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Value of External Reviews of Research at the International Agricultural Research Centers

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Abstract

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The Consultative Groups on International Agricultural Research (CGIAR) funds a decentralized system of International Agricultural Research Centers. To monitor the Centers, the CGIAR has instituted a system of program and management reviews. But there is some controversy concerning the proper role, cost, and impact of these reviews. In 1984 we conducted a survey of scientific and administrative staff at the Centers to elicit their perspectives about the benefits and costs of the reviews. We also canvassed the documentation prepared by the external review panels. In this paper we report some of the findings from this study and comment on what we feel is the proper role and scope for external reviews.

In particular, we feel that the efficiency of the review process can be improved if external program reviews focus on strategic issues, leaving peer review functions aside. Greater integration should be sought between external reviews and the internal planning and review mechanisms of the Centers. The successes achieved by this international system of research institutes should lead to considerable confidence about both the system's research and managerial capacity, though not all Centers have achieved uniformly high rates of productivity.

Introduction

It has been repeatedly documented that agricultural research represents one of the more productive investments available to both industrial and developing countries (Anderson, 1985, pp. 12–14; Ruttan, 1982, pp. 241–249). And the performance of the system of International Agricultural Research Centers (IARCs) has more than met the expectations of its founders (Anderson, 1985). To support this growing public sector commitment to national and international agricultural research, a modest program of research on agricultural science policy has developed over the past several decades. This research has tended to concentrate on establishing research priorities and on developing methodology for research resource allocation. Much less attention, however,

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has been given to the issue of organizing, managing and monitoring the performance of agricultural research programs. Research management and the monitoring of research performance is likely to be guided more by rule of thumb, personal insight, and idiosyncrasy than by firmly established and effective principles.

In this paper we investigate the organizational structure of the IARC system and some management, planning, and performance monitoring tools employed within this system and by its umbrella organization, the Consultative Group on International Agricultural Research (CGIAR). In the next section of the paper we discuss the organization of this system of research centers and present some rationale for why we believe the current system, with centralized funding and oversight but with decentralized responsibility for management and planning, is the most appropriate model for a research-oriented organization such as the CGIAR.

We then analyze some operational issues. The major tool for performance monitoring used by the CGIAR is an external quinquennial review, in which a panel of experts is assembled to visit a Center and evaluate its research mandate and program. More recently, this system of reviews has been expanded to include management reviews and special topic reviews as well. We discuss what we feel to be the appropriate role of these external reviews, and how they can be used to complement a Center's own long-range planning mechanisms. In this analysis we draw upon the review reports and Center planning documents, a survey of IARC scientists that we conducted in 1986, and personal interviews with persons who are or have been involved in the CGIAR system in a variety of capacities, including donor representatives, center staff, and review panel members.

Finally, we comment upon the overall impact and cost of these reviews of research, including the external reviews employed by the CGIAR, annual internal reviews carried out by Center management, and occasional reviews carried out by donor agencies. Clearly a quantitative evaluation of the impact of these reviews is impossible, but we do present some qualitative assessments from our survey of IARC scientists. In addition, we present some case material on how the recommendations from these reviews have and have not resulted in new research initiatives. We develop some estimates (which we believe to be conservative) of the costs of these reviews by including both the financial costs of conducting the reviews and the value of researchers' time spent preparing for and participating in the reviews. A relevant question is whether the research activities of the Centers are being 'over-reviewed', particularly in light of the significant accomplishments that have been forthcoming from their research, training, and outreach programs.

Governance and management

The Consultative Group was established in 1971 to provide oversight to the expanding system of international centers (now consisting of 13 research in-

stitutes) for a consortium of bilateral and multilateral assistance agencies and private foundations that provide the funding for the system and determine the overall research policy objectives. Funding for the system grew rapidly as the system was being expanded but has since leveled off at about US$ 200 million annually. Nevertheless, long-range CGIAR objectives have widened substantially in recent years. Initially, policy statements emphasized the need to expand foodcrop production. Over time, issues such as nutrition, employment generation, environmental impact, income generation and income distribution have been given greater weight (CGIAR, 1987).

