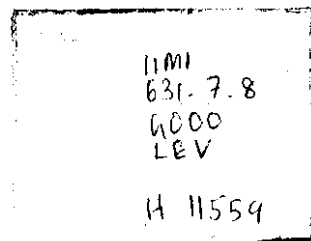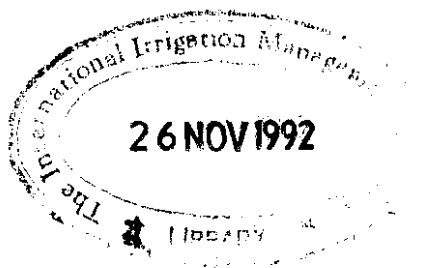# REVIEW AND ANALYSIS OF THE RESEARCH PROGRAM OF THE INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

by

Gilbert Levine[1]

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EXECUTIVE SUMMARY

This paper attempts to evaluate IIMI's past research programs for the purpose of improvement in the current and future programs. It starts by placing irrigation management research in its historical and institutional contexts by comparison to agricultural research, looks at the way IIMI conducts its research and then proceeds to evaluate the programs, with special emphasis on the results. It concludes with general and specific recommendations, and a brief section on implementation.

Context

Historically, non-biologic irrigation research has been very limited, primarily concerned with hydraulic structures and carried out by units within irrigation departments that have relatively low status and support. Research on irrigation management is a relatively recent phenomenon with few institutions engaged, and these have limited contact channels with potential users of the research. Thus, the irrigation management research context is very different from that of the agricultural research institutions, including those of the CG.

Research Modes

As a result of the limited number and limited nature of potential collaborators, IIMI's stated objective of carrying out its research collaboratively with host country partners has been difficult to implement. IIMI's field research orientation almost invariably requires the cooperation of the controller of the irrigation system, and this form of collaboration is found in most of IIMI's research. More active partnership is the exception rather than the rule. To maintain the quality of its research, IIMI has carried out more of its own data collection than was anticipated in its initial conception, with resulting difficulties for the country programs with only one-senior scientist. The major research output, both absolutely and proportionally has come from the Pakistan Branch and the Sri Lanka Field Office, the two largest units.

Research Evaluation

In carrying out its research, IIMI has utilized appropriate planning and research methodologies, but has not been efficient in relating the research carried out in the Field Operations country programs to the thematic research carried out under the auspices of the Research Division. The lack of an integrated perspective has resulted in less progress on the generic issues than would have otherwise been expected.

Notwithstanding the lack of coordination of the Country Programs and the Research Division a number of significant achievements have resulted. Perhaps the most significant has been the forcing of recognition of the reality of system operations, both government and farmer-managed, on the irrigation departments. The irrigation sector in many countries is plagued by the image of system operation, rather than the truth of that operation. This has prevented appropriate corrective measures in many systems.

A number of IIMI's research results have both problem-solving and policy aspects. Its research on the turnover of public systems to the users has had significant and useful impact in Indonesia, Nepal, and Sri Lanka. IIMI's findings on the impact of system operation on development of secondary salinity has raised extremely serious questions about the future of irrigated agriculture in the Punjab of Pakistan, questions that should affect future policy decisions. The research on the returns to investment in system management should markedly influence the pattern of investment, not only in Sri Lanka, but in other countries at similar stage of irrigation development. Similarly, research in Pakistan on selective maintenance, providing potential tools for informed decision-making in this area, revealed not only the utility of this type of tool, but also the relative effectiveness of desilting and channel lining. Thus, the technological spin-off from the management research has importance of its own.

The research on "decision-support"methodologies not only provides important tools for improvement of system operation and maintenance, it is potentially important as a vehicle for promoting institutional change. This latter, however, is likely to be slow and irregular.

The research on organizations, and on performance indicators is at a relatively early stage, but will be increasingly important as institutional change is more explicitly addressed.

While some of the potential of IIMI's research results are being utilized, much has not. Sri Lanka, Philippines and Indonesia have had contact with irrigation management research for relatively long periods, antedating IIMI's formation. This experience has made them more receptive to research results than the countries without this experience.

Recommendations

Four general principles to guide IIMI's research programs are suggested:

    1. the research must be of the highest quality possible;

2. there should be a unified research program that considers the thematic and location-specific research together:

3. the makeup of each research unit should be rationalized as to size and composition;

4. the research units need supporting services that can best be coordinated by headquarters.

Based on these general principles, seven specific recommendations are offered:

1. to foster the unification of thematic and location-specific research, the thematic research issues should be defined by explicit questions;

2. to facilitate comparative studies, there should be research protocols to indicate a required minimum data set for field studies;

3. each research unit should have at least three senior scientists;

4. each research unit should have an appropriate complement of supporting staff, both professional and non-professional;

5. field operations scientists should have the opportunity to formally participate in the thematic aspects of the research program;

6. there should be a program to archive and protect IIMI's research data;

7. appropriate data bases should be established and maintained.

Implementation

Most of the specific recommendations can be implemented with assignment of temporary priority and modest use of consultants. However, implementation of the recommendations on size and composition of the research units may be much more difficult, raising questions of IIMI's overall size and distribution of core resources.

Review and Analysis of the Research Program

of the International Irrigation Management Institute

Consultant Report -- Gilbert Levine[1]

November 10, **1992**

1   Introduction

The close of **1992** sees the start of a third era for
IIMI. The first, from **1984** to **1989,** was its establishment
phase as an independent international research, training and
assistance institution devoted to the problems of irrigation
system management, primarily in Asia. The second, from **1989**
to the present was an expansion phase in which IIMI's
activities extended to Africa, and the Near East, with a
corresponding growth of scientific and technical staff. The
forthcoming period is its transition to membership as a
constituent institute of the Consultative Group on
International Agricultural Research (CGIAR). As it enters
this third stage, IIMI has revised its overall strategy and
is evaluating its research programs, to guide its activities
for the next five years. As part of this process I was
asked to undertake the review of IIMI's research activity,
" ...to assess its value in terms of what has worked, what
hasn't worked and what we should avoid, and then based upon
the above what is it that we should be doing and how should
it be done in the future."[2]

This clearly is a challenging assignment, as well as an
important one. It is especially difficult because IIMI
makes no clear separation of its various mandates as it
carries out its activities. Since many of its field offices
are one-person offices, there is a major problem in
identifying the relative emphasis on research. The problem
is further complicated by the fact that to some extent
IIMI's mandates have changed in priority over time.   In
addition, since there is a separate paper addressing IIMI's
institutional impact, I have limited my study to the first,

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[1]   Professor Emeritus, Cornell University; Senior
        Associate, IIMI

[2]   Excerpt from Proposed Terms of Reference, provide by
        Mr. Khalid Mohtadullah, Director of Research, IIMI.
        The full Terms of Reference are provided in Appendix 1.

and to some extent the third of IIMI's current goals: generating knowledge to improve irrigation management and policy-making; suvwortins the introduction of imwroved manasement and policy-making, respectively, even though the research activity is expected to be an important mechanism for strengthening national research capacity. Within this complexity, **I** have interpreted my charge as one of looking to the future by learning from the past, and have not attempted to evaluate for the purpose of judging, either individual or overall program successes.

