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Methods for Diagnosing Research System Constraints and Assessing the Impact of Agricultural Research

Volume II: Assessing the Impact of Agricultural Research

Proceedings of the ISNAR/Rutgers Agricultural Technology Management Workshop, 6-8 July 1988, Rutgers University, New Jersey, USA

isnar

International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands, on September 1, 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing, and operations.

Of the thirteen centers in the CGIAR network, ISNAR is the only one that focuses primarily on national agricultural research issues. It provides advice to governments, upon request, on research policy, organization, and management issues, thus complementing the activities of other assistance agencies.

ISNAR has active advisory service, research, and training programs.

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REFLECTIONS ON IMPACT ASSESSMENT

Jock R. Anderson and Robert W. Herdt

Abstract

There are many useful spinoffs from exploring just what a program of agricultural research has achieved. These range from providing investors and other decision makers with pertinent information on the economic value of research, to providing a more complete understanding of what has been achieved, and then sharing this information with all parties to a research system. There are, however, many methodological difficulties inherent in such work and these vary from the challenge of measuring gains to knowledge, through the empirical difficulty of determining productivity effects (especially in relation to "counterfactual" situations), to dealing with attaching a value to the contributions of people involved in research activities. All these methodological issues should be broached. Attention is then turned to the practice of such a study, along with further difficulties that may be encountered and which must be dealt with. These include the difficulties of attribution among different, and sometimes competitive, agents working within what may be several distinct research systems, the possibilities for bias in all aspects of measurement, and the virtue of attempting to avoid (and being seen to be attempting to avoid) such biases. Particular reference is made to the impact study of the Consultative Group on International Agricultural Research (CGIAR) centers. The paper closes with a discussion of the possible impact of an impact study and the wider issues of agricultural policy that surround any analysis of investments in agricultural research.

Introduction

Impact assessment means different things to the many different observers of this latter-day phenomenon, but two broad categories can be identified.

The first is more concerned with the mechanisms and process of research. Observers with this perspective are interested primarily in what the direct products of research have been. These might be concrete items, such as new varieties of cultivated plants or new compounds that might have some desirable insecticidal or fungicidal properties, for example.

To most observers, however, the second interpretation is much more important, and this focuses on what such direct products (or even some of the indirect ones) have actually led to in farmers' fields, or wherever else research is applied. Even in this perspective, there are many shades of emphasis that can be given to the effects of research. One popular line of investigation has been to look at the effects of the spread of modern plant varieties on crop yields. The green revolution, with its overtly significant effects on intensification and increased yields of wheat and rice in so many of the more favored growing environments of these crops, has led to this emphasis in impact studies.

Yet other aspects of this second perspective look beyond mere yields and crop intensities to the wider economic effects of the adoption of new technology. Here again, there are several levels at which the effects can be examined. The most direct level is to look at what has happened to the incomes of rural households (whether farmers, tenants, or landless laborers) as a consequence of changing technologies.

There are much broader ways of looking at all this, however. The effects such as those just mentioned can be regarded as first-round effects which are only the start of the impact of improved technology on the economy at large. The extra incomes earned by adopters of new technology are quickly circulated through the economy and have usually at least an equal impact on the secondary sectors that variously service agriculture, whether it be for supplying inputs or marketing and processing outputs.

More comprehensive ways of accounting for changes in the technologies used in an economy should not be discounted, although they are somewhat more difficult to deal with in empirical work. The "general equilibrium" effects of new technology are not to be underplayed. These work their way around economies and between economies in subtle but important ways. The effects are manifested in such things as population migrations both within and between countries in response to changes in productivity conditions in various industries. It is not just labor that moves. Other factors of production, particularly capital, are also mobile and move quickly in response to new technologies as they appear.

Given these different views of what constitutes an impact study, it is hardly surprising that people hold rather different views about what should have

been done and what has been done in impact studies. The difficulties, of course, do not end here and, as is detailed below, there are many diverse opinions about impact studies.

Why Study Impact?

There are surely many reasons for attempting to measure the impact of agricultural research. There is probably a complete spectrum ranging from pure inquisitiveness on the one hand through to investor concerns for the returns on their research on the other. Somewhere in the middle are the operational matters of interest to managers of research seeking feedback on what has been accomplished in order to help them direct the course of future work.

If research itself is a delicate flower-like thing, it follows that any attempt at pontification on aspects of this process must share some similar delicacies. Indeed, without due care, a research program can be analogous to a biological subject in an experiment wherein any attempt to monitor the progress of the biological entity can prove to be so intrusive to its performance that the experiment is jeopardized or invalidated.

It is imaginable that the delicate artistry involved in a research program could be stifled by a system of assessing impact. Some of the latter-day schemes for this are called "monitoring and evaluation systems." If allowed to become too heavy-handed, these may nullify the very phenomenon that was supposed to be nurtured and assessed. Confining attention momentarily to public agricultural research, there seems a clear duty for governments to conduct routine and regular reviews of the effectiveness of accountable expenditures on research.