Each research Center within the system is an autonomous corporate entity. The governing body of the Center is its Board of Trustees, which is responsible for all strategy and policy decisions as well for approving the programs and budgets needed to carry them out. The Board's decisions are implemented by a Director General who is appointed by and responsible to the Board. This combination of centralized oversight and decentralized management and operation is a notable characteristic of the CGIAR/IARC system.

The appropriate model for thinking about the relation between the Consultative Group and the Centers is not the relation between a corporate headquarters and its semi-autonomous operating divisions. A more appropriate analogy is the partially owned subsidiary of a venture capital firm in which the parent corporation is represented on the board of directors but does not directly participate in the management structure. Many major corporations have found it useful to spin off partially owned subsidiaries in order to give them greater autonomy and flexibility. This pattern is most common in research-intensive areas where creativity is highly valuated.

Several very good reasons can be stated for decentralizing responsibility in the planning and management of research intensive organization. One is that a research organization, or any other system in which there is great uncertainty about the relation between effort and outcome, is dependent on redundancy, decentralization, and feedback in the design of its decision processes and for the success of its operations. Our understanding of the importance of redundancy goes back at least to Von Neumann's demonstration that a system can be made more reliable than any of its parts by adding sufficient redundancy (Von Neumann, 1956). Public administrators, however, who typically prefer neat linear organization charts, have been slow to absorb the implications of Von Neumann's insight for the design and management of research institutions.[1]

A second and related reason is the nature of the information that must be

[1]The implications of Von Neumann's theorem on the design of bureaucratic institutions have been investigated by Landau (1969). This principle is also apparent in the work of Sah and Stiglitz (1986) in their comparison of polyarchial and hierarchial decision making in economic organizations and institutions.

brought to bear on the research-planning process. It has become increasingly obvious that effective research planning requires the close collaboration of natural and social scientists and of agronomists, engineers and planners. This is because research resource-allocation decisions involve either explicit or implicit judgment of two distinct questions:

(1) What are the possibilities of advancing knowledge or technology if resources are allocated to a particular commodity, problem, or discipline?
(2) What will be the value of the new knowledge or the new technology to society if the research effort is successful?

The first question can only be answered with any degree of authority by researchers on the leading edge of their discipline or of the problems being considered. Answers to the second question require the use of formal economic and social analysis. Intuitive insights of research scientists and administrators are no more reliable in answering questions about the societal value of scientific achievements than are the insight of research planners in evaluating scientific and technical potential. Many arguments about priorities in the allocation of research resources founder on the failure to recognize clearly the distinction between the two preceding questions and the differences in expertise and judgment that must be brought to bear in seeking responses to them.

Role of external reviews

The link between research policy, strategic planning and performance evaluation is an intimate one. The effective monitoring of research or an effective review process clearly presumes the existence of an unambiguous research policy. In an absence of a clear understanding of the policies and objectives that guide a research system and the research activities of individual Centers, a review team is analogous to a pilot trying to steer a ship without a map, compass or rudder.

In a decentralized management system such as the one outlined above, a research institute needs to have in place an effective internal planning mechanism that will bring together the diverse expertise and information necessary for efficient resource allocation and project selection. These procedures include internal reviews, external peer reviews and consultations, technology assessment and impact studies, and an active program of seminars and symposia.

External reviews such as those commissioned by the CGIAR can serve as a quality 'check' by the parent organization on its subsidiaries. Such reviews can also be used as an analytical tool to help set system policies and research priorities. The review process instituted by the CGIAR is quite extensive (see Table 1). It includes: (a) annual reviews of Center budgets, (b) external program reviews, (c) external management reviews, (d) 'stripe' reviews that focus on an activity, and (e) system reviews. External program and management re-

views of each Center are conducted every 5 of 6 years. Stripe and system reviews are commissioned as the need arises.[2]

Below we describe in detail what we feel to be the comparative advantage and complementarities of internal and external reviews of an institute's programs, and present findings from a survey of IARC scientific and management staff that give their perspective about the adequacy of these reviews on major topical areas. Additional results of the survey are available in Ruttan (1987, appendix 4).