I have carried out the assignment by reviewing the available research reports, obtaining information from many, but not all of the researchers, personally and through a brief questionnaire (see Appendix 2), and through direct contact with the government officials, as well as the research in Nepal, the Sudan, Pakistan, and Sri Lanka, a substantial portion of IIMI's research program. Since I have not personally had direct contact with the Morocco program or the sub-Saharan Africa program managed from Burkina-Faso these represent weaknesses in this evaluation. The report benefits from my opportunity to discuss the draft with many of the IIMI scientific staff of the Research Division, of the Sri Lanka Field Office, and with members of the administration. The comments were very helpful in correcting mistakes and omissions in the original draft, and to the extent these still remain the responsibility is mine.

This report is presented in five sections, This introduction and the second section, to place **IIMI's** research program into its historical, problem and institutional contexts (an essential for a realistic appraisal of a relatively new institution). The third, to describe IIMI's general research modes, the fourth to evaluate the research in relation to the Terms of Reference, and the fifth, to offer general principles and specific recommendations.

2   Context

2.1 Historical

In many countries the agricultural sector has long been served by a research community dedicated to solving the problems in the sector. In some, this community is located within a government bureaucracy: in others, it is located within the academic community, usually in agricultural universities; in some, their may be both types of research organizations. Almost invariably, however, the research institutions are linked to the farmers through some form of information service, frequently a formal Extension Service, often complemented by private sector activities. **As** a result, the agricultural research institutes of the **CGIAR** have had **a** defined place in the hierarchy of research

efforts, a logical collegial constituency and a substantial mechanism for getting the results of institute and collaborative research disseminated to potential users. The international institutes address problems of generic concern, generally those that lie between basic science questions usually studied in academic research institutions and the location-specific questions considered the responsibility of the national research institutions. The international institutes have their counterparts in the national research entities with whom they collaborate and interact, and they have direct and indirect links to the various national information dissemination mechanisms, as well as to the international system.

By contrast, the irrigation component of the agricultural sector does not have an historical tie to a research community. With the exception of the area of soil-plant-water relationships (usually addressed by the agricultural research establishment), irrigation research carried out in the context of developing countries has been very limited. At the national and/or state levels there are very few irrigation research agencies, and most of these are focused on problems of hydraulic structures, with an emphasis on materials and model testing. This research frequently is carried out in the context of specific project needs. There is essentially no research on system management carried out within these agencies. where these irrigation research units exist, they usually are parts of the governmental irrigation department, frequently with limited funding, relatively low status, and staffed by employees of the department with little research training and experience.

Some irrigation system management research is carried out in the academic community, but there are few linkages between that community and irrigation system operators -- governmental, communal or private.

As a result of this situation IIMI has not had the obvious institutional context to help define its research role, nor the national research community that would provide appropriate collaborators, nor a linkage to a traditional communication mechanism to potential users of the research results. IIMI's research program, thus has evolved in a context significantly different from that of the original CGIAR institutes. In addition, from IIMI's beginning, a much smaller fraction of its operating budget has been in the nature of "unrestricted core funding". This has resulted in much greater external influence on its research direction than characterized the original CGIAR institutes. Notwithstanding these important influencing factors, it is clear that IIMI did not place a high priority on developing a unified research agenda. The lack of a Director of Research in its early phase and the subsequent establishment of a Research Division separate from its "country program" research provide evidence.

2.2 Nature of the Irrigation Management Problems

The evolution of IIMI's research program also has differed from that of the original CGIAR institutes because of the nature of problems being addressed. The CGIAR institutes' mandates initially focused on the need to increase the yield and production of specified crops. This was generally interpreted as a need to increase the genetic yield potential, and more recently, to improve other genetic characteristics such as disease and insect resistance. With this interpretation, it was possible to design research programs that were significantly discipline-oriented, with plant breeding, agronomy, plant pathology, entomology, etc. each carrying out individual, though coordinated programs. Over time, there has been increasing concern for the integrated system nature of agricultural production, with inclusion of more complex aspects of the production environment, including ecologic, economic and social factors, but these have been secondary to the primary emphasis on genetic improvement.

By contrast, IIMI recognized that most irrigation management problems almost invariably involve a complex combination of human, physical and economic factors that are difficult, if not impossible, to separate or control. Thus, it has been necessary for IIMI to study irrigation management holistically, in an institutional sense as well as a disciplinary sense. For ease of communication IIMI has identified thematic areas of emphasis, but in the reality of irrigation in the field many of these areas overlap and it has been impossible to maintain a consistent independent focus on individual themes.

IIMI, from its inception, recognized that except for very special, limited instances, irrigation system problems must be studied as they exist in the field, rather than in a controlled environment. This precludes the use of an experiment station on which to investigate the problems, and requires the research to be conducted in operating systems. Thus, in its first two phases IIMI identified as its basic unit of analysis the irrigation system, or appropriately defined subset, usually with hydraulic and/or managerial boundaries. In some instances the entire organization was considered the unit of analysis, but almost invariably the measures by which the organization is judged are based on the performance of individual systems.

The requirement that the research be conducted in the real-world environment in operating systems, brings with it a number of limitations on how the research can be conducted. The powerful tools of biological research -- replication, control of the research environment, and the imposition of differential treatments -- can be used only to a very limited extent. System and even sub-units within systems, usually are different physically, and may have

significant social, and economic differences as well. Thus, true replication is not feasible. Since the systems are operating systems, usually with 24 hours per day operation, often involving relatively large areas with significant numbers of water users and operating staff, control of the system to provide a constant, defined environment generally is not feasible. This implies that an important component of irrigation management research is the measurement of system parameters, social and organizational as well as physical, with sufficient detail that an appropriate definition of the research situation is possible.

In addition, because the system is providing an important, sometimes critical service to relatively large numbers of users, changes in that service must be made with care to ensure that the users are not adversely affected. This limits the range of experimental variables that can be utilized to those that are not likely to have a negative effect on performance of the system.

The need to test experimental findings in operating systems, usually with operators not familiar with research methodologies, implies the involvement of IIMI in a relatively large number of action research efforts. This type of research is more demanding than customary experimental research in that it requires a higher level of continuity in monitoring and closer collaboration with the potential end users of the research. Due to the importance of the ongoing irrigation service to the water users, there is a requirement that the impacts of changes being studied in the action research effort be monitored essentially continuously and modifications made as suggested by the monitored performance. This dynamic pattern of research makes the analysis and interpretation of results more difficult.

As a result of this complex situation and the fact that research on irrigation management is relatively new, there is no generally accepted research mode for addressing irrigation management problems. IIMI has been evolving useful methodologies and continues to search for new ones.

2.3 Institutional Context

IIMI has organized its research activities under three institutional units, the Field Operations Division, the Research Division and the Pakistan Branch. The first is responsible for the administration of the research (as well as the other activities) carried out by IIMI staff and collaborators in the various participating countries, while the second is responsible for the research efforts of the scientific and technical staff at Headquarters. In principle, the Field Operations Division has as it primary

responsibility research that addresses location-specific
issues, while the Research Division is intended to
concentrate on the generic aspects of the thematic issues.
The degree to which this actually occurred will be discussed
in succeeding sections. The Pakistan Branch, by virtue of
its size, its relatively unrestricted mandate and the
importance of irrigation in Pakistan has had opportunity to
consider both types of issues.

The Field Operations Division and the Pakistan Branch
have expanded substantially in the eight years of IIMI's
existence, while the Research Division has remained
essentially static. However, only one of the Field
Operations, the Sri Lanka Field Office, has had a
significant breadth of multi-disciplinary expertise
available. Most of the others have only one
internationally-recruited senior scientist (with an
occasional national scientist) who, as suggested earlier,
must engage in a wide variety of activities, of which
research is a modest part.

