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*Evaluation
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Proceedings of a Workshop Held in
Singapore, 7-9 July 1986***

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Abstract

Interest in the potential role of evaluation in improving the management of research is growing. The use of evaluation, however, is probably one of the weakest areas of management at present. Although, there is a large body of literature on evaluation methodologies and the procedures for carrying out evaluation, little has been published on what evaluative information managers require and how this information can be most effectively gathered in a national research program. What resources should be devoted to ex ante assessment, monitoring, and ex post evaluations?

This workshop, held in Singapore on 7-9 July 1986, examined a number of case studies that document the present level of evaluation activities in different national programs and institutions. Participants used this case study material and their practical experience to reach consensus on some aspects relating to the different uses and users of evaluation, the role of evaluation in the planning process, and how to organize and implement an evaluation program in different types of research organizations. One session was devoted to reviewing the evaluation activities of external donor agencies. An alternative approach was suggested that would be more effective in the long run to both national programs and donor agencies. Areas of further collaboration between national programs related to training and impact studies were identified.

Résumé

On s'intéresse de plus en plus au rôle que pourrait jouer l'évaluation pour mieux gérer la recherche. Pourtant, l'évaluation est peut-être l'un des outils les plus négligés en gestion aujourd'hui. Bien qu'il existe une importante documentation sur les méthodes d'évaluation et sur les règles à suivre en la matière, peu d'auteurs ont abordé la question des besoins d'information des gestionnaires concernant l'évaluation, ni celle de savoir quel est le meilleur moyen de rassembler cette information au sein d'un programme de recherche national. Quelles ressources doivent être consacrées aux estimations, aux suivis et aux évaluations rétrospectives?

Un atelier, tenu à Singapour du 7 au 9 juillet 1986, s'est penché sur un certain nombre d'études de cas qui illustrent bien les activités d'évaluation qui ont cours dans les différents programmes et instituts nationaux. Les participants ont utilisé les informations rassemblées dans ces études de cas, y ajoutant leur propre expérience pratique, pour se mettre d'accord sur certains aspects tels que les différents objectifs de l'évaluation et ses divers usagers, le rôle de l'évaluation dans la planification, et la façon d'organiser et de mettre en place un programme d'évaluation dans divers types d'organismes de recherche. Étant donné que les agences subventionnaires étrangères sont à l'origine d'un grand nombre d'études d'évaluation, une session entière de l'atelier leur a été consacrée. On a suggéré une nouvelle approche, plus efficace à long terme, tant pour les programmes nationaux que pour les agences subventionnaires. On a aussi déterminé de nouveaux domaines de collaboration entre les programmes nationaux intéressés par la formation, d'une part, et les études d'impact, d'autre part.

Resumen

El interés en el papel potencial de la evaluación para mejorar la administración de la investigación, es creciente. Actualmente, sin embargo, el uso de la evaluación es una de las áreas más débiles de la administración. A pesar de que existe una literatura voluminosa sobre metodologías de evaluación y procedimientos para llevarla a cabo, poco se ha publicado sobre qué información evaluativa requieren los administradores o cuál es la manera más eficiente de recopilar esta información en un programa nacional de investigación. ¿Qué recursos deben dedicarse a las evaluaciones previas, a los controles y a las evaluaciones posteriores?

Este taller, celebrado en Singapur del 7 al 9 de julio de 1986, examinó una serie de estudios de caso que documentan el nivel actual de las actividades de evaluación en diferentes programas e instituciones nacionales. Los participantes aprovecharon este material de estudios de caso y sus experiencias prácticas para lograr consenso sobre algunos aspectos relacionados con los diferentes usos y usuarios de la evaluación, su papel en el proceso de planificación y la manera de organizar y ejecutar un programa de evaluación en diferentes tipos de organizaciones de investigación. En vista del alto número de evaluaciones que se comisionan, se dedicó una sesión a revisar las actividades evaluativas de los organismos donantes externos y se sugirió un enfoque alternativo que a la larga sería más efectivo tanto para los programas nacionales como para los organismos donantes. También se identificaron áreas para mayor colaboración entre los programas nacionales en relación con la capacitación y los estudios de impacto.

Contents

Foreword v

Acknowledgments vii

Summary 1

Introduction 3

Conclusions 13

Evaluation in Agricultural Research Systems 15

Evaluation of Agricultural Research in the Philippines

Aida R. Librero, Ramon V. Valmayor, and Maripaz L. Perez 17

Evaluation of Agricultural Research in Southern Africa

M.L. Kyomo, A.L. Doto, and C.L. Keswani 32

Need for Evaluation: Uses and Users 39

Institutionalizing Review and Evaluation in National Agricultural
Research Systems *S.W. Sadikin* 41

Evaluation of Research in Indian Agricultural Universities *A. Appa Rao* 46

Evaluation of Agricultural Research in Thailand *Kamphol Adulavidhaya,
Rungruang Isarangkura, Preeyanuch Apibunyopas, and Nittaya
Dulyasatit* 51

Role of Evaluation 63

Evaluation of Agricultural Research in Colombia *Hernán Chaverra G.* 65

Agricultural Research Evaluation in Latin America: A Literature Review
Santiago Fonseca Martínez 80