Reviewing disciplinary research. As institutional research seeks solutions to increasingly complex scientific and technological problems, it finds it necessary to draw upon a greater variety and depth of disciplinary capacities. A single review team does not have the range of leading-edge disciplinary or professional experience that is adequate to perform project and peer review functions. Disciplinary and project activity should be reviewed by individuals who are at the leading edges of their field of science or technology development. They usually will not be the same individuals who are best able to evaluate long-range strategies and priorities, i.e., to evaluate relevance rather than competence.

Some perspectives of the IARC staff toward the effectiveness of the reviews are revealed in Table 2. Survey respondents scored each review in which they had participated on a series of topics, including the review's attention to disciplinary research, technology development, training, goals and strategies of the institute, etc. Though most respondents appeared to be satisfied with the reviews, there were a significant number who felt that the reviews were not able to give adequate attention to these issues. There is a definite tendency for the scores to be skewed toward the lower end. Though internal reviews did a bit better than external reviews in their attention to disciplinary research and technology development (over one standard error higher), these differences were not significant at a 10% significance level (i.e. at 1.645 standard errors).

Written comments on several questionnaires revealed sources of dissatisfaction with both internal and external reviews (see Ruttan, 1987, appendix 3). Respondents complained that some internal reviews were superficial in their assessment of disciplinary programs and that external reviews often did not have the appropriate disciplinary representation to review their particular program adequately. This latter criticism reflects a failure to articulate clearly the goals and scope of the external review. Scientific staff often perceive an exter-

[2]The CGIAR has two administrative bodies, the CG Secretariat covering financial and policy matters and a Technical Advisory Committee (TAC) covering scientific matters. The Secretariat has held responsibility for external management reviews and annual audits, while TAC has conducted external program reviews. In this paper, we simply refer to all of these bodies as the 'CGIAR'.

nal review as having a peer evaluation function, and some review members may carry the same perception.

Evaluating goals and strategies. Rather than try to evaluate the scientific quality of an institute's research staff, the external program review team is better suited to assess a Center's priorities and strategies. This means focusing on: (a) the appropriateness of the specific research objectives that the Center has set for

TABLE 1

Reviews of CGIAR activities: description, periodicity, and responsibilities

Type	Description	Output	Periodicity	Commissioned by
Internally managed Center-specific reviews	Internal program reviews, internal management reviews, external peer reviews, impact assessments	Conclusions of internal review; annual report; internal audit reports; management reports; peer review reports; special impact studies	Variable	Board/ Management of the Center
Externally managed Center-specific reviews	EPRs: Review of program relevance, impact and strategy	EPR Report	5–7 years	TAC
	EMRs: Review of administrative and management effectiveness	EMR report	5–7 years	CGIAR Secretariat
Inter-Center reviews	Review of collective efforts of Centers	Review report	Variable	TAC, CGIAR Secretariat, Centers
System-level reviews	Comprehensive system reviews	Review report	Variable	CGIAR
	Priority and strategy reviews	Priorities and strategies document	Continuous, with updates every 5 years	TAC
	Other narrowly-focused reviews: in-depth assessment of specific system- wide issues	Review report	Variable	CGIAR/TAC

itself; (b) the schedule of anticipated research accomplishments; and (c) the staff, facility and financial resources required to achieve the proposed objectives.

Probably the most appropriate time to schedule an external review is when a Center is engaged in a long-term planning effort. At this time, dialogue between a review panel that is experienced in research management and strategy and Center staff who are thinking about the longer term strategic issues could be highly complementary. This view is reinforced by the survey results, which scored external and internal reviews similarly in their attention to the goals

Undertaken by	Reviewed by	Implementation of recommendations	Monitoring of implementation
Center staff and/or consultants	Board/Management of the Center	Center management	Boards of Trustees; TAC/CGIAR Secretariat through EPRs and EMRs
Commissioned panel	TAC and CGIAR	Board/Management of the Center	TAC
Commissioned panel	TAC and CGIAR	Board/Management of the Center	CGIAR; CGIAR Secretariat
Commissioned panel	TAC and CGIAR	Board/Management of concerned Centers	TAC; CGIAR Secretariat
Review committee/ panel	CIGAR	All components of the system	CGIAR
TAC	CGIAR	Board/Management of the Centers	TAC
Review committee/ panel;	CGIAR	Affected components of the system	CGIAR; TAC

TABLE 2

Effectiveness of reviews as seen by IARC staff

"How much attention did the review give to each of the following topics?"