In addition to IIMI itself, there are two major groups
instrumental in defining the specifics of IIMI's research
programs ·· the donors, and the National Consultative
Committees. **As** indicated earlier, IIMI has had limited
unrestricted core funding and has been very dependent upon
individual project, rather than program funding. While some
of the donors have permitted the use of the funds for broad
problem areas, much of the funding has been restricted to
relatively specific project-related research. Thus, while
IIMI has had the opportunity to define the specifics of its
research, it has had limited freedom to establish the
overall direction and priorities of the research programs.

In its Field Operations, IIMI has a policy of
establishing Consultative Committees (CC) in each of the
countries within which it operates, with formal committees
established in Bangladesh, Morocco, Pakistan, Sri Lanka,
Sudan. However, even where formal committees are not in
place, there is a high degree of consultation with host
country nationals on IIMI's research program. These
consultative committees, formal or informal, usually are
comprised of representatives of the major government
departments in the irrigation sector, and occasionally with
representation from the academic and farming communities.
They are intended to serve as an important <u>mechanism for
obtaining collaboration</u>, as a <u>channel of communication for
research findings</u>, and as a primary <u>source of problem
identification and priority-setting</u>. The authority accorded
to these groups to set IIMI's research agenda varies in the
different countries, but the committee in each of the
countries clearly influences IIMI's research program. This
is a higher degree of national influence than is typical for
the CGIAR Institutes.

It is clear that the first purpose is well-served by the CC. Involvement of the government agencies responsible for the irrigation systems provides an imprimatur for IIMI's work that obviously is useful for obtaining access to the systems and the organizations, and for eliciting more active collaboration. The role of the CC as a channel for communicating research findings is less clear. My impression of the meetings is that they concentrate more on the future program than in substantive review of the results of the current work. In addition, the potential users of the research findings frequently are more appropriately reached through other mechanisms, including workshops, retreats, etc.

It is difficult to judge the CC's utility for research (as contrasted with other aspects of IIMI's mandate) problem identification and priority setting, in part because the role and makeup varies among the CCs. The primary difficulty in the research problem identification area is that most of the time the problems that are identified are those that currently exist, and not those that are likely to be important in the foreseeable future. While research can be useful in addressing current problems, particularly if they have a generic character, it is most useful in addressing problems that are incipient. (Where significant problems exist, and have been identified for some time, potential solutions usually have been identified. A lack of application almost always reflects a lack of will, usually political, to implement them.) The time usually necessary to obtain research results for significant problems is such that addressing problems with some lead time generally are better served.

In some of the countries, research project committees are established, primarily to facilitate the implementation of the projects. Again, the utility of these committees is difficult to establish, though they have obviously been helpful in the Sudan, and in the North West Frontier Province of Pakistan.

The combination of history, nature of the problem and institutional contexts within which IIMI's research program has been carried out suggests that the program must be visualized and evaluated with a different framework from that of a typical agricultural research institution. In principle, this framework would utilize different criteria €or the Field Operations and Research Division and Pakistan Branch, but the reality of the problems, the way they can be addressed, and the manner in which the research programs evolved combine to justify consideration of the three components of IIMI's overall research program as a whole.

3 Research Modes

3.1   Collaboration

IIMI is committed to the concept of collaborative research, i.e. research carried out with the involvement of non-IIMI individuals and/or agencies. The commitment is based upon a number of basic premises: collaboration is necessary to obtain access to the field systems essential for the research program; it is desirable because agency involvement can be an effective method for transmission and acceptance of research results; it is important because it can be an efficient mechanism for developing institutional capacity for research-based problem solving; it can result in more economical research; out can be a vehicle for encouraging other forms of institutional change. while these premises have a high degree of validity, there has been no specification of what constitutes collaboration, nor has there been an evaluation of the degree to which the various forms of collaboration contribute to achievement of the different objectives.

In reviewing IIMI's research program I have observed a wide range of "collaboration"with very different implications for the achievement of the objectives of collaborative work. To characterize this range I have suggested four categories: tolerance, cooperation, partial partnership, full Rartnership. These are described more fully in Appendix 2, but they indicate a range of external involvement from the minimal to full, collegial participation in all aspects of the research.

The responses from the IIMI researchers indicate that most of the project relationships range between tolerance and cooperation, with a few of the partial partnership type and a very few full-partnerships. There is no consistent pattern of relationship within a country, but is project- related, In some countries, IIMI has had a supervisory/advisory relationship with host-country research institutions (among them, Indonesia and Pakistan),but this would not fall in my definitions of collaboration.

The patterns of collaboration, and particularly the relatively modest level is not surprising, given the emphasis on the irrigation operating agencies (to achieve access, and to foster acceptance of research findings by the potential users) with their lack of established research entities and lack of experience with irrigation management research. The university research community, with whom the full-partnership mode, in principle, would be more feasible, typically is constrained by relatively heavy teaching loads, low salaries (requiring supplementation) and a lack of logistic support, in addition to the lack of familiarity with irrigation management research. The implications of

the lack of closer collaboration are reflected in a number
of the specific recommendations made in Section 5.

3.2   Degree of Responsibility

IIMI has carried out its research program in four ways:
essentially by itself, in which IIMI has done the planning,
data collection, analysis and reporting and is fully
responsible for the work; collaboratively, in a limited
number of instances, where there is some active
participation on the part of others, but where IIMI takes
primary leadership and accepts full responsibility for the
validity and quality of the work; by contract, in which some
portion of the research is carried out by another entity,
e.g. a private research unit, or a research entity of the
government, and IIMI pays for the effort and assumes full
responsibility for the way it monitors and utilizes the
results; through assistance, in which the research is
essentially carried out by others with some degree of IIMI
assistance, and for which IIMI does not assume
responsibility.

Notwithstanding the commitment to collaboration, in
view of the context described earlier, much of IIMI's
research has been carried out essentially by itself. The
early years of the research program in Pakistan, Nepal, much
of the Indonesia program, a substantial portion of the
Philippines, and the current Sudan program exemplify this
situation.

IIMI has engaged in some fully collaborative research,
primarily with other CGIAR institutions, IFPRI and IRRI.
Even though there are some other potential national research
collaborators, constraints of local funding -- both amount
and procedures -- place the primary financing responsibility
on IIMI. The nature and extent of IIMI's funding has been
such that there has been limited opportunity to pay for
these collaborative efforts, even to the extent otherwise
feasible. An example of a partial partnership with a
government agency is the study of wheat irrigation in the
Punjab in Pakistan, where the Agricultural Extension
Department was involved in the planning, and provided a
relatively large number of staff for data collection in the
field. One example of full partnership is that with the
Department of Agricultural Engineering in Gaja Mada
University in Indonesia; this effort was supported by Ford
Foundation funds that complemented the funds provided by the
Asian Development Bank, with follow-on support from the
Rockefeller Foundation funds that provided the opportunity
to involve the university substantively in the crop
diversification program.

Some contracting of research has been carried out, with
mixed results. The consensus of staff responding to my
questionnaire, and others to whom I have posed the question

has been that there is discomfort in accepting the results because of questions about the rigor with which the research has been conducted. Again, this should not be surprising, given the limited experience with this type of research and the relatively modest funding available to the contractors.

With the exceptions of the USAID-supported Irrigation Systems Management Project, in Pakistan, responsibility for which was given to IIMI in 1990, elements of the Diversification Project, some contracted work in the Philippines and a relatively new effort with Indian institutions, IIMI's assistance to national research institutions has been informal and limited.