Organization and Implementation 91

Evaluation in the Malaysian Agricultural Research and Development
Institute *Mohd. Yusof bin Hashim and Encik Samion Haji
Abdullah* 93

Evaluation in the Indian Council of Agricultural Research *R.M. Acharya* 99

Evaluation of Agricultural Research in Indonesia *Ibrahim Manwan and
Barry Nestel* 114

Maximizing Benefits from External Evaluations 125

Donor Evaluations: What Is and What Could Be *Robert J. Berg* 127

Agricultural Research in Peru *Victor Palma* 140

Evaluation in the Caribbean Agricultural Research and Development
Institute *Samsundar Parasram* 151

Participants 161

Agricultural Research Evaluation in Latin America: A Literature Review

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This study identifies the present state of agricultural research evaluation in Latin America, based on a review of the literature on this topic which only began to appear in 1970. The sources consulted to identify available literature for each of the aspects of the research process and the impact of its results are mentioned.

The compiled information is analyzed following the elements that make up the research process and its interface with the productive system, followed by general conclusions and recommendations.

Most of the titles compiled refer to studies on technical change and the modernization of agriculture including ex post evaluation. These studies look at the economic benefits and use different methodologies to determine the profitability of research, which in most cases is quite high in comparison with other activities. In contrast, there is very little literature on the social impact or influence of research on agriculture.

With regard to ongoing evaluation of the research process, again there is little published information available and there are large gaps. The stress is on the lack of monitoring procedures, the lack of methodology to evaluate scientific results, the need to regulate periodic technical meetings and reports, and the urgent need to propose adequate models to institutionalize this function. Also, very little has been published on ex ante evaluation in Latin America.

The general topic of research evaluation is relatively new, especially in the field of agricultural research in Latin America. The discussion on evaluation began indirectly once studies were carried out on technical change and the modernization of agriculture. The need for evaluation was clear when research funding was restricted and when the practical implementation of the results of research began to be questioned.

This study approaches the topic by considering

some questions used as guidelines in analyzing the literature. At what level is the evaluation carried out and by whom? When should it be done? What is being evaluated? At what cost? What is the usefulness of the results? What are the main difficulties or limitations in carrying out the evaluation?

The titles reviewed are very specific to areas and products. Several of the articles refer to the economic impact of technical change in agriculture as an indirect form of evaluating research results; however, it was not possible to find material on certain aspects of those questions. Conclusions and recommendations are also presented on the literature review and on the topic of institutionalized evaluation of agricultural research.

The literature review in general permits a rapid overview of the present state of development in the field with regard to the conception and models used in agricultural research as well as to identify some trends and gaps. A deeper analysis, however, would require a new study.

Research Infrastructure

Research on agriculture and livestock in Latin America, dating back to the middle of the last century, began to institutionalize in the late 1940s with the establishment of specific divisions for the generation of technology within the respective ministries, mainly of agriculture. At the same time, advanced academic training began essentially in the United States, with the participation primarily of agronomists specializing in plant pathology and plant breeding. The guidance received by those who later headed research in their countries, was reflected in their respective institutions.

The 1960s were characterized by the setting up of decentralized, autonomous public agencies responsible for research. Later the majority of the countries established autonomous institutions devoted mainly to agriculture and livestock research. From the beginning, most of the new agencies institutionalized the planning function, which was in general coordinated by an office directly responsible to the highest echelons of the institution.

By the end of the 1960s and the beginning of the 1970s, these institutions reached a high point of development. By showing their management efficiency and the impact of their results, they received the necessary backing and gained appropriately trained personnel. This backing, however, also brought additional functions that were in some cases related to research, as extension and transfer of technology, but, in other cases, these functions were broader, covering promotion, development, technical assistance, and activities such as sanitation or quality control.

In the second half of the 1970s, these institutions began to deteriorate. One of the reasons was because of the world financial crisis, which brought with it a shift toward improved planning and priorities in research. At the same time, international financial institutions (the International Bank for Reconstruction and Development [IBRD] and the Inter-American Development Bank [IDB]) began to invest in this field.

The development of agricultural research in the region, the background and the institutionalization process, and the in-depth analysis of the factors directly related to that process, such as the question of specialized personnel, are all topics that have been dealt with by various authors. Especially noteworthy in this field are the efforts of the Inter-American Institute for Cooperation on Agriculture (IICA) with its research cooperative project on agricultural technology in Latin America (Proyecto Cooperativo de Investigación sobre Tecnología Agropecuaria en América Latina [PROTAAL]).

From a review of the articles on the development of this field in the region, some noteworthy facts can be found relating to evaluation, the central theme of this paper. For example, the planning function in autonomous research agencies of the region was institutionalized almost from the start, and it was concerned with priorities and allocation of resources.

Agricultural research evaluation, however, is a relatively recent function that has not yet been institutionalized in the region. This was one of the main concerns in looking at the literature on the state of the art in this field in Latin American countries.