Topic	Review	Percentage			Number responding	Mean[a]	s.e.[b]
		Too little	About right	Too much			
Disciplinary research	External	23	71	6	144	1.83 x	0.042
	Internal	18	76	6	120	1.88 x	0.044
Applied research	External	23	69	8	143	1.85 x	0.045
	Internal	23	71	6	118	1.83 x	0.047
Technology development	External	23	73	4	133	1.82 x	0.042
	Internal	20	71	9	109	1.89 x	0.051
Technology impact	External	33	57	10	133	1.77 x	0.053
	Internal;	29	63	8	108	1.80 x	0.055
	Other CG[c]	18	68	14	22	1.96 w	0.123
Training	External	23	70	7	143	1.84 x	0.044
	Internal	28	66	6	109	1.77 x	0.052
	Other CG[c]	23	73	4	26	1.81 x	0.096
Outreach	External	25	69	6	138	1.82 x	0.045
	Internal	35	61	4	113	1.70 y	0.052
Management	External	26	67	7	143	1.78 x	0.050
	Internal	41	55	4	87	1.62 y	0.059
Goals and strategies	External	18	76	6	144	1.88 x	0.040
	Internal	22	70	8	102	1.87 x	0.053
Board of trustees	External	36	59	5	131	1.69 x	0.049
	Internal	46	53	1	83	1.55 y	0.058

[a]The w,x,y following the means test the hypothesis that the average score of an internal or other CGIAR review is the same as the score of an external review. The same letter means that the scores fall within a 90% confidence interval of each other. A different letter implies that the mean is significantly higher (w) or lower (y) than the mean of the external review.

[b]The standard error of the mean score.

[c]Recently, the CGIAR commissioned a special review on IARC training programs and an impact study of the CGIAR system. The scores for these reviews are included in the table.

and strategies of an institute. An implication of this perspective is the need for greater flexibility (and perhaps less frequency) in the timing of external program reviews.

Evaluating management. The myth that all a research director needs to do is to hire good people and let them 'do their thing' has only minimal support at a time when the solution to many significant technical and social problems requires concentrated research effort. Managers of research institutes must be articulate communicators of the potential contribution of the research institute to the solution of pressing problems. They must be capable of mobilizing

both financial and scientific resources as as to to produce the high returns to investments in research that society has come to expect. This includes the difficult task of creating an institutional environment where resources can be most productive.

Management reviews provide an assessment of the professional environment in which the institute's activities take place. This is probably one area where external reviews have a strong comparative advantage over internal reviews (the survey scores appear to support this, though internal reviews are generally not perceived as having a management review function).

The reports of the external management review teams have identified a wide spectrum of institutional environments at the IARCs. This is reflected in the degree to which Center staff are involved in resource allocation and policy decisions and in the cohesion felt amongst the scientific staff. Some Center directors have been highly successful in developing 'participatory' management procedures, in which Center staff are made to feel a part of the decision making process through the use of committee structures and substantive internal planning exercises. Other Center directors have preferred to keep the decision-making activity within a small group of higher-level staff and program leaders. In these cases the internal reviews tend to be more or less perfunctory. The external management reviews have consistently favored a more participatory institutional environment for research planning and decision making.

Reviewing outreach programs. 'Off-campus' outreach and service programs are utilized by the international research institutes to speed up the diffusion of new knowledge or new technology to national agricultural research and extension programs, and ultimately to the farm level. International institutes, as they mature, typically establish regional offices to facilitate the operation of their global mandates on commodity research. Outreach programs will probably consume an increasingly important share of an institute's resources in the future.

The survey scores suggest that both external and internal reviews are deficient in their attention to outreach programs. Staff posted at 'off-campus' sites often feel isolated from the research programs and staff at the central station. Because these programs are often conducted in collaboration with other institutions and national programs, there is frequently less freedom on the part of the IARC management to choose the objectives and to design the outreach program, and in personnel selection and management.

