Minutes

Technology Assessment Workshop

Michigan State University

Department of Agricultural Economics

June 17-21, 1991

Jaakko Kangasniemi and Bernard Kupfuma

Warning:
These minutes represent the biases and misunderstandings of the writers and have not been reviewed by those who gave presentations.

Table of Contents

A Departure to the Returns

Minutes from the first day's discussions in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

The workshop started with Oehmke's explanation of the background of the ongoing studies on rates of return (ROR) to agricultural research in Africa. The studies are part of the current approach of having the US Congress to attach less detailed restrictions on the use of development aid and requiring USAID to provide the Congress with evaluations on what is accomplished with the funds.

In USAID's Africa Bureau the new approach has lead to four major decisions: First, every new project is now mandated to include a baseline study that could be used to evaluate the impacts of this and other future projects. Second, the Bureau has decided to fund a continent-wide descriptive study on maize research in Africa. This study is organized and largely carried out by Elon Gilbert. Third, Management Systems International was contracted to develop intermediate impact indicators to be used in rapid assessments of AID-funded research projects. Fourth, MSU is carrying out ROR studies under the 'Food Security in Africa' cooperative agreement.

The ROR studies have been divided into two phases. The first phase consists of three country studies - Malawi (public and private research on maize), Kenya (maize and wheat), and Mali (maize). The scope of these studies came directly from AID and even though "noneconomic factors" are considered, the main focus is on the calculation of the rate of return to agricultural research. The field work for Phase I studies should be accomplished by November 1991.

In the second phase four studies are under way in Cameroon (sorghum, cowpea, and maize), Uganda (soybean, sunflower, maize), Zambia (maize), and Niger (millet). The field work for Phase II studies should be completed by November 1992.

Crawford reported that even though institutional factors are now emphasized more than before, the intention of USAID has always been to go beyond the calculation of a rate of return. He also explained that MSU involvement in ROR studies consists of three parts. First, there was a review of relevant literature with emphasis on finding out which methods used in Latin America and Asia could be used to evaluate agricultural research in Africa. This study was led by Oehmke and largely carried out by MSU graduate students. Second, Howard, Boughton, and Eicher have conducted a "desk study" on the process of designing and implementing World Bank and USAID projects to strengthen national agricultural research systems. Third, seven country studies are being carried out by MSU faculty and graduate students in collaboration with host-country institutions. The length of field work in these studies varies from three to twelve months.

Oehmke explained that the seven countries being studied by MSU were not randomly sampled but rather were picked in consultation with AID/AFR to ensure that they are countries that have received significant USAID funding for agricultural research, had USAID missions that were willing to cooperate and from those where MSU had some experience. The intention, however, was to have both "success" and "failures" in the "sample".

Weber added that, to the extent possible, MSU tries to collaborate with host-country institutions and other US institutions working in host countries.

What costs to count?

Participants discussed what investments should be included as the costs of agricultural research. In principle, USAID is interested in the economic returns to their investments. But in most African countries USAID is only one of many donors funding agricultural research. What share of the benefits is attributable to that funding? Should one attribute any costs to the material received from international research centers? Should one take into consideration the costs of research prior to a particular USAID-funded project? What is the value of landraces developed by local farmers and used by breeders?

According to Schaffer, one should ignore the costs of past investments (eg. those incurred in breeding parent varieties used in adaptive research) and concentrate on adaptation. The key issue is how to deal with current complementary investments such as extension and seed multiplication.

Oehmke reported that USAID would probably be happy with an approach that assumes the CGIAR institutions are in place and calculates, what is the ROR of national investments ignoring those international costs".

Howard noted that if breeding research is done in international research institutions and the national institutions do some adaptation, this approach would overstate the returns to national research. Also, it would be a misleading signal to those who decide how much to invest in national research systems vs. in the CGIAR centers. The benefits do not come out of adaptive research alone, they stem from the whole package.

Sanders admitted that ignoring the costs of international centers would be misleading if the question concerns optimal allocation of research funds. This, however, is an extremely difficult question and should probably not be addressed in the proposed ROR country studies. In general, more consideration should be given to problem definition. Here the problem has to do with the returns to national adaptive research, given the existence of international and past domestic research. Therefore, the costs of international centers should be ignored. On the other hand, the costs of additional extension, fertilizer, etc. should be added to the costs of domestic adaptive research.

Henry de Frahan mentioned that in one study in Latin America, researchers had not included all costs and all benefits but rather had assumed that 40 % of the benefits were attributed to international agricultural research, 20 % to local adaptive research and 40 % to extension. Then they had compared the costs of national research to 20 % of the benefits. Sanders asserted that these percentages were quite arbitrary. If one had long time series of data, one could use regression analysis to get less arbitrary estimates of the contributions, but in any case the question addressed with this approach would be different from the one at hand.

Oehmke: No shopping!