Development of Agricultural Research Evaluation

The interest about evaluation of agricultural research in Latin America is more recent than it is on a world level, and even at that level it is fairly recent. Before 1960, this function was almost totally undiscussed. It should be stated that information on evaluation was closely related to technical change and the economic impact in the majority of the initial documents. Ruttan (1982) summarized studies that analyzed the contribution of agricultural research to the growth of productivity in the sector. This information showed 30 titles and only one is dated before 1960. Ohayon (1983) reviewed 81 titles, of which only one was published before 1960, 29 during the 1960–74 period, 36 between 1975 and 1979, and 15 between 1980 and 1983. This bibliographical review covers several areas and focuses on Brazilian institutions and industrial research centres. It gives a general idea of evaluation in projects covering the

field of science and technology in industry. Ohayon also states that the main reason for the increase and the success of recent evaluation studies are the growing interest in setting national development goals, the need for the practical applications of research results, and the interest to find rapid solutions to socioeconomic challenges. Lindarte (1985) reviewed 89 references for the period 1932–85.

The titles quoted by these three authors give an idea about when publication began at the world level. From the end of the 1950s publication increased, especially in the last 10 years. In Latin America, this activity began during the 1970s and intensified toward the end of that decade.

These brief notes on the historical development of evaluation are complemented by reference to a number of regional events at which papers related to the topic were presented. The first, mainly directed at the economic aspects of evaluation, was an international seminar on the "Evaluation Methodology for Agriculture and Livestock Development Projects" held in Montevideo, Uruguay, in 1976 and sponsored by IICA. A workshop for the English-speaking Caribbean was held at Port-of-Spain in 1981 on the "Organization and Administration of Agricultural Research." In cooperation with Yale University, the Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), organized a workshop on "Socioeconomic Evaluation Methodology in Agriculture and Livestock Research," which was held in Brasília from August to September 1983 and included the presentation of 35 papers. Finally, reference is made to the "Consultation of Experts on the Supervision and Evaluation of Agricultural Research in Latin America organized by the Food and Agriculture Organization of the United Nations (FAO) at the end of 1983 and held in Santo Domingo, Dominican Republic. The foregoing statements show that on both the world and regional scale, evaluation is a relatively recent function within the institutionalization process of agricultural research.

Compiled Bibliography

The main objective of this study was to inquire into the present state of evaluation of agricultural research in Latin America, the trends to fulfill this function, and the main topics being discussed in the region.

To meet this objective, information was requested from various known sources and a visit was made to several institutions in Brazil, Colombia, Ecuador, and Peru. During this visit, documentation on evaluation was compiled and general discussions were held on the activities of follow-up and evaluation of research results.

The search for documents stressing the Latin American content concentrated on the last decade, because this topic is one of relatively recent discussion. With the cooperation of bibliography experts of IICA (Bogotá) and the Colombian Agriculture and Livestock Library (BAC), a number of sources of information were chosen and listings requested according to a developed profile. This section describes these sources and gives a summary of the findings.

Sources

After a quick initial survey about agricultural evaluation and local consultation, information was requested from the following sources:

(a) The Inter-American Information System for the Agricultural Sciences — (AGRINTER) data base through the selective dissemination of information system of BAC in Tibaitatá and the statistics and biometry section of the Instituto Colombiano Agropecuario (ICA);

(b) The International Information System for Agricultural Sciences Technology (AGRIS) in Vienna;

(c) Bibliography prepared by the Inter-American Centre of Agricultural Documentation and Information (CIDIA), Orton library, Turrialba, Costa Rica;

(d) Documentation services of the communication and information unit library of the International Centre for Tropical Agriculture (CIAT);

(e) Available listings from the Information Retrieval Service (IRS);

(f) Bibliographies available in documents by other authors, especially Lindarte (1985), Ruttan (1982), and Ohayon (1983); and

(g) Materials compiled directly in Brazil, Colombia, Ecuador, and Peru, all available at the Programa Colombiano en Administración de la Investigación Agraria (PROCADI) (Colombian Agrarian Research Management Program).

Before requesting material from the different sources, a profile was drawn up to allow for the recovery of the greatest number of titles on the topic of agriculture and livestock research evaluation with Latin American content. In the cases of AGRINTER, AGRIS, and CIDIA, the descriptions used were key words already established in AGRINTER's list, such as agricultural research, evaluation, impact, profitability, technology, policy, program, project, and finally the areas of management and planning.

The request to CIAT was broader and included management and research evaluation in general, trying to direct the search to Latin America. In the case of the IRS, the listing was already available and originally it used the following fields: agricultural research, monitoring and evaluation, methodology,

indicators, technique evaluation, review of priorities, cost-benefit, etc.

The literature quoted by other authors required no profile; however, it should be noted that it corresponds to the specific interest of the authors, and, in this case, the bias is toward the economic impact or benefits from research. The last source was the documents compiled at the institutions of the four countries visited. An effort was made to ensure that this material was representative of what was most recently being done in this field.

Bibliographic Production From Sources

AGRINTER

AGRINTER's listing had no summaries and covered 78 titles. All but one of the references had information on Latin America, and the list covered the years 1975–82. On this list, 17 of the 78 documents can be placed within the parameters of the topic of this study, i.e., agriculture and livestock research evaluation. The remaining 61 titles can be classified into commission or mission reports (about 15) with the majority referring to specific activities or prefeasibility studies and management (about 10). The rest covered project design and formulation for production and development, operational plans, yearly reports, and evaluation of products. Seven out of the 17 titles directly related to the topic could be classified as economic evaluation and six as technical evaluation of research results. The rest deal mainly with the establishment and organization of research evaluation programs and their problems and limitations. Several of them, eight out of 17, were papers given at regional seminars or conferences, most of them at the seminar the "Evaluation Methodology for Agriculture and Livestock Development Projects" held in Montevideo, (Uruguay), in 1976. Finally, of the 17 articles identified in AGRINTER's listing, 76% correspond to the years 1976 and 1977.