A thorough review of all outreach programs is inevitably beyond the scope of an external review team, though their itinerary typically includes a visit to one or more off-campus projects. The external review team should focus on the proper scope and mix of outreach programs that should be considered during an external review (see Ruttan, 1982, p. 155–157). Careful evaluation of

individual outreach activities is more appropriately the role of internal reviews. Ways need to be found to include off-campus staff more directly in the review process and to enhance their ties to the Center's program.

Cost and impact of reviews

The most important performance test of decentralized responsibility of a research system is scientific productivity, successful new product development, and high private or social rates of return. The CGIAR system as a whole has achieved a high rate of productivity and most of the Centers in the CGIAR system are now reaching a level of maturity that should lead to considerable confidence in the donor community about both their research and managerial capacity.

A consequence of this high productivity is that any resources that are poorly spent carry a high opportunity cost in foregone scientific productivity. A central question of this study is to determine whether oversight and monitoring activities conducted by the CGIAR can be made more efficient. In other words, can the cost of the reviews be reduced without detracting from scientific productivity?

Cost of reviews. The extensive use of CGIAR, internal, and donor reviews raises the concern that too many resources may be devoted to 'reviewing' research, and that this places an excessive burden on Center staff. In Table 3 we present some estimates of the costs of reviews. In these estimates we show both the financial costs of conducting a review and the value of staff time spent preparing for and participating in the reviews, adopted from the survey of IARC scientists. Average salary figures are used to estimate the value of staff time ($40/h for Center directors, $30/h for middle-level management, and $20/h for regular scientific staff). But this is probably a conservative valuation of the opportunity cost of staff time, given the high rate of return that has been forthcoming from expenditures on international agricultural research.

The direct financial cost of conducting an external program and management review, which includes the travel costs and per diems of the review panel, come to around US$122 000 per review. On average, staff time devoted to external reviews amounts to 7 weeks for Center directors, 2 weeks for program leaders, and 1.5 weeks for scientific staff, summing to $83 000 worth of personnel resources. Center directors and program leaders typically spend only half as much time on internal reviews, and regular staff about 1 week, for a total of $49 000 worth of staff time for internal reviews. Financial costs of internal reviews are not available. In Table 3 we also estimate the costs of irregular reviews on special topics ('other CGIAR' reviews). Based on data from three such reviews that have been conducted since 1980, these cost about $369 000 per review ($166 000 in financial costs and $203 000 in staff time).

TABLE 3

Cost of reviews (US$)

Cost Category	External review		Internal review		Other CGIAR reviews	
Financial costs[a]		115 570		n.a.		166 000
Value of staff time[b]						
Center directors	22 480		10 000		53 040	
middle-level management	8 880		4 800		14 430	
scientific staff	52 000		34 400		135 200	
Total		83 360		49 200		202 670
Total cost per review		198 930		49 200		368 670
Frequency of reviews[c]	Once in 5 years (2.6 per year)		Annually (13 per year)		1-2 in 5 years (0.3 per year)	

Total annual costs of reviews in the CGIAR: $1 267 419

[a]Average financial cost of external and other CGIAR reviews are adapted from Ruttan (1987, table 3, p. 35).
[b]We assume each Center has two 'Center directors' (the Director-General and an assistant Director-General), four middle-level management staff (program leaders), and 40 regular scientific and professional staff. All staff are involved in the external and internal reviews, but only one director and one-fourth of the other staff are assumed to take part in other CGIAR reviews, such as system or 'stripe' review (see text for explanation of types of reviews).
[c]The first line gives the frequency of the review per Center. The number in parentheses is the annual frequency of reviews for the entire CGIAR system of 13 Centers.

External reviews are conducted every 5 years for each Center (or 2.6 per year for the system), and internal reviews are usually annual exercises. Other CGIAR reviews are conducted as the need arises, typically once every 3 years. Thus the total costs of CGIAR review activity amounts to roughly $1.27 million annually.

Not included in this estimate are the additional costs of staff time devoted to occasional reviews by individual donor agencies. A donor will sometimes conduct its own review if it has contracted a special project with the Center. Special project funding has become a significantly more important component of total Center resource in recent years, especially at some of the more recently established Centers, and has led to a substantial number of donor reviews (one per year per Center is not atypical). Each donor review can cost a Center around $10 000 in foregone staff time (assuming one director and one fourth of the Center's staff is involved).