Investigation of research impacts is considerably confounded by the complexities associated with the slow and uncertain evolution of research effects over time. The research itself takes quite some time, particularly when it is related to the life cycles of crop and livestock species. The research worker takes time to have the imaginative ideas that are worth investigating. It often takes quite a long time to implement these as empirical investigations. Even after the results in the field are measured, subject to the environmental uncertainties thrown up by nature, it again takes time to collate, analyze, and interpret the results.

Even the interpretation itself can be subject to considerable uncertainty and is surely an artistic as well as a scientific matter. A researcher may well be convinced that something significant has been found but then the task is to persuade others that the results are real. There are many processes for this, ranging from peer reviews for professional journals to a variety of forms of

internal and external program reviews. Oftentimes, but surely not always, people expert in the relevant fields are involved in making the difficult judgments required.

Processes such as these are necessarily involved in establishing whether research has contributed to knowledge. Again, all this is only one part of the impact process, although a part important to holders of the first perspective. For the economic advancement of humankind, attention must then shift to the second kind of impact assessment, which involves flows of information outside the research system, itself, through various forms of information exchange, such as agricultural extension services, rural media, etc.

Counterfactual Analysis

Knowledge is growing more or less rapidly in every field. Within the many subdisciplines of agriculture, this is also the case, and while desirable in most general terms because it inevitably contributes to the general advance of agriculture and its productivity, it does create some difficulties for those who would attempt to measure the contribution of specific research programs.

Knowledge is a wonderful thing in that it is not narrowly circumscribed. There are spillovers between every aspect of it, so that as an advance is made in one field, analogous insights are gained in others, and there are also positive interactions between the advances of knowledge in different subfields. There is thus a certain degree of arrogance required for those who feel that they can ascribe particular advances to specified scientific investigative programs. It involves taking a somewhat blinkered view of the world and the well-developed mechanisms for transmitting information between people, nations, disciplines, etc., not to mention the innovative drives of the many diverse agents—and, in agriculture, especially of farmers themselves.

In its purest form, a counterfactual situation is one that would most probably have prevailed in the absence of a specified research activity. At this level of generality, it remains unbounded in terms of time or the flow of scientific information (which has its own inertia in modern information systems). Indeed, modern computer technology has greatly speeded the rate at which such information can be shared amongst people in very wide-ranging areas of geography and discipline.

In raising these issues, we should hasten to add that we do not feel that we have any especially novel answers to the difficult questions. It is our impression that such matters will necessarily continue to depend on the personal judgments of the impact assessors. It is also not really a scientific field in which advance can be expected because there is no scope for making

critical observations of just what the counterfactual situation could have been. Cross-country comparisons are fraught with difficulties in method and information measurement.

Considerations of Human Capital

Contemporary economics places justified importance on human capital as an element of the total capital available for investment and development. Conceptually, this is an insightful breakthrough and can assist in understanding the flows of information within a community and the economic valuation of these flows. Unfortunately, however, a conceptually powerful tool does not always lend itself to ready translation into measurable quantities and improved assessment of just how knowledge is captured and exploited. In looking ahead, one of the fond hopes for the future of economic analysis is that the methods of measuring human capital and its use will be greatly elevated.

One thing is sure: the human capital market is much less than perfect. One observes situations, especially in the developing world, where human capital is placed in a research system that essentially constrains its productivity to zero. Situations of extremely scarce operating funds, stifling promotion procedures, inappropriately pegged salaries, and much bureaucratic nonsense, all play their part in turning potentially highly productive human capital into completely depreciated people.

Other Practical Considerations

Many conceptual problems have already been mentioned and all these are significant in empirical endeavors. There are issues of measurement that must be grappled with as well. At the most basic level, many national statistical services are much less than perfect in their description of the physical and economic environment in which research is conducted. Data on agricultural statistics are notoriously unreliable, and the situation is not always aided for the better through the statutory obligations of nations to report their data through the United Nations Food and Agriculture Organization (FAO).

Attribution

Attribution of effects is only straightforward when there is one effect and one cause. This situation never prevails in agricultural research as there are always many agents that are working more or less together in pursuit of research achievements. Any simplistic attempt to ascribe a measurable achievement to just one measured change on the cause side is bound to fall on rocky ground.

A key difficulty in this regard is the fact that the many agents involved in research do not work in a simple independent or additive manner. Indeed, some of the most productive sources of energy in agricultural research systems are highly interactive. The relationship between international agricultural research centers and national agricultural research systems is an ideal example of such synergistic effects. Both groups are working towards more or less identical ideals, and they pool a diversity of resources ranging from human capital to biological materials in joint pursuit of common aims. To disentangle the effects of productivity gains that may emerge from such activities is an exercise in futility. Some cases can be identified where there is clearly a dominant partner. In most cases, however, any success would not have been possible without the active cooperation of both parties.