AGRIS

The AGRIS listing, without summaries, covered 144 titles, all on Latin America for the period 1974–84. The majority of these titles were from the years 1979 and 1980. Of the 144 documents, only 22 correspond to the topic of agriculture and livestock research evaluation. From the rest, 38 were related to yearly reports of country missions. They also included the costs of production of certain products, prefeasibility studies, technical behaviour of varieties, and the use and dissemination of technology as well as general programming aspects, yearly or 5-year plans, and research organization.

More than half of the 22 titles directly related to the topic could be classified as evaluation with attempts to measure the financial return and impact

of technological change. Several of the documents were given as papers at regional meetings and seminars.

CIDIA

The bibliography without summaries prepared by CIDIA covered 23 titles, all Latin American for the period 1967–84. Only one title, however, dates before 1975. Of the 24 documents, 19 fit the parameters of this study. But it should be noted that most of them were papers presented at three events: (a) a seminar on the “Evaluation Methodology for Agriculture and Livestock Development Projects,” held in Montevideo, Uruguay, 1976; (b) a seminar on “Organic-Administrative Aspects of Agrarian Research,” held in Lima, Peru in 1979; and (c) the “Consultation of Experts on the Supervision and Evaluation of Agricultural Research in Latin America,” held in Santo Domingo, Dominican Republic in 1983.

The titles from the CIDIA bibliography are in general oriented toward showing the benefits of the systematization of the evaluation function to improve research planning and to analyze the financial aspects or impact of technical change.

CIAT

CIAT's bibliography, in general with summaries, covered a total of 146 titles, of which 48 are Latin American. The information covered the years 1967–85, with a concentration of titles in 1977–83. The 48 references with information on the region deal with evaluation aspects and with management and organization of agricultural research. Several of the documents covered topics in other fields, some bearing little relation to this study.

Of the 48 titles with Latin American information, about 50% (26) were identified in the field of agricultural research evaluation through their summaries. The majority of the 26 titles were related to aspects of economic evaluation of agricultural production or technological change. Some deal with cost-benefit analysis or with its theory and evolution. There are some titles on topics such as the design of research projects, aspects related to investment and preinvestment, mechanisms for adoption of technology, and indexes and measures of economic efficiency and social benefits based on rates of return on investment.

IRS

The IRS listing covered a total of 65 annotated references, of which only nine referred to Latin America and covered the period from 1973 to 1982. This listing contains mainly materials from the years 1980 to 1982 (26 titles) and was requested by FAO in 1983 during preparations for the meeting “Con-

sultation of Experts on the Supervision and Evaluation of Agricultural Research in Latin America” held that year in Santo Domingo.

On a world scale, the majority of the 65 titles concentrated on the field of evaluation, both of research results such as the impact of technology and of the socioeconomic benefits of technological change. A few concentrated on topics such as the distribution of benefits, surpluses, production and simulation functions, rates of return, and the impact of technological change. Seven articles were chosen within the parameters of the study.

Bibliography/Other Authors

Information already analyzed was used. Lindarte (1985) reviewed a total of 89 titles, of which 26 correspond to Latin America and 21 titles are directly related to the theme of this study. This bibliography covered the years 1932–85, with 56 of the references published during 1975–85. The majority of the articles are directly related to the author's topic, the economic evaluation of agricultural research.

In his book *Agricultural Research Policy*, Ruttan (1982) analyzed 30 titles on the productivity of agricultural research, 13 titles dated between 1960 and 1974 and 17 between 1975 and 1979. The review covered the period 1958–79. One of the first pioneering studies on the economic evaluation of agricultural research was that by Griliches (1958). All of the studies correspond to the topic, seven of them are on Latin America and cover the years 1970–78. These titles were classified by the author under two categories: indexed numbers and regression analysis. The majority of the Latin American studies fell under the former.

Materials Compiled for this Study

Materials were compiled for this study during the visit to Brazil, Colombia, Ecuador, and Peru. This documentation is available at PROCADI's headquarters and includes 75 titles, all directly related to the evaluation of agricultural research in those countries. They cover the period from 1976 to 1985, with a concentration on the later years, and all the materials contain information on Latin America.

More than half of the titles are from Brazil. Colombia follows in the number of documents, then Peru, and finally Ecuador. The majority of the Brazilian material was produced by EMBRAPA, and 10 of them are related to impact evaluations based on the results of rate of return estimates. Others deal with the evaluation of research results, especially with regard to personnel training at the institute. In the Peruvian case, six documents were compiled, mainly from the Instituto Nacional de Investigación Promoción Agropecuaria (INIPA). Four are related to the organization of the Institute's activities and functions,

among them monitoring and supervision of research activities, the other two documents deal with the evaluation of the impact and profitability of research investment.

In Colombia, ICA has intensified its actions on evaluation and monitoring of agricultural research. Two documents should be noted. One to organize all the planning activities within the Research Office, including formats for project design and monitoring, the other, to institutionalize economic evaluation of agricultural and livestock research.

