This will also include a group discussion on advantages and disadvantages of using a spreadsheet to estimate the returns to research
1700 – 2000	TGIF Break – Golconda Night and Light Show and dinner

<u>Saturday, March 21</u>

Day 4: Economic Impact Assessment: The DREAM Model

0830 – 900	Recap on yesterday's activities (Selected participant to lead – Tran Van The, Vietnam)
0900 – 1000	The DREAM model (presentation and setup)
	Session leaders: Debbie Templeton and Naveen Singh
1000 – 1030	Tea/coffee break
1030 – 1200	The DREAM model (hands-on exercise 1)
	Session leader: Naveen Singh
1200 – 1300	Lunch
1300 – 1500	The DREAM model (hands-on exercise 2)
	Session leader: Debbie Templeton
1500 – 1530	Tea/coffee break
1530 – 1700	Group discussion to be led by Debbie Templeton and Naveen Singh *Strengths and weaknesses of DREAM model*

<u>Sunday, March 22</u>

Day 5: Whole day tour and shopping in Hyderabad city

<u>Monday, March 23</u>

Day 6: Gaining First-hand Experience

0830 – 0900	Recap on yesterday's activities (Selected participant to lead – M Harun-Ar Rachid, Bangladesh)

0900 – 1015	Assessment of returns to research on quality change: Genetic enhancement of crop residues fed to ruminants Session leader: VR Kiresur
1015 – 1030	Tea/coffee break
1030– 1200	Challenges in assessing biofuel research in a changing price scenario: Case of sweet sorghum research Session leader: KPC Rao Biological scientists will be also be invited to participate in this participatory session (CLL Gowda, Belum Subba Reddy, KN Rai, Shyam Nigam, KB Saxena, Pooran Gaur, Srinivas Rao and Ashok Alur)
1200 – 1300	Lunch
1300 – 1400	Concepts on NRM research impacts: Examining efficiency gains in resource (e.g. water) use through improved technologies Session leader: K Palanisamy, IWMI
1400 – 1500	NRM research impacts hands-on experience using the case of surface and ground water irrigation Session leader: K Palanisamy, IWMI
1500 – 1530	Tea/coffee break
1530- 1700	Assessing economic and environmental impacts of NRM technologies: empirical application using the economic surplus approach Session leaders: Cynthia Bantilan and GV Anupama

<u>Tuesday, March 24</u>

Day 7: Gaining First-hand Experience

0830 – 0930	Field visit in ICRISAT Watershed long-term trials - session with NRM scientists in the field on NRM impact dimensions Led by Dr. PK Joshi and NRM scientists will join in this participatory session in the field (SP Wani, KL Sahrawat, Piara Singh, P Pathak and Rosana Mula)
0930-1000	Refreshments
1000-1030	Recap on yesterday’s activities (Selected participant to lead- Frank Niranjan, Sri Lanka)

1030-1200	Empirical challenges in impact assessment of NRM research: Watershed technology case studies Session leader: PK Joshi
1200 – 1300	Lunch
1300 – 1500	Meta-analysis approach in assessing NRM technology impacts – the case of Watersheds technology Session leader: PK Joshi
1500 – 1530	Tea/coffee break
1530-1630	Meta-analysis approach in assessing NRM technology impacts – the case of Watersheds technology, continued with hands-on exercises and discussion Session leader: PK Joshi NRM scientists will be also be invited to participate in this participatory session (SP Wani, KL Sahrawat, Piara Singh, P Pathak and Rosana Mula)
1630 – 1800	ICRISAT Campus Ecotourism before dinner

Wednesday, March 25

Day 8: Gaining First-hand Experience (Continued)