Oehmke presented his "philosophy of ROR-studies": First, he advised researchers to stay away from "the shopping list of problems". Initially one should concentrate on the impacts of the research, primarily on the increased yields. Second, one

should ask what are constraints on increased yields that research can eliminate or, more likely, replace with new constraints (eg. replace varietal constraint with a fertilizer constraint). The purpose is to find out what are the additional constraints that need to be eliminated to increase yields. Finally, one could then ask what institutional changes could alleviate the constraints that research did not.

Sanders admitted that it makes sense to start with the impacts, particularly on yields. One has to focus; it's dangerous to try too many things.

"How do you select the key factors to focus on?" Howard asked. Answers ranged from "intuition" to "the issues under debate". Oehmke explained that in Malawi the decision to focus on the role of the private actors (a seed firm) had to do with USAID involvement in the private-public debate.

Shapiro recommended that to study how future investments might be made more effective one should pick a few key factors. To identify them one could do cross-country comparisons. In this project one could perhaps draw lessons from the relatively more successful cases (maize in Kenya) to the less successful ones (maize in Malawi).

Sanders warned that in searching for the key factors one should beware of the outdated conventional wisdom in the literature. One example is the claim that lack of credit is a constraint on production in the Sahel. Another is the assumption that a new variety that tastes different and is disliked by farmers and consumers will not be adopted. In practice, if the yield increase is huge, tastes will change. Price- and yield-induced change in tastes has occurred in the case of Hageen Dura hybrid sorghum variety in Sudan. Shapiro mentioned that in Niger taste preferences changed in six months.

Sanders reported that the heavy emphasis on short-season varieties in the Sahel may be unfortunate, because the climatologists contend that the drought is temporary and that a permanent shift in rainfall patterns has not occurred. One should have something in portfolio for better rains.

"What about organizational problems, low salaries, lack of recurrent funding, lack of long-term planning", etc., Howard asked. Naomi Ngwira added that often the key problem is not lack of skills but lack of dedication. Low remuneration diverts efforts elsewhere.

Sanders agreed that it is crucially important to understand what it takes to make organizations successful. The discussion did not, however, provide answers to Howard's question.

Index-numbers or production functions?

Henry de Frahan compared the two approaches to ROR studies. The index-number approach, which is a sort of benefit-cost analysis produces an estimated *average* rate of return. The production function approach, on the other hand, is used to calculate *marginal* rates of return. It can be used to evaluate whether the allocation of resources among research projects is appropriate. In developing countries it is generally easier to get data for the former approach.

Oehmke contended the index-number approach is an appropriate method of evaluating particular projects and the changes in total factor productivity attributable to them. Moreover, this approach is more suitable when changes are discrete.

The production function approach has trouble in distinguishing between discrete changes. The way around this is usually to use research costs as a proxy of research outputs. This gives us a continuous variable, the impact of which on the production function we can estimate. Finally,

Oehmke explained that the two approaches are, in fact, compatible, due to the connection between the production function and the supply function.

Without-technology case

In Monday afternoon participants discussed the counterfactual without-technology case, to which the actual case is compared. Henry de Frahan said that sometimes it is possible to study non-adopters, even though one must be careful since there are likely to be other differences between adopters and non-adopters. Sometimes expert opinion is the best choice. Soil scientists may be able to say whether soil degradation would have reduced yields without the new technology. Crawford pointed out that if time-series data on yields exist, one could use it to estimate what would have happened without the new technology.

With respect to no-new-technology prices, Sanders said that the use of demand elasticities takes care of this. On the other hand, the demand elasticities generally used are very low.

Ngwira pointed out that if research and extension promotes monocropping, yields will decline over time. Shapiro doubted that farmers could be persuaded to monocrop if it destroys their fields. Sanders asserted that declining yields are not caused by monocropping or fertilizer but rather by the lack of organic material and lack of potassium. He lamented that the World Bank repeats the claim that fertilizer reduces fertility. Sanders claimed that the declining land fertility because of the lack of organic matter is a "second-generation" problem that is easier to solve in places where technical progress has been rapid. Crawford responded that some soil degradation may be irreversible.

Data collection

Henry de Frahan emphasized the importance of working with a local counterpart, because it helps to create local capacity. A good counterpart also gives a lot of feedback and keeps the expatriate on the right track.

Henry de Frahan said that the researchers should work closely with a few counterparts. In francophone Africa an additional benefit stems from the fact that most economists working in agriculture have had their first degree in agronomy.

Sanders pointed out that it is important to gain the credibility of those who are going to be affected. He advised researchers to be aware of the conflicts that are common between the people in on-station research, FSR, and in extension.

Shapiro recommended that in the field low priority should be given to data analysis and high priority to data collection. He also emphasized preparatory work.