Summary of Regional Bibliographical Production

The literature on evaluation concentrates on the aspects of the economic impact of technical change in agriculture and on the importance of institutional structures of research and development in the modernization of agriculture. In general terms, the approach used in these studies is based on the pioneer work of Griliches (1958). Studies with Latin American information begin in 1970 with Ardito Barleta's thesis using Mexican material; Ayer's thesis in 1972 on cotton in Brazil; and Ardila's thesis in 1973 on rice and Montes' on soya, both derived from Colombian information. Based on these titles, there is a 15-year lag between documents published on a world scale and those with Latin American information on agricultural research evaluation.

Although it was possible to compile a total of 409 titles with Latin American information, it should be noted that only 181 of the 409 were chosen (45%) as pertinent to this topic (Table 1). Several of the Latin American titles related to theses for higher academic degrees, corresponding to universities in the

countries generating the information and in U.S. universities. These results were later published, and they are quoted by various sources.

With regard to the personal compilation of materials in the four countries, the effort being made by EMBRAPA is especially clear over the last 5 years. There are three teams involved with this topic, each of them with specialized personnel, several of them with PhDs, and they are integrating their efforts to carry out evaluation activities on institutionalized research.

After EMBRAPA, which produced almost 50% of the materials compiled, comes the Colombian effort with ICA's intentions to progress in this field. Both INIPA in Peru and the Instituto Nacional de Investigaciones Agropecuarias (INIAP) in Ecuador are at the reorganization stage and have little material available. It is interesting to note that a large part of the materials compiled for this study corresponding to the years 1982-85 has not reached the data bases of the sources consulted. Finally, it should be stressed that the majority of the documents consulted, as well as the materials compiled, concentrated on the economic impact of technical change in agriculture as an indirect form of evaluating research results.

Information Analysis

The documents compiled in person make up a list of 75 titles, a copy of which is available on request from the author. Twenty-eight were chosen for deeper examination, and most are included in the bibliography at the end of this paper. From those titles, almost all of the 28 were published between 1982 and 1985. One-third refer to project evaluation and

Table 1. Sources, number of titles, and periods covered in articles published on agricultural research evaluation.

Source ^a	Total references		Latin American references		Documents consulted and bibliography
	Number	Period	Number	Period	
AGRINTER	78	1975-82	77	1976-81	17
AGRIS	144	1974-84	144	1974-84	22
CIDIA	23	1967-84	23	1976-84	19
CIAT	146	1967-84	48	1970-84	26
IRS	65	1973-82	9	1973-82	9
Lindarte	89	1957-85 ^b	26	1972-85	21
Ruttan	30	1958-79	7	1970-78	7
Compiled ^c	75	1976-85	75	1976-85	75
Total	650	1957-85	409	1970-85	196 ^d

^a AGRINTER (Inter-American Information System for the Agricultural Sciences), AGRIS (International Information System for Agricultural Sciences Technology), CIDIA (Inter-American Centre of Agricultural Documentation and Information), CIAT (International Centre for Tropical Agriculture), and IRS (Information Retrieval Service).

^b Only quotes one article from 1932, the rest of the information covers 1957-85.

^c These are the documents consulted appearing in this study for which 28 have an entry card.

^d This grand total is reduced to 181 when duplicates are eliminated, and 75 appear as consulted documents found at the Programa Colombiano en Administración de la Investigación Agraria (PROCADI).

the rest to evaluation of institutions, and programs on specific topics. The majority of the documents are from EMBRAPA and nearly all refer to ex ante evaluation. They also refer as much to internal as to external evaluations and, on some occasions, to mixed evaluations. Most of them refer to economic evaluation and profitability, impact, distribution of benefits, and investment and socioeconomic evaluation. Several of these publications address theoretical issues, and others attempt to propose models or rules.

Analysis

A model of the agricultural production process and how the research component fitted that model was proposed in the original Spanish paper. With that reasoning, several elements were identified and were taken into consideration when the search for literature was done. This English version does not include that information, however, those elements were maintained in this chapter for the analysis of the literature review.

Level of Evaluation

Institution It has been stated that institutions periodically review their policies and general objectives to bring them in line with the changing situation that surrounds them. It is interesting to note that the four institutions visited were in the process of restructuring or had carried out recent changes. In the case of Peru, the International Service for National Agricultural Research (ISNAR) had gone on a mission to INIPA; its report was not yet available, however, when this study was prepared. Of the information compiled, only two documents deal with investment and profitability at the institutional level.

At the institution level, there are programs that rather than being evaluated are periodically reviewed. Of the 28 entry cards, seven deal with programs, some of them on extension or technology transfer as well as training. One should stress here the technical reviews, generally done every 5 years, and external reviews being carried out for the 32 International Potato Center (Centro Internacional de la Papa [CIP]) programs through planning conferences.

Latin American literature is scarce on evaluation at the institutional level. International centres have been undertaking external reviews every 5 years organized by the Technical Advisory Committee (TAC) for the Consultative Group on International Agricultural Research (CGIAR). Both the FAO and now ISNAR, are bringing out conceptual materials drawn up to guide program review missions to different countries. As this is a recent activity, it would be interesting to specify methodologies and adapt material of this sort for research institutions of developing countries. Another alternative would be

to start up an institutional self-evaluation plan as proposed by Marcano (1984).