3.3 Primary v Secondary Data

Much of IIMI's research is based upon a combination of primary and secondary data. The primary data usually focus on the water supply, its distribution -- to the level where control is in the hands of the farmers, and the factors affecting that distribution. In some cases meteorological data are collected, and in others primary agricultural data are collected at the level of the individual farm. These latter frequently are obtained through contract studies. In the area of farmer managed systems, and in some research on jointly managed systems (government and users),social and institutional data are collected, frequently using primary sources. Among the latter are studies in Sri Lanka (Kirindi Oya and system H) and Pakistan (Punjab and NWFP).

IIMI, in comparison to most of the other international groups engaged in irrigation research, has a strong comparative advantage in collecting primary data. With its resident position and linkage to the irrigation operating agencies in a number of the major irrigating countries IIMI is in a position to provide both the depth of planning and the continuity of on-site supervision essential to the collection of reliable primary data. In addition, it is in a position to more fully evaluate the primary data collected by others. This is especially important since, in many situations, the secondary data are of questionable accuracy.

4   Research Evaluation

4.1 Goals and Objectives

4.1.1 Goals

The broad goal of the research program, both in the past and as IIMI looks to the future is the improvement in the Derformance of irrigation systems in the developing countries. This is reflected in the specific goals of:

seneratins knowledse; and supporting the introduction of
imwroved management and policy·making, In the period
reviewed, these goals were directed primarily at the system
and agency levels, rather than at the sector, though current
goals include emphasis on the latter.

Two caveats should be exwressed at this time. IIMI is,
from a research perspective, a young organization. This is
especially true of a number of the country programs.
Research results are not obtained overnight, and as will
become clear, this is especially the case with respect to
irrigation management research. As a result, a number of
the efforts currently underway are not reflected in terms of
research output. Thus, the output asuect of this evaluation
will not wrovide a full accounting of the projects IIMI has
undertaken. Secondly, for a variety of reasons, but
primarily funding difficulties, IIMI has remained for an
extended period in a limited number of countries ·· Sri
Lanka and Pakistan, and Nepal, primarily, with the
Philippines to a lesser extent. Since implementation of
research findings is not automatic ·· sometimes requiring
extended interaction and encouragement -- achievements in
the second goal, to support the introduction of imwroved
management and policy·making, should not be. exwected to be
larse.

The research program, in a number of cases, has
generated the knowledge that provides the basis for moving
substantially toward improving the performance of irrigation
systems. **The potential derived from the research has been
realized only partially** and not in all countries in which
IIMI has worked. Specifics of this potential will be
presented in subsequent sections.

The research program, generally, has been much less
successful in increasing local capacity for carrying out
continuing research in the area of irrigation management.
By contrast to most of the other CGIAR institutes, IIMI's
research program has been used as a training vehicle only
modestly. This is due significantly to the lack of
resources committed to this effort, primarily to the
limitations of senior staff time (see section 5.1.3, for
comments and recommendation on staffing), and to the
constraints of discretionary funding, In the case of IIMI,
this discretionary funding was on the order of 25 percent of
its total funding, in sharp contrast to the original CG
centers. In addition, these centers, allocated a large part
of core funding for development of national research
capacities; in IRRI and CIMMYT, e.g, this represented
almost half of the total operating budget.

However, the problem of effective use of the research
program for capacity enhancement is affected also by the
lack of research interest on the part of the operating
agencies. In Pakistan, for example, the combination of

governmental rules that make it difficult for IIMI to obtain "seconded" staff and the limited funds available to provide training fellowships illustrate these difficulties, though the Pakistan Branch has been able to provide some research opportunities for both national and expatriate graduate students and other trainees.

IIMI's use of graduate students and other trainees in its research program has had variable success. Involving Master's level students represents a very significant cost to the program, primarily in terms of the staff time necessary to guide their participation. It almost always is a <u>net cost</u> to the research effort. If this is not explicitly identified as an enhancing capacity objective and budgeted as part of the program, the research program inevitably suffers. Students at the Doctoral level <u>can be</u> a significant <u>net gain</u>. For the benefits from doctoral student participation to be obtained, IIMI must participate in the decisions about the student's research, and this participation must start relatively early in the process of problem identification. This implies an on-going relationship with the institutions from which appropriate graduate students can be anticipated. These institutions can be in the host country, or in the more developed countries. In the case of host country institutions, collaboration at the doctoral level can contribute significantly to enhancing local capacity, without a net cost to the research program. In the case of the developed countries, there often are opportunities for the students to bring some of their own support, further increasing project and program resources.

The goal of more generic understanding has been addressed only sporadically. As indicated earlier, most of IIMI's research support has been obtained through some form of project support, usually with a strong location-specific character. Exceptions have been the studies of irrigation fees, performance criteria, of crop diversification, and the use of models. With the exception of the study of irrigation fees, supported by the Asian Development Bank, support for the remaining studies was provided by Foundation grants and IIMI discretionary funding.

The program on Farmer Managed Irrigation **Systems** has attempted to develop more generic understanding through IIMI's own research, supported through a variety of sources including IFAD, and various Foundations, in conjunction with that of a semi-formal network of Asian researchers. These are brought together at occasional meetings and through the medium of the FMIS newsletter produced by IIMI. This pattern anticipates the development of the generic understanding by evolution and induction, rather than by posing specific hypotheses which are then explored explicitly. Other efforts at the development of answers to generic issues have been more explicitly driven by theoretical or deductive approaches. Some of the work on

institutional arrangements, performance indicators, and
information needs are illustrative. Their impacts are yet
to be realized.

Contributions to the development of generic
understanding have been made by the location-specific
activity, e.g. the problem of conjunctive use of surface and
groundwater in Pakistan, but these are results of the
concern for the location specific issues rather than the
product of specific association with efforts to develop
generic understanding.

4.1.2 Objectives

There are a number of objectives associated with the
general goals, but with no consistent set of priorities for
these among the various research units. Most of the
objectives are derived from location-specific
considerations, rather than the more generic issues. Among
the objectives are: 1) to solve specific problems identified
by the host government and its collaborating funder
(frequently an external donor or lender}; 2) to increase
understanding of the current functioning of the irrigation
systems at the specific location; 3) to identify ways to
improve the functioning of the systems; **4)** to improve
irrigation policies to permit utilization of the
improvements; 5) to add to the understanding of generic
issues.

4.2 Problem Definition

In general, in almost all of the countries in which
IIMI has resident capacity three mechanisms were operative
in determining the specific problems upon which IIMI's
research has focused. There was IIMI's general
understanding of irrigation systems and their problems;
there were the problems perceived by the government and/or
donors that constituted the potential source of funding
support for the work; there was IIMI's specific
understanding of the problems in the systems in the country
or region of interest.

Specific understanding of the systems is a critical
factor in IIMI's research program. Section 4.5.1. discusses
the problem of "image and reality" in some detail; suffice
it to say at this time that the description of system
operation and performance provided by irrigation departments
to newcomers (nationals as well as expatriates) frequently
is at significant variance from the facts. This is not to
imply that there is deliberate misleading (though in some
cases this may be). Rather, it is primarily a result of the
failure to receive (to want?) and/or to internalize
appropriate field information. The result, however, is that

there must be an initial period of learning about how the systems actually function to establish the reality of the problems that have been superficially identified. The insistence of the Irrigation Department in the Sudan on describing the Gezira System as a "Night-Storage" system, even though its ability to function as a night-storage system has not existed for many years, is illustrative of the generic problem that exists.