Howard asked whether it would be better to try to use existing data on yields, since surveys can generate very unreliable results. Sanders warned that yield data collected by others may be difficult or impossible to use. He also claimed that farmers usually know their yields, at least in irrigated areas. Since yield is the most important number in the study, much work should be put in estimating it as accurately as possible. Still the numbers will be quite crude. According to Sanders, 10-20 percent difference in yields is not observable to farmers. Therefore slightly improved varieties are difficult to diffuse.

Shapiro said that even if one would end up using secondary data one should validate it by interviewing farmers. His experience has showed that farmers bias both yields and increases in them upwards.

Jaakko Kangasniemi

Assessing Costs and Benefits

Minutes of Topic 4: "Assessing benefits and costs attributable to research" by Drs. Russell Freed and Barry Shapiro in Technology Assessment Workshop, MSU, June 17-21, 1991.

Dr Freed started the presentation by defining three major categories of a "technology". Technology can be a new variety/cultivar, a new output-enhancing input, such as fertiliser, or an improved management practice. Any of these can be combined to form a technology package. The choice of any combination should depend on circumstances specific to a given case.

During the discussion it was pointed out that people are usually more willing to adopt a component of a technical package than taking up the whole complex package. This gives rise to the need to specify an adoption curve on the basis of the specific characteristics of the technology.

Once one has defined the technology to be evaluated is, one should proceed to identify the costs and benefits associated with this technical package. Although USAID is mainly interested in real monetary returns in terms of increased yields, area planted, and increased employment, the issues of sustainability, social benefits and privatisation are also important. The latter involves impact assessment and specific issues such as the level of chemical use, reduction/increase of erosion and maintenance of genetic diversity.

Taken as a whole, this calls for an analysis not only of farm production, but of the whole food system. The ensuing discussion highlighted potential problems of dealing with the sustainability and reduction in the use of chemicals issues as these are not well-defined. For the latter issue participants were encouraged to consult the staff in the Department of Crop and Soil Sciences especially on the effects of nitrogen.

Dr Freed also pointed out that basic technology has higher returns/impacts than applied technology and therefore has higher multiplier effects.

Data and distortions

Dr. Shapiro's presentation concentrated on data collection for use in identifying costs and benefits. The diffusion path can be obtained through stochastic models. Yield distribution schedules can be estimated based on farmers' subjective probabilities of the different states of nature elicited from historical data and key informants.

The sources of data to estimate input-output coefficients include on-farm trial results (to be used cautiously) and data from IARCs among others. Dr Shapiro stressed that since aggregate data reduces variability, it understates the actual risk. This may be unavoidable given the short period available for data collection. Under these circumstances one should rely more on people on the ground and on available secondary sources of data.

Dealing with distorted markets presents special problems in impact assessment studies because of the need to measure the changes in welfare. This was illustrated by a case where a subsidy on fertiliser was inducing the development and adoption of a fertiliser-using hybrid, which required an increase in government fertiliser subsidy. The resulting dead weight loss should be considered through the use of economic prices. While this may reflect returns to real resources, it must be recognised that adoption will remain a function of financial prices;that is to say the prices that prevail at the farm level.

Bernard Kupfuma

Light from Purdue

Miautes from Dr. John Sander's presentation 'Lessons from Purdue's agricultural research experience in West Africa' in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

The returns to agricultural research in West Africa were estimated using the Akino and Hayami method. This is an economic surplus approach to estimate the benefits and costs. Graphically this can be demonstrated by a shift in the supply curve to the right.

The parameters to be estimated include the mode of the shift of the supply curve, the elasticities of demand and supply, and the diffusion path. The latter parameters are based on secondary data sources and expert opinion.

This method was used to evaluate returns to technology uptake in three agro-climatic zones. The main characteristic of these zones is that population density increased from low to high rainfall zones.

The main productivity improvement challenge was in the drier zones. The major components of the technical package included supplementary irrigation, early cereal varieties, contour dikes to hold runoff water, and organic fertilisers and chemical fertilisers.

With increasing soil degradation and population pressure, labour-intensive technologies were adopted as this appeared to be the best way to maintain production levels. This is confirmed by observed shifts in relative prices of land and labour. The adoption of labour- intensive innovations was further encouraged by a favourable government subsidy.

The main constraints on agricultural production in these zones; that is, water availability and low soil fertility; could not be separated in the analysis. It is debateable whether such complementality should be ignored and each technology dealt with separately. This method does not appear to handle research, extension and input costs satisfactorily.

Bernard Kupfuma

Complementarities Abound

Lessons from an Ex-ante Assessment in Mali

Minutes from June 20, 1991 presentation by Bruno Henry de Frahan in Technology Assessment Workshop in MSU.

Henry de Frahan explained the approach he had used in his dissertation (MSU, 1990) on the returns to farming systems research (FSR) in Mali. The study was done in a context where FSR was about to be extended to a new, low-potential area around the city of Mopti. The purpose of the study was to provide an ex ante assessment of the expected rate of return to this expansion as well as to find out what factors affect the returns. USAID requested guidance on whether higher returns to scarce resources could be secured by investing first in these complementary factors rather than in the expansion of FSR.