Project The majority of the studies examined refer to this project level, and a good number of them refer to economic evaluations. The experience on this level is undoubtedly greater as both national and international funding agencies, as well as some of the agencies carrying out the research, have made efforts to design, formulate, and develop projects not just for research but also for other activities in the sector. Several international agencies have evaluation manuals for the projects they fund, and, consequently, these evaluations are mostly externally decided. In some cases, periodic evaluations may be established to be carried out during the project, in other words, follow-up or monitoring activities to make the necessary adjustments along the way.

Experiments At the concrete actions or activities level during research, technical monitoring is essentially done by the researcher under the control or supervision of the project director. This level is mentioned only in one title besides the references to the pertinent parts of operating manuals. This is an area that requires greater reflection and possibly more work to document experiences that already exist.

Technical/scientific personnel In general, staffing is covered by the respective personnel offices of research institutions. In the literature reviewed, little was found on this subject. In some of the 60 documents reviewed, the topic of evaluation of training programs is dealt with, especially with reference to academic specialization. In these cases, there was an evaluation or review both of the program and of the impact with the organization of the work carried out by this type of personnel. On a more general level, the PROTAAL group carried out numerous studies on the specialized personnel in several Latin American institutions.

Who Evaluates?

Internal This evaluation is generally carried out by the personnel who executed research and, normally, they are from the same institution but are involved with other projects or programs. Several of the articles reviewed deal with this topic from the point of view of supervision or technical monitoring of research. Although these authors agree in stressing the monitoring strategy, such as periodic meetings and reports, as a means to measure results, neither meetings nor reports are sufficiently regulated and enforced to fulfill the objective. International centres have been doing this at their yearly programing meetings.

Apart from the effort proposed by Marcano (1984) on institutional self-evaluation, little or nothing has

been done with regard to internal program and institutional evaluation. This is one of the areas where methodologies and strategies should be proposed to help the institution and its programs adapt to the changing needs of the environment they work in. Training of personnel in this type of evaluation is also lacking.

External The review of programs and the evaluation of projects funded by agencies other than those performing the research is usually carried out by external missions. The most interesting case examined was that of the planning conferences at CIP where a panel, with a number of renowned scientists selected from within each field, meets every 4–6 years to formulate recommendations and produce a report on the respective program. The majority of the evaluation studies on production or on impact are carried out by independent consultants. ISNAR has issued guidelines for external evaluation drawn up for its review missions. FAO also has its manuals and instructions on the subject.

When is Evaluation Carried Out?

Ex ante In general, ex ante evaluation studies are more recent than ex post. The former correspond essentially to conceptual and theoretical frameworks that are later tested as models against selected information. Of the literature reviewed only one refers to ex ante evaluation and it examines several models with studies under way in Brazil.

Most research funding agencies, both international and national, carry out some type of ex ante evaluation to decide which project to fund, especially when there is a range to choose from. In Colombia, a guide to project formulation has been drawn up considering this kind of evaluation. Ex ante evaluation is both recent and theoretical and this is why within this review there are so few articles on the subject.

Ongoing evaluation While a project is being executed, there is evaluation or rather monitoring. This type of evaluation is more technical than socioeconomic in nature and is carried out either by the researcher or by the project director. In this review of the literature, few documents dealt with this activity.

In general, these articles correspond to internal program analysis or project execution. They reflect on the need to review periodically what is being executed to introduce necessary changes in a timely fashion. Other studies mention the work of periodic technical meetings and reports. Some operations manuals deal with this subject and recommend the reports as the unit of measurement but do not regulate them.

The task of evaluation or monitoring of projects overlaps with internal evaluation, because it is es-

entially a technical evaluation carried out almost exclusively by the researchers themselves. Reports should be both on a regular basis and written in such a way as to facilitate the evaluation process. Once more, CIP's experiences in this area should be utilized.

Ex post Once the project or activity has been completed and the results disseminated, the evaluation or measurement of its effects or impact begins. In general, this only takes into account effects already caused. Although, as in the case of hybrid maize, these evaluations are frequently supplemented with estimates of the impact or effect that will take place after the evaluation. Furthermore, as already stated, the results of ex post evaluation become indicators that assist in the decision-making process and in setting priorities to determine which projects should be carried out. In this case, the results of this evaluation become ex ante.

Most of the documents reviewed belong to this category and concentrate on aspects of the economic impact of technical change in agriculture as well as in the effect of the institutional research and development structure in agricultural modernization. In general, these studies follow the economic approach of neoclassic theory, based on the handling of concepts such as production functions, index numbers, and consumer and producer surplus.

What is Evaluated?

Scientific knowledge The evaluation of research results on a scientific and academic level is difficult and is generally carried out by peer reviews either at scientific meetings or through publications in well-known journals within the scientific community. An indicator, therefore, to evaluate the quality of scientific knowledge, both of an institution and of a researcher, would be the number of articles published in recognized scientific journals. This system as used in developed countries would have to be adapted to fit within the context of regions where little is written because of the lack of publishing means. Furthermore, the incentive of traveling to deliver papers at meetings is increasingly complicated by bureaucratic paperwork in the official agencies of all countries and by the limited resources for this activity.