Impact of reviews. The costs of reviews can only be justified if they substantially

TABLE 4

Impact of reviews as assessed by IARC staff

Review	Number of respondents	Mean impact score[a]	Standard deviation
All institutes			
External	210	3.19 xy	0.978
Internal	115	3.08 yz	1.055
Other CG	27	3.00 yz	1.000
Donor	41	2.88 z	1.109
Institutes with strong internal reviews[b]			
Internal	61	3.38 x	0.805
External	67	3.36 x	0.781
Donor	19	2.84 z	0.918
Other CG	16	2.75 z	1.000

[a]Survey respondents evaluated the impact of reviews in which they had participated on a scale from 1 to 5 (1 being no impact to 5 being very much impact). The small letters following the scores group the means that are statistically the same. Scores having the same letter are not statistically different at a 10% level of significance (pairwise means test, using weighted averages of standard deviations; see Steel and Torrie, 1980, pp. 95-7).
[b]These IARCs were judged to have institutionalized a strong internal review process by 1986 (see text for group criteria).

contribute to research productivity through more relevant programs and improved research strategy. Furthermore, in a decentralized management structure, the performance monitoring process (i.e. the external reviews) must have the confidence of donor agencies so they do not feel the need to conduct their own independent evaluations. Table 4 presents further evidence from the survey of IARC staff on the effectiveness of reviews of research.

In the survey, we asked the respondents to evaluate the impact of the review in which they had participated on a scale from 1 to 5 (1 being 'no impact' to 5 being 'very much impact'). External reviews received the highest raw score (3.19) but this was not statistically different from the mean score of internal or other CGIAR reviews. Donor reviews scored significantly below the others.

These scores were also estimated for a subset of the research institutes that we identified as having institutionalized a strong internal review system by 1986 (the time of the survey). This subset (consisting of IRRI, CIMMYT, CIP and CIAT[3]) met the following criteria: (a) they have all been through at least two external reviews; (b) they have established a participatory management environment, and (c) they have made a deliberate effort to achieve close interaction between social and biological/physical scientists in research plan-

[3]These are acronyms for the International Rice Research Institute, the International Maize and Wheat Improvement Center, the International Potato Center, and the International Center for Tropical Agriculture, respectively.

ning. Evidence for these criteria come from the reports of the external management reviews of the Centers (see Ruttan, 1987, appendix 5).

A clear difference emerges between the impact of internal and external reviews versus other CGIAR and donor reviews. Furthermore, these figures support the hypothesis that internal and external reviews are complementary, i.e. they make a more significant contribution to research programs when there is a strong internal planning and review mechanism in place that can actively engage and respond to their recommendations. Such an external oversight process is more likely to have the confidence of donor agencies, reducing the need for independent donor reviews.

How reviews affect Center programs. In the preceding section we argued that external reviews work best when there is a strong internal planning process established and functioning at the research institute. Below we draw from the reports of external review teams and from Center documents to illustrate how the review process can function to improve the content and direction of an institute's research program. A good example of where this has occurred is given by the experience of the International Center for Tropical Agriculture (CIAT). CIAT, established at Cali, Columbia in 1968, has undergone two external 'quinquennial' reviews (in 1977 and 1984). The 1984 review also involved an evaluation of the Center's management.

According to the external review report on CIAT management, internal planning exercises and reviews have been 'institutionalized' at the Center (CGIAR, 1985, p. 147). But this has been an evolving process. During the first years of the institute, the Director General and senior research staff provided most of the leadership in internal planning. As the institute matured, members of the Board of Trustees increased their involvement in strategic planning (CGIAR, 1985, annex V, p. 5). Prominent scientists from outside CIAT were also invited to participate in internal reviews. The external review report also complimented the 'participatory' management style of the Director General. Channels were established to elicit the participation of scientific staff in management and policy formulation (CGIAR, 1985, p. 12–13).

Major program changes and new program initiatives that have occurred at CIAT over the past two decades can be traced to recommendations from Center long-range planning exercises and from the external review reports. For example, the First Quinquennial Review encouraged CIAT to initiate work in agrosystem characterization. This led to the establishment of an Agroecological Studies Unit in 1978, which was further expanded in 1982. The First Quinquennial Review also recommended that CIAT conduct technological impact studies, which has since become a major item on the social science research agenda at the institute. The Second Quinquennial Review included several recommendations that were aimed at increasing CIAT's commitment to basic research, in part a recognition that many of CIAT's clients, the national agri-

cultural research programs, had improved their capability to conduct applied and adaptive research.