The study used an economic surplus approach, which is basically benefit-cost analysis, to evaluate the economic surpluses of four different packages to be developed and adapted by a FSR team to the local conditions. FSR was expected to have negative net cash flow equivalents during the first years, and positive ones later. According to the standard procedure, one proceeded then to calculate the internal rate of return.

In the beginning, the analysts spent a lot of time identifying the potential technologies available on research stations that FSR could adapt to farmer conditions. Second, Henry de Frahan and his counterpart conducted a financial analyses of the different technologies to see whether they would be profitable to the farmers. They also used sensitivity analysis to see how stable these profits would be to chnges in cost of inputs, etc. The third step was economic analysis. The analysts also used DRC-ratio to study the potential impacts of farming system research to the comparative advantage of the area.

Rate of Adoption

In this kind of situation the ROR is greatly affected by how fast the benefits of the project materialize. The study identified three types of lags: technology generation lags, technology transfer lags, and lags in getting economic impacts.

The rate of adoption is of crucial importance in this kind of studies. Henry de Frahan used a well-known formula to estimate the diffusion path: The cumulative percentage of adopters is a function of the supply of technology, profitability (marginal rate of return), time, and the long-run upper limit of diffusion. Parameters were estimated by using

regression analysis, and the historical rate of adoption of animal traction was used to forecast the future diffusion path.

The study found that the expected ROR from the expansion of FSR into the Mopti region would be very low, less than two percent. This confirmed the preliminary view that there was very little new technology on the shelf developed by on-station research that FSR could adapt to farmer conditions. (Note that FSR is here defined as adaptive on-farm research. Because feedback from FSR to on-station research is ignored, this analysis does not measure what FSR has done to provide the on-station researchers with a better picture of on-farm conditions.)

The interesting result was that if FSR were combined with complementary changes, the ROR would be higher. A package of increased on-station research and FSR would yield quite respectable rates of return, much higher than any of them alone. Even better results could be achieved by adding a market information system and certain policy changes. In isolation extension and credit would have negative returns, but when added to a package that produces something to extend, they would make the whole package even more attractive.

Although the gains to research would be larger if Mali would strengthen complementary institutions in the Mopti region, Henry de Frahan did not recommend this course of action. Mali should concentrate on on-station research and policy reform and delay investments in other factors such as extension and credit.

Henry de Frahan admitted that policy costs are difficult to estimate. He had only included direct effects on farmers of his proposed policy change. Nevertheless, he believed that the study was important in underlining the importance of complementarities between factors. Particularly for agronomists it is important to see how much the returns to their work depend on complementary investments.

Jaakko Kangasniemi

****

(A paper by Bruno Henry de Frahan on this subject is available from the organizers.)

How High Yields Help Create New Tastes

Minutes from Dr. John Sander's presentation on the ex-post assessment of Hageen Dura I in the Gezira scheme, Sudan, in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

Hageen Dura I (HD-I) is a hybrid sorghum variety, developed by ICRISAT and Sudan Agriculture Research Corporation (ARC) over eight years and released in 1983. While researchers expected HD-I to be adopted both in irrigated and rainfed areas, it has had little diffusion outside the Gezira irrigation project.

The study by Purdue researchers calculates the rate of return to sorghum research including only the benefits in Gezira area. Sensitivity analysis was done by varying the assumptions about diffusion, price elasticities of demand, and fertilizer use.

While the yield differential of HD-I over traditional varieties is negligible without fertilizer, the picture is dramatically different if fertilizer is applied. Farmers growing HD-I with moderate fertilization and other recommended practices produce 3.28 m.t/ha as compared with 1.13 m.t/ha for the traditional varieties without fertilizer.

Rise and collapse

The introduction of HD-I in Gezira was accelerated by the high prices caused by the 1984-85 drought. Both public agencies and private seed firms started to sell HD-I enthusiastically, despite its smaller and harder seeds that the farmers and millers initially disliked.

But after the drought, production jumped upwards and sorghum prices collapsed. Moreover, one of the principal buyers, the Agricultural Bank of Sudan, panicked and stopped buying HD-I even though it had been encouraging farmers to plant it. The combination of a lack of an assured market and taste preferences for local cultivars created a large price differential (40% to 50%) between HD-I and local cultivars. As as result, many farmers refused to buy HD-I seeds for the 1986-87 season. Seed stocks accumulated, private seed firms stopped producing HD-I, and production declined. In 1988-89 the adoption rate bottomed at less than 2 percent.

Some farmers, however, were fascinated with the high yields of HD-I and developed a taste for it. The price differential was reduced. Some farmers interviewed by Purdue researchers even said that they preferred HD-I over local cultivars.