One of the articles reviewed deals with the quality of research. This type of evaluation is increasingly important in view of the growing volume of activities at the respective institutions and the growing public interest shown in this field. The authors recognize the complexity of the issue and have used a quality index obtained through employing a methodology for classifying quality into good, medium, and poor categories. This paper establishes indexes of agreement and visibility and concludes that having examined the different forms of validation, evidence

suggests that the quality index does effectively measure the quality of research.

Apart from the work already noted, there was no information reviewed on the evaluation of scientific knowledge produced from projects during the research process. It should be noted, however, that several of the documents not chosen for detailed study referred to the evaluation of genetic material and the review of methodologies.

Technological results After research is done, the first phase is the contact between the recommendations and the target (productive) environment. Adjustments are generally done here at regional trials that are carried out with the advanced material preselected by the researcher. In some cases, the farmer participates in the evaluation and selection of that material.

The majority of the documents take research results into account once they are in the productive phase, a point far from the culmination of research execution, and after considering other factors such as inputs to permit the fullest possible use of the results of research. The control of researchers over their results, however, has been almost totally lost.

Technological results are reported on in publications, based on records of programs or journals of the institute. This type of document, such as yearly reports, which primarily inform on research progress, was not examined in this study. These results can also be presented as technical evaluations of new materials generated by research. Certain evaluations take place during the annual monitoring meetings, but, as already mentioned, these should be organized in such a way as to allow a periodic evaluation of the results presented at such meetings.

Dissemination of technology Although several authors note the importance of the transfer of technology in the dissemination of information, only three attempt to measure the cost of this stage and the increase in benefits. This is a transitional stage between the research process and production. A good recommendation that is not disseminated will have no impact on production, just as a good recommendation that does not use appropriate channels will not reach the producer. The means of diffusion may limit or delay the dissemination of good recommendations that have already been tested at the producer level.

In Peru, specifically designed questionnaires are being used in several regions to measure the impact of research recommendations. The questionnaires were designed to measure the influence of the extension system in the task of disseminating the results; however, no analysis of the first results has been completed as yet.

The efficiency of dissemination or transfer of research results can also be measured through rural

development projects. In this case, it is necessary to calculate the relative weight of technology against other components that influence development.

The issue is a complex one, as is the model to measure the contribution of the dissemination stage to the final contribution of the technical change. Without valid recommendations from research (technology), it is difficult to justify a technology-transfer system, but, at the same time, without this channel, technology will take far longer to reach the process of production. There is a relationship of mutual dependence, and it is difficult to find a model that will separate their respective contributions. This field is open to further study and is an area where communication channels and message design are very important, as is counting on the appropriate technology to transfer.

Impact For the purposes of the literature review, this study has differentiated between the economic impact and the improvement in the producer's welfare as a result of the introduction of research recommendations into the production process. Most of the evaluation studies reviewed concentrate on the aspects of the economic impact of technical change in agriculture and the importance of institutional research and development structure in the modernization of agriculture. These studies, with objectives other than evaluation of the research process itself, have generated valuable information on the profitability of investment in this activity. These results have been important in resource allocation for research.

Although several of the papers on the economic impact also deal with the distribution of benefits, they do so at the macro level, in other words, at the national or regional level, and in most cases use the concept of an economic surplus.

The papers reviewed have produced precise and valuable information on, for example, the rates of return on investment. These results, however, are precise only for very specific periods and for just a few products. Although models have been designed to cover many of the factors that affect technical change, these models are very complex and are difficult to handle, especially within the tropical environment of developing countries. Less complex models, however, cannot cover all the spheres of influence and, therefore, to the unprepared observer, especially coming from the biological sector, these studies give the impression of being ad hoc. A contributing factor is that this field has been more of an area for individual research or small teams carrying out single or isolated studies.

In contrast to the abundant literature on the economic impact, literature on the effects of research results on the producers' welfare, especially those within the peasant economy, is rare. Some of the

articles on rural development projects deal with this subject. Tobon (1985) measures change with indicators such as surface area covered with technical assistance, hectares under cultivation, yield per hectare, number of users attended, and net income per family and credit granted.

Tobon's (1985) work also proposes other elements to measure impact. One could be institutional or the contribution of the project to changing the approach to research. Another is a change of attitude at the researcher's level. Finally, the development of that project served to initiate others.

It should be noted that among the documents reviewed no reference was found as to how research results change the quality of life of the producer, nor were there any attempts mentioned to measure that change. Furthermore, it is worth highlighting the fact that the technician/scientist has little direct participation in field production where the economic impact is measured by economists.

Related Evaluation Aspects

Why Evaluate?

Several of the authors reviewed agree in stressing the following important reasons for evaluating:

(a) It is a way to measure whether the objectives and goals originally established were met. To do this it is necessary to begin with clearly defined objectives and measurable goals;

(b) The evaluation results should be fed back into the research process to ensure that the appropriate changes are made if necessary;

(c) Evaluation furnishes financial information to justify the need for resources and a greater investment;

(d) The evaluation information becomes a valuable precedent to establish priorities and resources allocation; and

(e) It keeps research on the right track and offers information that allows the setting of minimum project standards to comply with the objectives, thus contributing to a more efficient process.

What Does Evaluation Cost?