Not all recommendations made by the external reviews have been adopted, however. It should be considered a strength, rather than a deficiency, of the CGIAR system that individual Centers have been able to reject what they regarded as inappropriate recommendations by External Reviews. There should always be a relatively short feedback loop between research findings and research objectives, and a research institute should not be locked in to the recommendations of external reviews. The First Quinquennial Review of CIAT (CGIAR, 1978), for example, recommended that CIAT expand its research effort an animal diseases (at the time CIAT had a rather modest program on cattle and swine diseases). But CIAT's own planning reviews concluded that there was "growing evidence that poor nutrition rather than animal diseases represented the key constraint to improved livestock production" (CGIAR 1985, annex V, p. 5). Furthermore, with the establishment of the International Laboratory for Research on Animal Diseases (ILRAD) in 1974, this line of research was well represented in the CGIAR system. Instead, CIAT eliminated its animal disease research program and significantly expanded its forage improvement efforts, and in 1979 renamed its livestock program the "Tropical Pastures Program" to reflect its principal thrust.

A second example of how CIAT's internal planning process has identified new strategic initiatives is the development of its Seed Unit in the late 1970s. Shortly after the First Quinquennial Review (which made no mention of a need for this initiative in its report), the CIAT management and staff identified the lack of a seed multiplication and distribution capacity within Latin America as a major constraint to the diffusion of improved genetic materials. A program was initiated to assist these countries to develop domestic seed industries. Additional financial resources were forthcoming from Swiss and other donor groups to support the newly established Seed Unit.

These examples shed light on how the review process functions when dynamic and innovative leadership is present. Most program changes are initiated through internal planning exercises. The external reviews provide an important outside critique of an institute's research strategy and serve as a 'check' to maintain the integrity of the decentralized management structure of the CGIAR. Final decision authority on strategy and programs, however, rests with the institute's Board of Trustees.

Conclusions

In a corporate system where there is a high degree of uncertainty concerning the likelihood of success of any one endeavor, as in research, management autonomy by individual research institutes is a desirable structural characteristic. External site reviews are a mechanism that the parent organization (the

CGIAR) can use to monitor the performance of its partially 'owned' subsidiaries (the IARCs). In this paper we have investigated the role of reviews and the linkages between research policy, strategic planning, and performance monitoring. An effective review process presumes the existence of an unambiguous research policy, clearly stated research objectives, and effective internal planning processes.

An external review is best suited to evaluate the strategic plan of a research institute. It must assess the resources of the institute, its organizational structure, and internal planning and review mechanisms to determine whether they can achieve the stated research objectives within a reasonable amount of time, given reasonable levels of financial support. But an external review cannot be a substitute for an institute's internal strategic planning capacity. Rather, an external review process will be most effective as a complement to a strong internal planning and review process, and external reviews should be timed so as to coincide with internal planning exercises. The evaluation of disciplinary research and peer reviews, also important to the productivity of the institute, is not well suited for the external reviews and should be left to internal mechanisms.

We also investigated the cost and impact of the internal reviews. The staff time incurred in the review process may tend to be overlooked in assessments of reviews. But for external reviews, the time costs amount to over 40% of the total cost of the reviews. In order to reduce the cost and time burden of the reviews, they should be coordinated and kept to a minimum. In particular, reviews carried out by donors independently of the CGIAR, which carry relatively little impact on the Centers' activities, should be reduced or eliminated.

It is not difficult to speculate on how the lessons and successful innovations of the CGIAR system can be applied to other research systems. The hierarchical system of governance employed in most national agricultural research systems weakens responsiveness to new scientific and technical opportunities and to changes in the demand for knowledge and technology. These dangers are somewhat muted where strong state or provincial research systems are capable of engaging in effective dialogue with a national system. Traditional systems of governance have a strong propensity to protect the system from new sources of knowledge and to limit the capacity of the system to respond to new demands.

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