0830 – 0900	Recap on yesterday's activities (Selected participant to lead: Idha Widi Arsanti- Indonesia)
0900 – 1000	Assessing policy-orientated research Session leader: Debbie Templeton
1000 – 1030	Tea/coffee break
1000 – 1200	Assessing policy-orientated research (Case studies and hand-on exercises) Session leader: Debbie Templeton
1200 – 1300	Lunch
1300 – 1400	Hands-on Exercises continued
1400 – 1500	Introducing gender in research evaluation: ICRISAT experience Session leaders: Cynthia Bantilan and R Padmaja
1500 – 1530	Tea/coffee break

1530 – 1700	Instruments in gender analysis and case study illustrating sequential analysis in monitoring gender impacts (qualitative and quantitative) Session leaders: R Padmaja and Cynthia Bantilan

<u>Thursday, March 26</u>

Day 9: Gaining First-hand Experience (Continued)

0830 – 0900	Recap on yesterday's activities (Selected participant to lead: Salome Bulayog, Philippines)
0900 – 1000	Measuring the returns to capacity building Session Leader: Cynthia Bantilan
1000 – 1030	Tea/coffee break
1030 – 1200	Hands-on Exercises - Measuring the returns to capacity building Session leaders: GV Anupama and Cynthia Bantilan
1200 – 1300	Lunch
1300 – 1430	Research priority setting – methodological, empirical and institutionalisation issues: case of Karnataka State in India (Case discussion to be led by VR Kiresur
1430- 1500	Institutionalisation of impacts-based evaluation system and research priority setting: ICRISAT perspective Session leader: Debbie Templeton
1500 – 1530	Horizontal and vertical disaggregation Session leader: Debbie Templeton
1530 – 1545	Tea/coffee break
1545 – 1645	Institutionalisation of impacts-based evaluation system and research priority setting: ICRISAT perspective Session leader: Cynthia Bantilan This concludes the program with a discussion on the development of an environment where research evaluations are encouraged and used in strategic planning, learning, and improving program and institutional management.

<u>Friday , March 27</u>

Day 10: Wrap-up and Close

0830 – 0900	Recap on yesterday’s activities (Selected participant to lead: Sa’ad H Mohamed, Iraq)
0900 – 0930	Workshop evaluation - to be conducted by Cynthia Bantilan and Debbie Templeton
0930 – 1000	Dartboard evaluation – to be coordinated by Debbie Templeton and Cynthia Bantilan
1000 – 1015	Tea/coffee break
1015 – 1200	Closing ceremony and awarding of certificates by Eric Craswell, Cynthia Bantilan, Debbie Templeton, and V Balaji)
1200 – 1300	Lunch

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Mr. G.D. Nageswara Rao

Annex 3 Post Master Class Survey

A. Questionnaire

PLEASE EMAIL THE COMPLETED QUESTIONNAIRE TO THE DIRECTOR OF THE MASTER CLASS PROGRAM, AND THE CRAWFORD FUND CENTRAL OFFICE email: eric.craswell@crawfordfund.org and moostende@crawfordfund.org

CRAWFORD FUND MASTER CLASS

TITLE:

Follow-up course participants' survey

This part of the questionnaire relates to the application of the knowledge/skills acquired during the Master Class.

A As a result of the Master Class I:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Relevant
(1) Was able to apply the skills/knowledge from the training to my work						
(2) Was able to continue to apply the skills/knowledge from the training to my work for a period after the training						
(3) Will continue to use the skills/knowledge learnt in the training in my current employment						
(4) Work more effectively and efficiently						
(5) Increased my competency and confidence in my work						
(6) Initiated my own projects/work activities						
(7) Increased my professional collaboration with organisations both nationally and internationally						
(8) Increased my professional collaboration with people both nationally and internationally						
(9) Increased my ability to continue to research in my subject area						

(10) Was able to improve my research processes due to the training

(11) Was able to build on my knowledge of the course content as a result of the networks made during the course.