In the 1988-89 and again in 1989-90, seed producers increased production, and in 1989-90 the adoption rate exceeded 7 percent. In the interviews in 1990 farmers said that they would produce more HD-I if they could get more seed and fertilizer.

High returns

In their most adverse case, Purdue researchers assumed no increase in the area under HD-I and low fertilizer usage. Depending on the price elasticity of demand, this generates a rate of return of 22 to 23 %, and a net present value of $4.4 to 4.7 million. According to Sanders this is equivalent to a net benefit of about one million dollars *per year* for the next 30 years.

This million-dollar 'annual flow of benefits' is the number Sanders used when explaining the results to agricultural scientists in the Sudan. Even under the most pessimistic assumptions, the annual benefits from HD-I would be more than enough to finance the entire annual budget for agricultural research (ARC) in the Sudan.

In the case Sanders considered most likely, (a diffusion rate of 35 % and low fertilization) the ROR would increase to 29 % and the annual flow of benefits would be close to five million dollars.

No shadow prices

The Purdue researchers did their financial analysis by using market prices. Despite currency overvaluation and large subsidies on irrigation, no attempt was made to convert their financial analysis into an economic analysis by using shadow prices was done. However, Sanders was confident that since the yield differential in favor of HD-I is so large, the main message would have been the same in economic analysis.

The study identified some significant benefits which were not included in the calculations: First, farmers had learned to use fertilizer voluntarily. This makes the future transition to higher-value crops such as vegetables, easier. Second, farmers had started to sell sorghum throughout the year, which reduces seasonal price variations.

Jaakko Kangasniemi

****

(A paper by John H. Sanders and Mohmed M. Ahmed 'The Impact of Hageen Dura I in the Gezira Scheme, Sudan' (February, 1991), is available from the organizers of the workshop.)

Assumptions Make It or Break It

Minutes from Lisa Schwartz' presentation on the payoffs to cowpea research and extension in Senegal (based on the paper written by James Sterns and herself) in Technology Assessment Workshop held in MSU on July 17-21, 1991.

After severe droughts from 1982 to 1984, the Government of Senegal, EC and USAID earmarked one million dollars for an initiative called "Operation Cowpea". Six hundred and fifty metric tons of drought-resistant cowpea seeds were imported from California, and distributed to farmers on the condition that after harvest they return 1.5 kilos of seed for every kilo they received. In 1986 Operation Cowpea continued at a reduced funding level of $600,000. No cowpea seeds have been imported since 1987, but some farmers continue to grow the Californian short-cycle cowpea variety.

Operation Cowpea was possible only because prior work by ISRA (the Senegalese Institute for Agricultural Research) and the University of California, Riverside, under the auspices of the USAID-funded Bean and Cowpea Collaborative Research Support Project (CRSP) had identified suitable cowpea varieties.

The study by Schwartz and Sterns looked at the ROR of the funds invested in CRSP and in Operation Cowpea. The study had calculated RORs for two different scenarios. The first assumes that cowpeas replaced peanut production. Thus, it reduced peanut production a little and increased labor costs only slightly, since the land would have been cultivated anyway. The first scenario generated a ROR of 92 %, mainly because of the high value for green pods (roughly double the value of cowpea grains).

The second scenario assumes that no peanut production is replaced, since the drought was assumed to be so severe that the chances of success in peanut production would have been negligible. The value of green pods is again included and the ROR is estimated to be 80 %.

Schwartz pointed out that the analysis was based on several questionable assumptions. First, the shadow price of farm labor, 500 CFA per man-day, was probably too high, since there were virtually no alternative uses for that labor in rural areas.

Second, the quantity of green pods consumed was only a guess. The monetary value of this guess is almost four million CFA. If this sum were excluded from the benefits, the returns for research would be negative.

Third, no benefits beyond 1986 are included even though the imported variety is still produced and consumed, albeit in small quantities. Fourth, all CRSP education and research costs until year 1988 are included, even though most of the benefits stemming from education and post-1985 research are not.

Schwartz concluded by saying that their study is a good example of how sensitive ROR numbers are to the base assumptions.

Jaakko Kangasniemi

More Costs and Benefits

Minutes from Dr. George Norton's presentation 'Assessing Benefits and Costs Attributable to Research - Part II' in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

This presentation focused on non-production benefits such as improvements in storage, nutrition, human capital, and some spill-over benefits. On the costs side, within-country costs run the risk of being ignored especially for research projects with significant levels of outside funding. Some insights on how to handle these issues are briefly presented below.

Storage benefits can be evaluated using the economic surplus approach. Improvement in storage effects can be expressed in terms of both quantity and quality. While the former aspect can be measured easily, the latter cannot. Quality improvement should result in either a shift in the demand curve or the supply curve if the improved product is seen as a different product. These shifts are clearly best handled by an economic surplus approach.