Even these remarks are probably too simplistic in their focus on just two agents. In nearly every case, there are many other research elements around the world that have played their part in establishing the existing knowledge base and being corresponding elements in the wider information system in which any particular research activity is taking place.

Possibilities for Bias

The essentially judgmental nature of much impact assessment has been noted, if not definitively established. Many aspects of science are highly judgmental and agricultural research is no exception. Investigators of impact have to seek advice from the different actors in the research systems and must be aware of the fact that their informants may well be biased for all sorts of good human reasons.

Of course, the impact assessors themselves can be biased and need to be alert to the likely impacts of such bias both on their findings and on the credibility of their findings.

Particularly when an outside body is seeking assessment of the results of their investment in research, it will be important not only to be unbiased but also to be seen to be unbiased. Bias is a rather subjective thing but some primary possibilities for at least being seen to be unbiased can immediately be identified.

In international comparisons of agricultural research productivity, there is a potential national element that can work in two ways. In the recent impact study of the Consultative Group on International Agricultural Research (CGIAR) institutions, for example, an attempt was made to involve national authorities as much as possible in the assessment of what the CG system had done for the progress of agriculture in their respective countries.

Such a strategy has the advantage of increasing the face validity of investment in international initiatives in research to critics of this sort of investment. Needless to say, it does not avoid the difficulties that having "local" observers assess "local" effects may well be driven by other considerations that lead to biases that may be positive or negative in terms of assessing impact. As the architects of this particular impact study, we are unrepentant about our strategy of pursuing such an approach to at least minimize the positive international bias that may otherwise have arisen. Our major regret relates to other aspects of our model.

In spreading a given quantum of resources around a number of country case studies with this orientation (about 30), we necessarily had to make many compromises relative to depth of analysis. Even hiring a national to study the impact of the CG system in a designated country does not make it feasible within a few months to investigate all the subtleties of the human relationships involved nor even to do a decent job on econometric measurement of any productivity effects that may, in principle, be measurable.

Conclusions

To judge the value of an impact study, it is necessary, in turn, to look at the possible impacts of such a study. This may have elements of an infinite regress but it is surely relevant to assessing the benefits relative to the costs of any such study.

The indicated diversity of types of impact studies means that there can be no simple generalization about the impacts of such diverse studies. It is surely important for research managers to keep a close eye on what is happening with their research products if they are going to manage the conduct of research in any useful manner. At the other end of the spectrum, what benefits can flow from an impact study?

There have been many studies of returns to research in agriculture. These tend to be rather simplistic impact studies focused on gross productivity gains and the gross costs of the research programs that are presumed to have led to such productivity gains. Such studies have probably been quite important in the wider political process of generating support for continued investment in public agricultural research. There is no controversy over whether or not most agricultural research constitutes an almost pure public good or whether there is an unequivocal case for public involvement. What is not so clear is the extent of returns on such investments. The studies conducted indicate significantly large positive returns, and notwithstanding the representativeness of such studies, these results may well have led to some of the strong continued support from investors in agricultural research,

whether they be industrial or developing countries, the World Bank, or other international agencies that assist in providing the wherewithal.

It is a moot point just how representative such studies are. There is naturally a strong incentive for investigators to seek out research enterprises that have been relatively productive. It is not clear that there are any significant rewards for identifying that there are significantly large negative returns to particular agricultural research investments. Such situations, however, surely exist.

Documentary evidence on the impacts of impact studies is difficult to come by. We have observed (needless to say, with more than passing interest) the fallout from the impact study of the CG system for 1984-85. Part of the process of this study involved close interaction with the institutions being studied. During the study, comments received on the role and effectiveness of the various centers were shared with them for comment as part of the process of attempting to validate or disprove each reaction received. Some of these comments were quite critical of particular aspects of the way that the centers functioned, and it was interesting to see the constructive manner in which the centers took action in response to these heightened perceptions of their methods of operation.

Some if the issues involved were quite broad, involving the need to adapt to a more developed infrastructure in many developing countries and to upgrade the services provided by the centers. Many changes were implemented to modify the diverse working arrangements between centers and countries. The accentuated recognition that times had changed since the mid 1960s in terms of the needs of many countries was quickly translated into a concrete program of new activities.

Even the claims implicit in the previous two paragraphs about the impact of our impact study may be too immodest because the centers, as always, have been responding simultaneously to many influences beyond our study. Perhaps we must forever remain ignorant of our impact. Perhaps the main impact will be through the main study document by Anderson, Herdt and Scobie (1988). Since this was published only in late 1988, it is surely too early to try to assess its impact.

Reference

Anderson, J. R., R. W. Herdt and G. M. Scobie. 1988. *Science and food: The CGIAR and its partners*. Washington DC: CGIAR and World Bank.