(12) As a result of the training my employer has sent staff to further training

(13) Was able to secure resources for further research

(14) The knowledge gained from the course enabled me to interpret government policy

(15) The knowledge gained from the course enabled me to influence government policy

(16) The networks made during the training will enable me to produce better research outputs

(17) The networks made during the training will enable me to produce better policy outputs

(18) Other: Please specify

The impact of the training course is assessed at two levels, your personal level and the institutional level.

B **Personal -** What sort of impact has the Crawford Fund training had on your current work situation? Please rate the statements bellow

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(1) The training had no impact on my work situation					
(2) The training enabled me to perform better at work					
(3) The training enabled me to move to another position in my workplace					

(4) The training enabled me to move to another institution or private company

(5) I have more opportunities to collaborate with international and national organisations

(6) I was offered a promotion

(7) I have changed my work situation for the better due to the training

(8) The training gave me motivation to research further in the field

(9) I have pursued work opportunities in the field of the training

(10) The training gave me the confidence to pursue other work opportunities

(11) The training gave me the confidence to pursue other research opportunities

(12) The training motivated me to participate in other trainings

(13) My life has changed significantly due to the training

(14) I was given the opportunity to train others in my organisation the skills/knowledge learnt during the training

(15) My employer offered me work which used the new skills I acquired during the training

(16) My managerial duties increased due to the training

(17) My new level of skill/knowledge was rewarded by my employer

(18) We would welcome any further comments you have about the impact the training activity has had on your life: (What was the most significant impact of the training for you personally?)

C Organisation - What sort of impact has the Crawford Fund training had on your organisation? Please rate the statements below

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
(1) The training had no impact on my organisation or the work it performs					
(2) The quality of internal training programs has been improved					
(3) The organisation has increased its R&D outputs					
(4) The uptake of new/improved technology has increased in the organisation					
(5) The adoption of new/improved technology by the organisation's clients (eg farmers or industry) has increased					
(6) The organisation is more innovative and prepared to fund new approaches					
(7) There is an improved flow of information within the organisation					
(8) The quality of discussion about work has improved in my department/organisation					
(9) The policies developed by the organisation are more considered and well informed about potential impact					
(10) The extension services provided are more efficient and effective					
(11) The quality of the advice provided to clients has improved					
(12) The training increased the organisations ability to influence and inform policy decisions made by government					
(13) The training has improved the management processes of the organisation					
(14) The training has added to the quality of research our organisation produces					

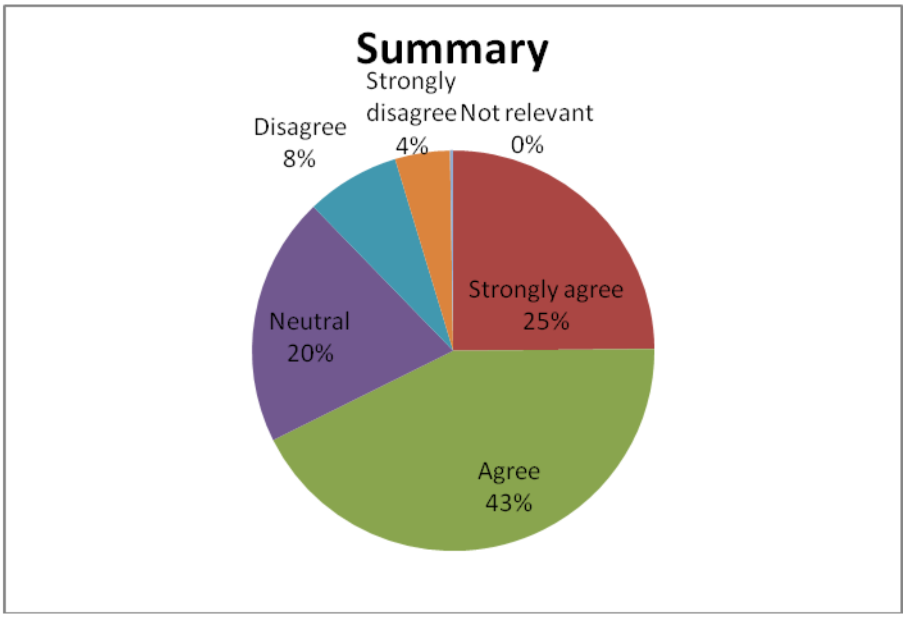
(15) The organisation has changed significantly for the better due to the training

(16) We would welcome any further comments you have about the impact the training activity has had on your organisation:

(17) We would appreciate any other comments you have relating to the Crawford Fund, this survey or the Master Class program you attended.