None of the articles reviewed addresses the cost of evaluation. None of them even suggests ways of doing it in the future. Clearly, the first direct cost is the payment of salaries to those who undertake this task. Certainly, there are various indirect costs involved in this work. One that is implicitly but not clearly stated is that of student theses, where students put in additional efforts on their own to finish the task. This is vital to the topic of economic evaluation, because several of the articles reviewed contain thesis information. Another indirect cost is the time researchers devote to these activities and, above all,

the negative impact it can produce on scientific personnel with some evaluation results.

The scarce information points to the high costs of evaluation, but they have not been calculated nor is there any short-term interest in doing so. It would be appropriate to put forward some effort on this topic and analyze its influence.

Information Needs and Evaluation Indicators

Nearly all authors refer to the importance of counting on adequate information, which eases the evaluation process. Within this review, however, very few articles were related to this topic. Evaluation requires valid and up-to-date information, one of the main reasons for recommending computerized information at the institutional level.

Only one study deals with the specific subject of indicators. These should be used for monitoring and evaluation of research. To be functional, they should fulfill such characteristics as precise measurement, a reasonable cost, estimated over relatively short intervals, and allow a high repetition of measurement. Compiling information to determine the indicators poses several problems and, once determined, they are rarely used, especially in the case of agricultural research in Latin America.

Conclusions and Recommendations

The evaluation of agricultural research is a topic that has only recently been discussed. The publication of studies on this subject began in the 1950s in the U.S., whereas Latin American studies can only be found from the 1970s.

Most of the latter concentrate on aspects of the economic impact of technical change in agriculture and on the importance of institutional research structures for the modernization of agriculture.

Evaluation, in contrast to other functions such as planning, has not been institutionalized. Its recognition began indirectly with the studies already mentioned, and became more apparent when financial restrictions for research activities appeared and the scope of agricultural results began to be questioned.

Institutions and programs are both reviewed. The project, as the basic operative unit of research, is evaluated and experiments or activities are supervised and monitored. This study has concentrated on evaluation aspects of research projects. A literature review on the results of these projects has been presented, seeking information on the evaluation of scientific knowledge, technological results, dissemination of results, and the economic and social impact of technology.

This literature review, which included 181 titles

relevant for evaluation, brought to light some interesting aspects. There are areas with large gaps, where either nothing has been done or little has been published. The stress here is on the lack of rules for the monitoring of experiments, the lack of models to evaluate scientific production and technological results, the reduced activity in ex ante evaluation, and the absence of agricultural researchers in evaluation of the economic impact. But perhaps most noticeable of all is the lack of indicators to evaluate changes in the quality of life of the producers. Also it is clear that there is a lack of training programs on research evaluation.

The institutionalization of evaluation in research agencies is an important task that should be undertaken as soon as possible, although this task is complex and slow. To initiate it, three main requirements must be complied with. First, a division of labour by projects, as the operative unit, and these should have very clear objectives and measurable goals. Second, it should be possible to rely on an up-to-date information system that is flexible and timely to provide promptly the necessary elements for decision-making. Third, to carry out this task, the main objective of evaluation should not be to control but to obtain updated information to feed back into the research process. To speed up the institutionalization process some measures should be taken to create a favourable atmosphere among researchers.

To have appropriate information to feed back into the research process it is necessary that all the technical/scientific personnel be directly involved in evaluation activities or, if not, that they at least be aware and interested enough to allow others to be involved. This will certainly necessitate taking the time to convince personnel of the usefulness of the system.

Most research institutions carry out technical meetings and request reports, but little has been done by way of regulating both the meetings and the reports. The former should be organized to permit the monitoring of research progress during the periods between meetings. The latter should follow certain guidelines to facilitate the periodical comparison of information. This is an area where much can be done to improve the efficiency of these events and strengthen monitoring and evaluation activities.

It would be interesting to document how international centres organize and carry out their yearly programming meetings, i.e., an in-house review, and how programs are reviewed or evaluated at those meetings — all of this being done with a view to adapting the methodology to the needs of national research systems in developing countries. It would also be appropriate to adapt the procedures of the CGIAR's 5-year review of international centres to evaluate programs at the national institutions.

The foregoing comments were related to the process and results of research itself. As can be seen from the literature reviewed, however, this is one of the least documented areas, so it will be necessary to intensify efforts and to draw up simple methodologies applicable in the Latin American context. In addition, most of the information refers to evaluation studies carried out at the production stage, where the agricultural researcher usually is not involved. It would be advisable to study strategies that incorporate the researchers to a greater degree in the evaluation of their technological results at the dissemination stage as well as at the production stage.

In conclusion, most of the literature reviewed can be classified as ex post evaluation of the technological impact, in other words, the effect of research results once they have been adopted. There are many gaps in ongoing evaluation, such as the monitoring of research execution and the evaluation of technical and scientific results before they are disseminated. Research evaluation, as a new activity, has a broad scope for action. The review of literature for the region has shown what a very preliminary stage it is at and what its strong and weak points are. The analysis of information has permitted a most realistic diagnosis about this function. To study this topic in greater depth, however, requires more advanced studies in fields where material already exists, initiating studies on areas where materials are lacking, intensifying the exchange of experience among the few technicians already involved in this type of activity, and encouraging greater discussion on how to evaluate. These are aspects on which agreement exists among several research leaders in the region consulted during this study.

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