Nutritional quality changes are usually ignored because their effects are uncertain and complex. As a result their attributes are not perceived in the markets. These issues need proper attention in estimating benefits and costs. It is also important to note that increases in quantity often result in more improved nutrition than increases in quality.

Human capital is also not accounted for in economic surplus analysis though conceptually this should be viewed as a supply curve shifter. In addition improvements in human capital is seen by many as a basic need leading to the notion of threshold level.

Spill-over effects, in terms of technology and prices, in either an intercountry or interregional context need to be accounted for. However, this is not necessary when looking at small countries with no major impact on world markets.

Within-country costs that include the costs of running public agricultural research and other complementary institutions should be taken into account to reflect real costs and benefits of technology generation, dissemination and adoption. Some categories of costs to include are salaries and operating costs. Capital expenditures should be broken down over time based on scientist years, if they are lumpy, and the costs of training.

Complementary institutions include extension services, seed supply, credit, roads, infrastructure among many others. These institutions speed up adoption and their effects can be demonstrated by looking at the with-and-without situations.

International costs; their inclusion depends on the perspective from which the analysis is being conducted. Disaggregating IARC costs by country is problematic. When the evaluation is conducted from the national agricultural research system's perspective, it is not necessary to take international osts into account.

Bernard Kupfuma

Policy and Distribution

Minutes from presentations by Dr. James Oehmke and Ms. Valentina Mazzucato, and Dr. John Staatz, and Dr. Bruno Henry de Frahan on topic 'Policy Effects and Distribution of Benefits' in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

The first presentation was based on Valentina Mazzucato's thesis research which seeks to incorporate policy effects and the distribution of benefits in the calculation of the rate of return (ROR) to maize research in Kenya.

Based on data from Daniel Karanja's MSc thesis work (1990) Mazzucato's analysis will recalculate the ROR using prices that do not exclude policy effects and then proceeds to analyse the distributional impacts.

The study focuses on two policies that affect maize production and therefore the ROR to maize research. These are the inter-district trade restrictions and fertiliser import restrictions and subsidies. An economic surplus approach is being used to demonstrate the distributional effects.

Policy & expectations

According to John Staatz, policies affect ROR through their effects on prices, patterns of research, and rate of adoption. This can be illustrated by the case where farmers equate expected marginal factor cost to expected value of marginal product. In this typical production economics relation, policies affect people's expectations. Prices of outputs are affected by macro-economic policies and marketing structures.

The organisation of input markets is also important to farmers in deciding on what their costs are. As a general rule all internal resources should be valued at their opportunity costs.

ROR and NPV of FSR

Bruno Henry de Frahan followed up Staatz's presentation by outlining the method he used to calculate the *ex ante* ROR of farming systems research in Mali. The study incorporated not only changes in policies but also the roles of extension, credit, and on-station research.

The NPV of FSR alone was negative but became positive when policy changes were incorporated. Looking at FSR plus a factorial combination of the four institutions it was found out that the best investment was a combination of policy changes and on-station research with FSR.

Bernard Kupfuma

Returns to Research Depend on Seemingly Unrelated Policies

Minutes from Derek Byerlee's presentation on June 20 in Technology Assessment Workshop held in MSU in June 17-21, 1991.

According to Byerlee, ROR studies are typically carried out in the context of tradable commodities produced, consumed and imported into the country in question. Artificially low domestic producer prices are corrected by using import parity prices.

Sometimes research simply causes a parallel shift in the supply curve. More complicated but also more realistic is the case where the shift is non-parallel. Often only part of the supply shift is attributable to research.

Wheat vs. milk

Byerlee reviewed his study on the comparative advantage of wheat in Ecuador (see World Development, Vol. 17, No. 10, pp. 1585-1596, 1989). The analysis showed that the huge reduction in wheat production was caused by price distortions, particularly an overvalued exchange rate and high protection of dairy, which increased the opportunity cost of the key input, land. However, Ecuador has a comparative advantage in wheat production and if farmers were paid import parity prices (adjusted for overvaluation), they would produce much more wheat and much less milk.

Thus, the ex ante analysis of returns to wheat research depended heavily on the assumptions about future distortions. Research alone could not make wheat production profitable under present distortions. If price distortions are phased out, one should continue wheat research.

Because huge distortions are not sustainable in developing countries, Byerlee suggested that wheat research in Ecuador should be maintained. In fact, since the study was done, wheat prices in Ecuador have been raised close to import parity prices.

Straw vs. grain

In Egypt, the adoption of Green Revolution wheat varieties has been much slower than in comparable agroecological conditions in Pakistan. According to Byerlee, this has been primarily caused by price policies, particularly a combination of low wheat prices caused by subsidized imports and food aid, and high meat prices caused by protection.

High meat prices naturally bid up fodder prices. In the late 1970s the straw to grain price ratio was many times higher in Egypt than it was in Pakistan. Consequently, semi-dwarf cultivars that produce more grain and less straw were less profitable in Egypt.