PLEASE EMAIL THE COMPLETED QUESTIONNAIRE TO THE DIRECTOR OF THE MASTER CLASS PROGRAM, AND THE CRAWFORD FUND CENTRAL OFFICE email: eric.craswell@crawfordfund.org and moostende@crawfordfund.org

B. Results of post-Master Class (ex-ante) survey of 24 participants



C. Comments

A18	As a result of the Master Class:-

	• The knowledge from training help me to implement more systematically the research and strongly involve in research activities in my institute • Very useful to me as a researcher lecturer. This has broadened my little knowledge on impact assessment; and can advise my thesis students more effectively especially in assessing nature and research investments. • Impact culture is in its infancy – need institutionalisation • The training will enhance the quality of my lecture book • Can affectionately use the tools for IA Studies carried out by PG students under my guidance • I strongly believe that I will be able to convince my departmental staff; and colleagues to follow the IA pathways in this research projects • Capacity to interpret information on past studies enhanced • There is a high need for continuity of this initiative • This workshop has strongly improved my knowledge • Overall, the participation in the Master class of Impact Assessment helped me a lot in learning many things about impact evaluation
B18	What sort of impact has the Crawford Fund training had on your current work situation?
	• Changed a lot in my way of work in my institute • The knowledge on how to decline k – shift as a result of a new technology is very new to me. I can use this in ordinary I A q techniques generated by my institution. • With the training, I will be able to do my ongoing project work more efficiently. I will also expose the possibility of improving impact assessment culture in my organisation. • My skills on impact assessment were enhanced and this training has further added to the knowledge. • Personally the impact of the training was an enhanced understanding • Reinforce impact orientation in my work and organisation since I am leading the Strategic Planning & Programming Plans and M & E. • The significant impact to me will be the lecture book application that I plan to produce; can finish with a good quality. • Useful to learn new tools in impact assessment; enables to develop collaborative bonds with other trainees from different countries and share experiences • This training has in fact, changed my attitude about the agricultural research • Confidence and capacity to carry out research in this area has been enhanced • The training course was able to improve my skills and understanding on impact assessment and would be able to develop more policy research and impact assessment projects. Also to be able to have my contribution in conducting impact assessment studies and capacity building in area • Calculating of the K Shift; dream model; incorporation of new supply shifter such as gender, capacity building into IA and priority setting exercises • The training has introduced specific methodologies in an effective manner. It has provided me with tools that will enable me to further enhance my career • Improved confidence levels in impact assessment project • Firstly, the environment for this was helpful as it motivated and lifted up my spirit to follow intensively. Secondly, my knowledge is improved, in particular, about impact pathway which I didn't know before I attended this workshop. Lastly, I personally am pleased and really appreciated for organising this workshop • Compared with my former work, impact assessment is a new concept, technique and culture. This training has been useful for me in gaining knowledge. I'll try my best to transfer all what I have learnt to my workmates at my institute in China. I'll try my best to form a team to work on Impact Assessment • I have learned many things in the training program about Impact Assessment. The practical exercises we did on different environments and experience of using