The requirement for development of real understanding of system functioning -- physical, institutional, economic and social -- has two important implications. First, in every new country, or significantly different location within a country, **there is a period of time (usually, at least a year) required to develop this understanding;** this "zero year" has been difficult to support adequately. Second, the benefits of this investment in learning cannot be fully realized unless **the research program is maintained in each location for a number of years.** There are a number of additional reasons why it is important to maintain each country program over an extended period of time, but these lie more in the institutional and utilization realm than directly in the research area and will not be addressed here.

The problems identified by the country and the donors almost invariable were related to some action need with an investment component, e.g. irrigation projects were to be built or rehabilitated or systems were to be "turned over" to the water users. The perceived problems were those characterized by readily observable symptoms (sometimes the symptoms were identified as the problems), such as relatively rapid system deterioration, low water efficiencies, and a lack of cooperation on the part of the water users. In some cases, these "problems" reflect the donor's perceptions, with acquiescence on the part of the country for financial reasons rather than from a felt need. In a number of cases IIMI **has tried to identify root causes of the problem symptoms,** and to focus the research on these. In others, however, it has limited itseif to the search for solution to the specific problem.

The association of the research with specific investment projects has facilitated acquisition of financial support for the research, but has meant that the emphasis has been on the rapid solution of existing problems. **There has been little ability to study problems likely to arise.** There also has been **little, if any, attempt to explicitly incorporate generic issues into the location-specific research.** This has made it very difficult to utilize the location-specific research in the studies of the generic issues.

4.3 Methodologies

4.3.1 Literature Review

In general, IIMI research is preceded by some form of review of the literature relating to the research questions. In a number of cases, however, the review takes place at the write-up stage. In some cases the review is a formal, relatively comprehensive review. I have the impression, however, that in most reviews are less comprehensive, utilizing the readily available sources. **IIMI would benefit from comprehensive reviews on selected topics, which could then be supplemented by more specific reviews that update and focus on the specific questions associated with individual research. As** IIMI moves to address sector-level issues the need for substantive literature reviews, supplemented by the maintenance of relevant data bases will become even more important. Unfortunately, there is relatively little donors interest in this type of effort.

4.3.2 Context Setting

The research seems to provide reasonable information on the institutional setting, particularly with respect to the irrigation agency, and on the physical setting, including standard meteorological information. There appears to be less information about the economic and financial environment, for the water users as well as for the agencies, and variable information of the social setting, except where the research emphasis is on the water users themselves. Frequently, there is information on the general historical context, but that information is only infrequently used to place the research period in perspective, e.g. is the study period in a continuing dry spell or is it following a wet year, etc. There is no consistent pattern to the way in which the context is established.

4.3.3 Data Collection

From the information available it is difficult. to evaluate all the dimensions associated data collection -- appropriateness, accuracy, precision, etc. -- but some aspects can be addressed. In general, the measurements that are made appear to be appropriate for the questions being studied. However, the scale of the measurements -- the size of sample, the frequency of measurement, etc. -- **seem to be dictated more by the resources available than by any systematic analysis** of what would be necessary to achieve specific levels of precision or confidence. Limitations of available equipment, very tight funding and the failure to achieve the anticipated level of collaborative input that has characterized many of IIMI's research projects, has meant in many cases there are fewer measurements and observations taken than would otherwise be desirable. It is also probable, however, that even with these limitations the

data collection systems can be improved by taking advantage of the expertise that exists within IIMI, logically through the Research Division (See recommendations). Given the situation that most of IIMI's field locations are staffed by one senior scientist, that individual's ability to design an efficient data collection program involving multi-disciplinary information would be markedly enhance by assistance from other expertise.

In the case of Pakistan, where a strong field data collection system has been developed there is a different problem, in that there is no defined procedure for determining when specific data should <u>cease being collected</u>.

Limitations of support staff has also meant that in many cases there probably has been inadequate supervision of the data collection process when that process has been contracted out, or left to cooperators. The Indonesia, Pakistan and Sri Lanka experience all suggest that the collection of appropriate, accurate, and reliable data requires regular and rigorous supervision by an appropriately trained individual, though not necessarily a senior scientist.

The studies also reveal that IIMI has no supporting program to inform the research staff about newer techniques, data collection equipment, etc. In addition, there is no provision to make special equipment available from a central source. For physical measurement, a few data loggers are being used, vibration meters have been used for pump studies, but in general, the techniques currently used are those requiring significant labor inputs utilizing traditional equipment. Equipment, such as digital surveying or global positioning equipment to assist in mapping the experimental areas illustrate the type of equipment that would facilitate much of the research work.

4.3.4 Analysis

In some, but not all of the research, there has been the **required** critical **review and** resolution of problems with the raw data prior to processing and analysis. This, obviously, is a critical step that should be standard with all of IIMI's research.

Most, but not all of IIMI's research has been designed to be amenable to some form of statistical verification. In some cases the analysis was anticipated in the planning of the research; in others, the statistical analysis was determined upon completion of the field studies. Most of the analyses utilized standard statistical measures, with relatively few examples of more sophisticated analysis.

4.4 Linkage with Policy-makers

   With the exceptions of Sri Lanka, and perhaps to a
degree in the Philippines, and in the Sudan, **there is
relatively little effective linkage between the IIMI
research unite and policy-makers.** In Sri Lanka, at the
policy level within the Ministry of Lands, Irrigation and
Mahaweli Development, there has been interest in improvement
of irrigation management for over 20 years. This interest
was tangibly demonstrated by the enthusiasm with which the
Government of Sri Lanka welcomed and has continued
supporting IIMI. In addition, many of the staff of the IIMI
had previous experience in Sri Lanka, with personal contacts
at a range of levels in the Irrigation Department and in the
Ministry.

   This has resulted in significant informal input into
policy discussion, as well as formal input through a
recently concluded project[3]. The results of this
significant effort, carried out in a participatory mode with
representatives of the major government agencies involved in
the agriculture and irrigation sectors over a number of
years, are only now beginning to be apparent. What the
final impact will be is yet to be determined.

   In the case of the Philippines the irrigation agency,
the National Irrigation Administration, has had a long
history (almost 30 years) of interest in issues of system
management. This interest was developed and supported with
major Ford Foundation grants and professional involvement
from the University of the Philippines, Cornell, IRRI and
the Ford Foundation itself. In addition to its experience
with, and interest in the contributions of research to
management improvement, the NIA is essentially an autonomous
agency with substantial freedom at the policy level. This
combination of experience -- providing receptivity, and
policy freedom -- providing opportunity, made an effective
linkage possible.

   In the Sudan, IIMI's potential impact on policy is a
result, in part. of the ability to make contact at the
Ministerial level and, in part due to the lack of other
sources of expatriate advice; IIMI remains one of the few
international agencies still active in the country. From
the standpoint of the research program, IIMI's input at the
policy level has been one of drawing upon its work in other
countries -- its store of accumulated knowledge -- though

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[3]   The Irrigation Management Policy Support Activity,
        carried out through the USAID-Supported Irrigation
        Support Program for Asia and the Near East (ISPAN)

the current research has the potential to have significant policy impact.

In most of IIMI's other locations, IIMI's major contacts have been with the irrigation agency responsible for government systems. These agencies have limited degrees of freedom with respect to policy. Where policy-making is within their mandate it is usually on matters internal to the organization and primarily administrative. Policy-making with respect to the irrigation sector is usually made within a Planning Ministry, and IIMI has little, if any contact with this Ministry.