Breeding is only half of the story

Even though agricultural research is often associated with crop breeding, about half of the research budgets are devoted to crop and resource management issues such as weed control, irrigation, harvesting practices, land preparation, timing of planting, fertilizer use, etc. This research produces information on improved practices, not genetically improved varieties. But adoption rates of improved practices are difficult to measure, because adoption is often partial and because farmers develop and extend many skills themselves. Moreover, the costs of extension are difficult to deal with in ROR analysis.

CIMMYT has recently worked on developing a simplified method to analyze the returns to crop and resource management research. The approach starts by identifying the products of the research, that is, changes in crop management recommendations. The analysis proceeds by asking what role the research had in causing or speeding up the change in farmer practices.

In northwestern Mexico, where the approach was applied, it was found that practically all the benefits were produced by one innovation, while most research projects were "failures". Since this is normally the case, Byerlee emphasized that one should always look at the whole portfolio of research projects, not single success stories alone.

Sensitivity analysis showed two significant lessons. First, RORs are not very sensitive to whether maintenance research is needed in the future, because discounting reduces the significance of late events. Second, also due to discounting, possible adoption of the improved practices years or decades later elsewhere, does not generally make a large difference.

In the discussion that followed Byerlee added that micro-level analyses like the one discussed above are generally well understood by non-economists, whereas more complex studies using, say, abstract production functions may not be appreciated by biological scientists. Byerlee also said that ROR studies of crop management research may be valuable for internal management purposes. They may help to determine whether certain types of research projects should be continued or whether resources should be devoted for something else that has produced respectable returns before.

Jaakko Kangasniemi

Efficiency Depends on Distribution

Minutes from A. Allan Schmid's presentation on June 21 in Technology Assessment Workshop held in MSU in June 17-21, 1991.

Schmid commented on some conceptual problems about ROR studies in general. He started by emphasizing the importance of distinguishing between institutions and organizations. Institutions are the "rules of the game", such as land tenure and laws of contract. They limit and expand people's opportunities. Organizations include political, economic, and social bodies that are formed by groups of individuals bound by some common purpose to achieve objectives.

He also noted that "government intervention" is a misleading expression, since no "natural state without government" exists. Government always intervenes.

Schmid asserted that the distinction between efficiency and distribution is flawed. Efficiency cannot be calculated without demand curves which depend on income distribution. You cannot say that A is more efficient than B, unless you say something about distribution. In our second-best world the desired redistribution cannot be achieved through costless lump-sum transfers. Many methods are used. Tariffs, for instance, are not merely distortions. Their purpose may be distributional.

Also the "real costs of research" are not something that just has to be discovered. Rather, they depend on institutions that determine whose costs get counted. Similarly, whether displaced labor has property rights to the job affects the net benefits of the research. Therefore, if you want to allocate your research resources so as to maximize the rate of return, you must first decide whether you are designing the breeding programs for the existing institutions or for some preferred ones.

Schmid commented on the conceptual problems of allocating joint costs. Finally, he pointed out that if the budget-makers believe the results of ROR studies and agree to expand agricultural research, the funds for, say, health or education may be cut. This may not be desirable, for instance because healthy and educated people are complementary inputs for adopting the results of agricultural research.

Boughton asked, how these issues can be understood and addressed in the three-month ROR studies. Schmid admitted that he does not know. Elon Gilbert warned that many institutional issues may turn out to be "intellectually interesting dry holes". Schmid replied that distributional impacts may be extremely important, since "civil order is not inconsequential."

Jaakko Kangasniemi

Oh, MARIA!

Minutes from Dr. Elon Gilbert's presentation 'Maize Research in Africa (MARIA); Institutional and Organisational Analysis' in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

The MARIA study aims at assessing the quality of maize research resources, examining the pattern of technology adoption, and assessing trends and roles of technology in production, consumption and trade, and the constraints on maize research to fulfill these roles. This is done through a quick review of secondary data sources, key informants, IARCs, bilateral donor agencies, and country case studies.

The countries involved in the case studies include Zaire, Congo, Ethiopia, Kenya, and The Gambia in phase one and Nigeria, Senegal, Ghana, Zambia, and Cameroon in phase two.

The impacts of maize research will be assessed from a regional (Sub-Saharan Africa) level down to the individual farm family in order to examine diverse factors such as production trends, environmental issues, policies, institutions, and farm level resource allocation. The merit of such an analytical framework was illustrated by the case of introduction of animal traction in the Gambia. This major transformation in agricultural production did not result in a substantial change in output. The innovation simply changed sub-regional labour flows. The displaced labour moved out of agriculture, and the real impact of this change was felt somewhere in the sub-region.

Often it works!