	DREAM model which will help a lot in the future
C16	What sort of impact has the Crawford Fund training had on your organisation?
	• Environmental impact assessment – but limited • The impact training used changed the impact assessment cultivated by my institution as a result; research efforts will have monitoring and evaluation components to facilitate research impacts assessment after project implementation • This master's class will help in capacity building to do impact priority setting which will further in research and better quality of output if the impact culture is getting boost in our organisation is still in primitive stage and it has come up to the advance stage. This training will certainly help in improving impact culture in our organisation • The impact culture may be developed in our organisation • Capacity building on IA enable suggestion to undertake IA of some of its research activities • The training activity has a direct impact on the improvement of course curriculum at the post graduate level at any university • This initiative has to be followed by hands-on impact assessment study in the respective country and to be presented in the workshop or seminar • I would prefer to undertake a collaborative research project impact assessment with ICRISAT & ACIAR. This is more appropriate for me to go back home discuss with my boss; prepare initial Research Cost data (Time Series) for a selected sector with all minimum data set. When Cynthia and Debbie come to Sri Lanka on a different mission then I will time with them to refine IA work • Awareness created on the institution impact culture would help the organisation to have continuity on impacts of research and can get more funds from banks. • Directly, the impact of the workshop may delay because I need much time to socialise with impact pathway. We really appreciate further advice and suggestion from both ACIAR & ICRISAT and other participants. • I hope that this initiation would be further continued • The training program helped me a lot to focus on organisational impact pathways. I will help me to do more technology impact studies and policy oriented studies
C17	Any other comments you have relating to the Crawford Fund, this survey or the Master Class program you attended?
	• Support more training for poor and developing countries and especially in agricultural countries • The training is very important and interesting. The topics are very relevant to be able to account most of the impacts of technology. For sure I can use it in my own organisation. The program, although comprehensive stills needs a lot of improvement to be more effective. • We can't really be sure if the data we are promoting will really tell the time we got back to the institution. This survey should be get achieve data. • The efforts to build up capacity among the researchers in developing countries by the Crawford Fund for impact assessment are a very noble idea. This will help the developing countries in improving their research output/outcomes with their limited funds. There is need to further increase in the efforts by organising some more follow up programme to solve the problems in ongoing impact assessment. • A very good and comprehensive training program. • I appreciate the good work of building the capacity of young professionals in agricultural research and development. I hope many more people benefit from such training, now and in the future. Thank you. • Suggestion: for any future training activities of the Crawford Fund, these information should be distributed to all alumni in order to strengthen further benefits • Opportunities needed for participating in the real life impact assessment studies • Monitoring of using the impact assessment tools in the participant's organisation

	would be worthwhile/Participants should be kept in touch with the Crawford Fund as to encourage them using this IA tools in their research and techniques activities • Consider including participants from SSA • We are very grateful to the Crawford Fund for initiating this project and hoping that there will be more impact assessment projects generating from this information. • Thank you for our IA class. I would be very appreciative if I get an opportunity to visit ACIAR and 1 week to learn about the ongoing IA work. Since Sri Lanka has very low exposure to such IA studies, more emphasis should be given to the country to enhance our capabilities. In Sri Lanka, this assessment is requested. • I enjoyed the program. It may be more helpful if there was only one reason leading the training, i.e. to offer a cohesive framework. More practical exercises and assignments with data from line projects would be helpful. It might be beneficial, if there was an entire exercise on a simulated IA, beginning with a collection of data to pulling out short reports. • Training was too long. Could have learned in one week. Some of the lectures were not necessary and could have just been integrated with others. A better schedule is 9-12, 1-5, but other weeks free. • Follow-up survey is suggested. Have participants on collaborative networks. Successful participants should undertake further training. • I would like to thank the Crawford Fund for this initiation and I hope that the Crawford Fund would fund more projects on impact assessment. I also hope that Crawford Fund and ICRISAT can come to Gui Zhou Academy of Agricultural Science to give us more guide and training. Thank you • Finally, I'm thankful to the Crawford Fund, ACIAR, and ICRISAT for providing me with the opportunity to participate in the training program. The way of conducting the pre-course survey, training program and follow-up course participants' survey is a good idea.