The Consultative Committee provides a potential vehicle for contact with policy-makers, but generally has not be utilized for this purpose. Participants in these committees usually are representatives from the action agencies related to irrigation, and rarely are they at the policy-making level, particularly at the sector level.

This is not to say that IIMI's research has not had impact at the policy level, nor is it to suggest that IIMI should be more involved directly at that level. As is detailed in the succeeding section, there are a number of examples of significant policy implications to IIMI's work and in at least a few instances these have been recognized and are being considered at the policy level. This is evident in Sri Lanka, Pakistan, Indonesia and Nepal. This experience suggests that **IIMI's policy role to this date has been one that evolves out of a combination of substantive field study in the country, continuing for a period of time that provides the insights into the reality of irrigation conditions, the understanding of potentials for effective and acceptable change, and the opportunity to establish the institutional and personal relationships that are necessary for policy input.**

4.5   Innovations

The word "innovation" is defined as "something, as a product or method, newly introduced"[4], and not necessarily newly invented (emphasis mine). In this sense, IIMI has been significantly innovative.

4.5.1 Reality and Image

Perhaps the **most** important of IIMI's innovations, and one of the most difficult, has been the introduction of "realism" into the "imagery" of the perceptions about the operation of major irrigation systems in the countries in

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[4]   The American Heritage Dictionary 1989. Dell Publishing. New York

which it is working. **While realism is not necessarily a
"new" method it is a relatively scarce commodity in the
context of irrigation.** And it is a critical one if
irrigation management is to be improved. Without a
recognition of the reality of system and sector performance,
there is little incentive for change.

For a variety of reasons in many, if not most, of the
countries in which government-developed irrigation systems
are important there is an image of how these systems
function that frequently is at major variance from reality
(as illustrated by the Gezira example, earlier). This
discrepancy can, and has been found in a number of IIMI
studies. There are "images" of how planning is done, of how
and how well (or how poorly[5]) the water is delivered, of the
degree of equity achieved, and of the ways the water users
act that frequently differ substantially from actuality.

IIMI's studies in <u>Indonesia, Pakistan</u> and <u>Sri Lanka</u> all
have been important in "forcing" the irrigation departments
to accept the fact that their systems were operating
significantly different from their image of the system and,
in fact, different from what their limited data were
indicating about the operations. I have used the word
"forcing" because there generally has been a marked
reluctance to accept this reality. This reluctance has been
evidenced through questions of the "representativeness" of
IIMI research locations, the "accuracy" of the measurements
and the interpretation of the results. It should be pointed
out that this preference for image over reality is
substantially shared by many of the donor/lenders. Over
time in the countries identified, this reluctance has, to a
significant but not complete extent, been overcome.
However, it should also be pointed out that <u>accepting
reality does not mean internalizing the implications</u>.

4.5.2 Participatory Turnover

In contrast to the relative paucity of research on the
management problems in government operated systems there is
a substantial body of research on farmer-managed irrigation
systems. This research, primarily from the academic
community, has served as a base for IIMI's research on
increasing participation of the users in the management of
government systems. The rapid growth of interest in the
turnover of part or all government systems in a number of

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[5]   In some countries there is a perception that many
        irrigation systems are performing very poorly,
        particularly in relation to the utilization of system
        infrastructure. There is some evidence to suggest that
        these systems may, in reality, be performing better
        than perceived when the full spectrum of constraints
        are recognized.

countries, has permitted IIMI to make important
contributions. Efforts to increase understanding of the
potentials and requirements associated with farmer
management of extended portions of government systems have
been successful in Nepal, Indonesia and Sri Lanka, and to
some extent translated into action. In the Philippines, the
turnover process was initiated prior to IIMI research, but
this research is contributing to more effective support of
the water user organizations by the National Irrigation
Administration. In the Sudan, where turnover is being
adopted, the government has benefitted from IIMI experience
through exposure to that experience rather than through
direct studies. It must be recognized, however, that in
other countries in which IIMI is working this understanding
has not always been translated into appropriate actions.

4.5.3 Decision Support

Management basically is informed decision-making to
meet defined objectives. In many irrigation systems,
particularly government-managed systems, there is a
dependence upon administration rather than management. Much
of the decision-making in this part of the irrigation sector
is based upon administrative rules and experience (sometimes
one year's experience twenty times, rather than twenty
year's experience). Frequently, there is limited
information from the field, and much of that of questionable
utility. IIMI's research in Pakistan, Indonesia and Sri
Lanka has developed or adapted a variety of tools to assist
those charged with making management decisions. Most of
these, to date, are at the operating level and to some
extent location-specific. The use of water delivery models
to assist in selective maintenance in Pakistan and the
Kirindi Oya, operating model, in Sri Lanka and in Pakistan
are illustrative. In the Research Division, the COMA model
permits the evaluation of design-management interactions to
improve matching of institutional capacities to the physical
infrastructure.

These tools basically add to the skills of the user.
However, their greatest utility in the longer-term is likely
to be to increase attention on the meaning of management,
and upon the information requirements associated with it.
Adoption of some of the "innovations", for example, regular
flow measurement at points where responsibility is
transferred, can take place in the absence of significant
institutional change. Others, such as the use of operating
models may require some change, e.g. to enforce the
requirement for collection of accurate field information.

The apparent usefulness of these tools has stimulated
interest in some countries in improving operational
management more generally. In both Pakistan and the Sudan
there is expressed interest in obtaining improved
information on channel flows, to permit more accurate

control. This can lead, indirectly, to increased
accountability, an essential for improved management. In
the case of the Punjab in Pakistan, where requests for
training in flow measurement were a result of the relatively
long contact of the Irrigation Department with IIMI's field
program, the current interest is limited, but has opened the
route for more substantive change.

4.5.4 Irrigation Financing and Investment

The area of irrigation financing, and particularly the
question of user fees and local mobilization of resources
for system recurrent costs, has been a contentious one for
many years. IIMI's research has clarified many of the
generic issues and provided the stimulus for a recent book'
that synthesizes the understanding from IIMI's studies and a
similar set supported by USAID. A number of alternative
approaches to financing are identified, along with the
recognition that no one approach is appropriate for all
cases. While questions still remain, the explicit
identification of the options and the exploration of the
impacts of these in specific circumstances are important
contributions to an increasingly important sectoral problem.

IIMI has had relatively little expertise in the area of
economics, at least used as such, but at least one research
effort to evaluate relative merits of investment in new
construction, rehabilitation, and irrigation management in
Sri Lanka should have a significant impact at the policy
level. This has implications for other geographic areas and
should reinforce questions that are being raised with the
various donor/lenders.

4.5.5 Secondary Salinity

The problem of salinization as a result of irrigation
has long been recognized, and major amelioration projects
have been instituted to address it in many countries. The
problem is usually identified with water tables that have
been brought close to the soil surface as a result of over-
irrigation in areas with high evaporation rates. The
salinization of the soil as a result of inadequate
irrigation, and/or the use of relatively poor quality
(saline) irrigation water (secondary salinity), has received
much less attention, particularly in areas where salinity
from water-logging has been considered the major problem.
IIMI's studies in Pakistan have revealed a pattern of
secondary salinity that indicates a potentially very serious
threat, to agricultural production in a major part of the

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[6]   Small, L.E. and Carruthers, I. 1991. Farmer-Financed
        Irrigation: The Economics of Reform. Cambridge
        University Press (in association with IIMI).

country. While IIMI's results have raised concern with an important, but limited circle of government officials, its continued research has further defined the circumstances leading to the problem, and the difficulty of solution. There should be a sharp increase in concern and efforts for correction. This research has obvious implications for Pakistan, and suggests that similar problems may exist in parts of India and other semi-arid countries with limited irrigation supplies. At the least, it should stimulate efforts to define the extent of the problem in many areas.