The emerging issues of the MARIA study show that generally agricultural research produces results. The IARCs have played an instrumental role in this process. The national agricultural research systems (NARS) have not fared well in terms of building up and maintaining research capacity. The major factors determining the performance of NARS include continuity in funding and scientific leadership, incentive structures to recruit, promote and maintain high quality scientists, and an efficient capacity to borrow technology from the global system and adapt it to local environments. In the 1980s the research themes seem to have broadened beyond the NARS capacities in most African countries.

Insights

The following insights flow from the experience of those conducting the impact assessment studies to date:

* It is important to identify and distinguish between technical innovations, events, and institutions. In assessing the innovations, one should avoid the trap of engaging in a historical analysis without defining a reasonable and relevant time frame.

* Once an innovation has been identified and a time frame defined a chronology of events associated with the development of the technology should be developed. This will helps in identifying costs and benefits.

* In an all-embracing evaluation, the focus should be on key institutions, key time periods and events. Secondary documents and key informants must be employed. On controversial matters, extensive use of second opinions is strongly recommended.

Bernard Kupfuma

Maize, Mali and MSU

Minutes from Mr. Duncan Boughton's presentation on MSU country study in Mali in the Technology Assessment Workshop held in MSU in June 17-21, 1991.

This study builds upon a considerable amount of work done in Mali by the MSU food security teams. The study aims to estimate the RoR of maize research in areas where adoption was a success story.

In Mali, maize has not been competitive with rice especially among urban consumers. Thus the role of technology development and adoption in changing relative prices and therefore consumption patterns is an important part of this study.

Another objective of this study is to analyse how different farming systems and institutional support have affected the adoption ofimproved maize technology. The study will examine the impact of the government's decision to abandon its guaranteed market for maize especially the effects of prices variability on technology development and adoption.

The study will focus on two areas and will be part of the national efforts in Mali to develop a method of evaluating the impact of agricultural research. There will be an initial one-month long survey, a follow-up analysis, and interviews with key informants to nail down what exactly happened. The follow-up study will be based on the findings of these initial exercises.

The expected output of this study includes a description of the maize sub-sector, the key constraints and opportunities for technical and institutional innovations/changes, sets of sub-sector accounts to identify the locus and reasons for high margins in maize marketing, an evaluation of the capacity of different farming systems to respond to evolving demand patterns for maize, and the implications for input supply and soil fertility.

The other important output of this study is the evaluation of the national maize programme in terms of its priorities and linkages with other institutions.

Bernard Kupfuma

Participants and Their Organizational Affiliation

Mohmed M. Ahmed	Purdue University
Richard Bernsten	Associate Professor, MSU
Duncan Boughton	Graduate Student, MSU
Derek Byerlee	Chief Economist, CIMMYT
Eric Crawford	Professor, MSU
Carl K. Eicher	Professor, MSU
Russel Freed	Professor, MSU
Michael Fuchs-Carsch	USAID/AFR/TR/ANR
Elon Gilbert	Independent Consultant
Bruno Henry de Frahan	Professor, Insitut de Gestion Internationale Agro-Alimentaire
Tom Hobgood	USAID/AFR/TR/ANR
Julie Howard	Graduate Student, MSU
Teresa Howes	Graduate Student, MSU
Jaakko Kangasniemi	Graduate Student, MSU
Lydia Kimenye	Graduate Student, MSU
Bernard Kupfuma	Graduate Student, MSU
Mywish Maredia	Graduate Student, MSU
Valentina Mazzucato	ISNAR
Naomi Ngwira	Graduate Student, MSU
George Norton	Professor, Virginia Polytechnic Institute and State University
James Oehmke	Associate Professor, MSU
John Sanders	Professor, Purdue University
A. Allan Schmid	Professor, MSU
Lisa Schwartz	Independent Consultant
James Shaffer	Professor, MSU
Barry Shapiro	Purdue University
John Staatz	Professor, MSU
Gloria Steele	USAID/AFR/TR/ANR
Michael Weber	Professor, MSU

Bibliography

Byerlee, Derek and Piedad Moya. 1991. "Ex-post Assessment of Research Impacts: CIMMYT's Experience." Paper presented in the Technology Assessment Workshop, Michigan State University.

Henry de Frahan, Bruno. 1990. "The effects of interactions between technology, institutions and policy on the potential returns to farming systems research in semi-arid northeastern Mali." Unpublished Ph.D. dissertation. Michigan State University.

Sanders, John H. and Mohmed M. Ahmed. 1991. "The Impact of Hageen Dura I in the Gezira Scheme, Sudan", Paper presented in the Technology Assessment Workshop, Michigan State University.

Schwartz, Lisa A. and James A. Sterns. 1990. "Impact Study of the Bean/Cowpea CRSP for Senegal". Study report submitted to the Bean/Cowpea Collaborative Research Support Program.

Traxler, Greg and Derek Byerlee. 1991. "The Economic Returns to Crop Management Research in a Post-Green Revolution Setting," Mexico D.F.: CIMMYT, April.