4.5.6 Irrigation Organization

IIMI has looked directly at issues of irrigation organization in the Research Division, in Indonesia., Nepal, Pakistan, Sri Lanka, and the Philippines. The research is helping to develop a body of knowledge about the structure and functioning of a variety of institutions in a range of settings. However, the individual efforts appear to be just that. There does not appear to be a consistent set of approaches to the data collection, or a generally agreed upon framework to permit more generic use of the individual studies.

4.5.7 Performance Measures

The work on performance measures is one of the few areas where there has been an attempt to capitalize on the interdisciplinary resources of IIMI (as well as of others) to develop a basic framework for addressing the issues, and to devise indicators that can be tested in a range of settings. The work still is at an early stage, but if successful in identifying readily obtainable, robust, useful measures of system, organization and sector performance it will be a very important contribution.

4.6 Utilization

It is difficult to determine the degree to which the results of IIMI's research are being utilized, beyond the immediate projects within which the research **was** conducted. In the case of Sri Lanka, the concern for improved management has permeated through much of the Irrigation Department, though this process was started prior to IIMI's research. **As** indicated earlier, much of the understanding developed by IIMI and others involved with irrigation research in Sri Lanka recently has been incorporated into a series of policy recommendations. The rate and degree of adoption is yet to be seen, though the first of the recommendations has been adopted.

In Pakistan, it has only been recently that the "reality" of system operation has been accepted and a

climate for utilization developed. Those research-based
recommendations that do not seriously affect the Punjab
Irrigation Department's relations with the external power
structure are being considered with interest. Those
recommendations that have implications for potential social
and/or political problems are not likely to be adopted soon.
How rapidly there is wider understanding and acceptance of
the issues relating to secondary salinity, as delineated by
IIMI is still to be determined.

In India, the use of computer scheduling is being tried
out in an experimental mode.

In the Philippines, results of the studies on support
to water user organizations are being incorporated into the
operations of the National Irrigation Administration.

In the Sudan, IIMI's expertise in the "turnover-
participation" area has been utilized, at least to some
extent, in the planning for the country's system turnover
program, and there is expressed interest in IIMI's
information-based approach to canal operation.

In Nepal, IIMI's studies on the formation of farmer-
managed irrigation systems have been used in development of
new systems. However, there is less evidence that IIMI's
understanding of the operations of government systems is
being utilized.

4.7 Beneficiaries

The direct beneficiaries of IIMI's research, in
general, are the irrigation departments in the various
countries. The major part of IIMI's research program has
been aimed at the improvement of irrigation system
performance, with an emphasis on government-managed systems.
However, to the extent that there is a more realistic
understanding of the actual technical functioning of the
irrigation systems there is likely to be more appropriate
policy formulation. In addition, the identification of
unrecognized problems at a relatively early stage, such as
the secondary salinity issue, should be of critical benefit
to those concerned with resource management and maintenance.

A second set of direct beneficiaries are the water
users who increasingly are being asked to take additional
responsibilities for the management, in some cases total, of
the irrigation systems. IIMI's research, in conjunction
with others, should lead to improved processes of devolution
of responsibility and more realistic apportioning of the
investment and recurrent costs. Where governments are
attempting to assist in the development of farmer-owned
systems, these more appropriate processes and cost
distribution should be especially important. This latter is
evident in Nepal.

Obviously, improvement in the performance of the irrigation systems should result in direct benefits to the water users, particularly when that improvement includes greater equity. These should then result in improvement in the irrigation sectors, with resultant indirect benefits to the country as a whole.

4.8 Reporting

The research process is not complete without reporting of the results. This reporting frequently has four objectives. The primary objective is to transmit the results and their interpretation to potential users as rapidly and effectively as possible. A second objective is to provide for internal examination of the course of the research, both at the project and program level, to improve the progress of the work. These are in the nature of interim, or progress reports. The third objective permits external evaluation of the quality of the research -- from the standpoint of its rigor and its appropriateness. The fourth objective is to have a measure of the program's (or individual's} productivity.

In my opinion, IIMI's research program has met the first objective substantially. Typically, there are reports and formal, semi-formal and informal meetings during the course of the research designed to keep interested parties informed. IIMI has placed significant priority on producing reports of the research in readable form, though not without the delay that frequently characterizes the research publication process. Some of these are in the language of the host country. IIMI participates significantly in symposia and other meetings to present research findings, and it has taken advantage of the ODI Newsletter to present information and ideas for discussion before more final and formal reports are available.

IIMI is less successful in meeting the second objective. IIMI rapidly became too large for the Internal Program Review to serve that purpose. The Pakistan Unit and the Sri Lanka Field Office both are sufficiently large and discipline varied, in terms of senior and support staff that some internal review for the purpose of project improvement is carried out. It is not clear that the Research Division engages in this type of interim reporting and evaluation.

The third objective also is only partially achieved. There are relatively few publications in journals that are subject to peer review, and thus little opportunity for ongoing evaluation from the larger irrigation research community. At some later date it would be possible to evaluate the peer judgement of IIMI's work through the frequency with which IIMI's research is cited, but it is not possible at this time.

The use of reports and other forms of publication as a measure of productivity is a problematic one. In the academic community, the phrase "publish or perish" is the expression of the problem. Where publication productivity is used as the sole criterium of productivity, or as a minimum standard, it is a very blunt instrument often leading to proliferation of trivial papers. However, an evaluation of the nature, quality and quantity of research output is a legitimate measure of a program's productivity, but should not be the only one. The use of these types of reports for evaluation of individuals is much more questionable, given the cooperative, occasionally collaborative nature of the research efforts and the mixed responsibilities of the research staff.

5   General Principles and Recommendations

5.1 General Principles

5.1.1   **All of IIMI's research must be carried out with the highest standards consistent with the research objectives.**

Problems in the irrigation sector, as in other parts of the agricultural sector, have been addressed through a combination of art and science. The art -- that information and understanding not in the "books" -- is developed and practiced by individuals who have gained their skills through observation, trial and error, and occasional experimentation. Surprisingly, perhaps. in the field of irrigation there remains a significant dependence upon art rather than science. In the government irrigation sector, Chief Engineers are presumed to be proficient "artists" who combine their "science" with their "art" to answer the non-routine problems. To an even greater extent, in the farmer managed irrigation sector there is almost total dependence upon the art of irrigation. Unfortunately, art is more difficult to teach than science, and a major purpose of research is to **change this "technical" art into science.** The transmission of understanding can then be transmitted much more efficiently, more economically, and with a reduced requirement for experience.

For research, particularly research on generic questions, to fill this role, each individual study must have the robustness and the rigor to serve as a substantial building block as the structure of understanding is built. This implies that an essential element of IIMI's research to enhance understandins must be the requirement that the research results be valid, when tested against the highest standards. This may seem a truism, but its application can appear to conflict with IIMI's other objectives of enhancing national capacities for carrying out irrigation management

research, and of fostering organizational change. I have
emphasized "appear to conflict" because the view is
sometimes held that researchers (and it is people that do
research, not organizations) in developing cannot do work of
the highest standards because of limitations of financial,
time, equipment and other types *of* resources. while some
impact is felt from these limitations, my experience is that
when a good researcher wants to work on a problem of
interest, he/she can almost always devise the approach and
the methodologies that will permit quality output. The
proliferation of poor output is more the result of an
incentive system that encourages quantity and not quality,
than it is the constraints of resources. In carrying out
its institutional strengthening objective, <u>IIMI should not
ask a collaborator to do more than it can do well</u>. I do not
think it either necessary nor respectful of the
collaborators not to expect the highest standard of output
from them.

**5.1.2 IIMI's research program must be planned as a
single, coordinated program, with <u>no</u> differentiation
between a "Field Operations Program" and a "Research
Division Program".**

From its beginning the foundation of IIMI's research
program has been the operating irrigation system. It was
recognized that the problems and questions of management
cannot be addressed in an experiment station context, and
that it would be necessary to carry out the majority of its
research in operating irrigation systems in a variety of
agro-ecologic, economic, institutional and soclo-cultural
contexts. Given this understanding, it is clear that while
some issues at the sector level can be addressed in an
"office setting", the major research contributions will be
derived from the studies of in the field.

Even the comparative studies designed to enhance the
breadth of applicability of the location-specific research
are basically dependent upon that field research. Thus, the
field studies should be planned with the dual objectives of
contributing to IIMI's <u>core</u> program and addressing the
location-specific objectives as defined in the associated
<u>complementary</u> program. This should not be a serious
intellectual nor practical problem, since IIMI's core
program is intended to address, important, relatively
widespread generic issues and most location-specific issues
should fit within this set of generic areas.

IIMI's new institutional structure should permit this
integration. However, to achieve it there will have to be
close coordination between the Director of Research, the
Director of International Cooperation and the Director,
Pakistan. In addition, since the Program Leaders will have
important. responsibility, there will have to be sufficient

resources to permit them to interact personally, and in the field with the researchers in those countries where core thematic research logically should be carried out.

An integrated research program has implications for the manner in which IIMI interacts with the host country, particularly in relation to the National Consultative Committees. A major implication in relation to the host country is that the research agenda will be guided more explicitly by IIMI. As suggested earlier, this should not present a serious problem, though there may be differences in the sense of priority.

An integrated research program also has implications for the financing of the research. This is addressed in section 5.2.3.

5.1.3 There should be a rational basis for size and composition of each research unit.

While no standard format can be suggested, because of the wide variety of situations within which IIMI works, it is apparent that most of IIMI's research units are inappropriately staffed, with a result that senior scientific staff often are carrying out activities that more appropriately be done by more junior scientific staff and technicians. The basis for this twofold. The original premise of "collaborative"work envisioned significant contribution of local staff to complement the senior, usually internationally-recruited, scientist. As indicated earlier, this has not materialized to any significant extent, resulting in the present imbalance. The second reason is the overly tight budgets under which the various units operate. The result of this disproportionate dependence upon senior scientists is much <u>more expensive research and lower productivity</u>.

The Pakistan Branch, to a large extent, represents a departure from the general situation, resulting from the combination of significant initial unrestricted funding, experienced senior research scientists, and relatively few administrative rules to inhibit the development of reasonably balanced research infrastructure. Even here, thee are individual projects for which the contract budget is inadequate to provide an economical research structure.

In addition to the need for a more balanced structure in the field, there is a need for larger units. The range of activities associated with a country effort are such that one senior person spends a disproportionate share of time moving from one activity to another ·· including the search for more support. The much greater research output from Pakistan and Sri Lanka is a reflection not only of the larger number, but the greater efficiency of the larger

units.   In this case, there are substantial "economies of
scale".

    In addition to the foregoing, often there are gaps in
the supporting structure which could be more appropriately
be provided by other units of IIMI, including Headquarters.

5.1.4 Critical supporting services are required which can best be provided directly or indirectly by IIMI Headquarters.

    The IIMI pattern of a widespread research activity,
with relatively few research staff at a single location
 (even if the foregoing recommendation is accepted in
principle) imposes a need for a strong system of central
support. This need is both substantive and administrative.
While IIMI's research staff are unusually interdisciplinary
in perspective, there are many situations where assistance
in the form of specific skills would be beneficial, and in
some cases, essential. The establishment of Geographic
Information System capability, the design of data handling
systems including advising on computer investment, the
design of special analytical and/or statistical procedures
are a few of the areas which are likely to be generic needs
that logically could be met either directly from a central
source, or indirectly.

    This indirect provision of support is dependent upon
the necessary administrative support that would facilitate
the short time allocation of disciplinary or other special
expertise to locations where such allocation would be
important. There would not be a need to maintain this
disciplinary capability at Headquarters, since substantial
expertise exists among IIMI's scientific staff. What is
needed are administrative and accounting mechanisms that
facilitate this movement, rather than impede it.

    **The Headquarter's support, both direct and indirect can
be provided through a Research Support Unit.** (See
Recommendation **5.2.3.1)**

5.2 Specific Recommendations

    5.2.1 Principle 2, to have a single, unified research
program brings with it two specific recommendations:

5.2.1.1 the research in each of the major areas of **research concentration should be defined by a <u>set of auestions</u>, the answers to which would provide the basis** for **significant improvement in the management of irrigation systems and the irrigated sector.**

    To integrate the location-specific research with the
efforts to develop more generic answers it is necessary that

both efforts be developed in parallel. The past pattern
defined the field operations research program almost
entirely on the basis of local questions. As a result, the
attempt to extract from the varied sets of individual
location-specific research results the data and information
to address the generic issues was neither effective not
efficient. It is necessary, therefore, to design the field
studies with both the local and generic view in mind.

This will require substantive interaction among the
scientific staff associated with the major problem areas.
These staff are likely to be located in a variety of
locations where there are needs and opportunities for
addressing the individual issues. As suggested earlier,
there should be sufficient resources available to the
Program Leaders to permit significant interaction with the
researchers in the field, both to develop the generic issue
questions and to engage interest and involvement. However,
even under the best of circumstances, this type of face to
face meetings will be limited. If there is an agreed-upon
set of questions that define the major issues research
planning can proceed in a timely manner with the more
limited personal interaction.

5.2.1.2 there must be an agreed-upon set of research protocols that would ensure the collection of the necessary data, and permit the uses of the data for comparative purposes.

The problems of generating the data necessary for
comparative analyses appropriate to address the irrigation
management issues generically are compounded by the lack of
minimum standardization of data collection among IIMI's
research studies. Essentially all of IIMI's research is to
a substantial extent location-specific. This specificity
applies, not only to the environments within which the
research is conducted, but also to many of the research
questions that are investigated. Inevitably specific
questions will have individualized data needs, but there are
a number of measurements and other types of data that are
common to many of the questions, and particularly to the
generic aspects of the questions. These should be a part of
all of IIMI's primary data collection activities.

The protocols should identify the necessary data and
the methodologies by which the data should be collected.
These methodologies should specify both the desired accuracy
and precision.

The data covered by the protocols would be the minimum
set of data to be collected, and customarily would be
supplemented by additional data addressing the specific
research questions being considered in the particular
location. While these protocols would be of primary value
to IIMI, as it carries out it research program, there would

be significant value to the expanding network of national
institutions that are developing interest in the management
problems of the irrigation sector.

Data should be obtained not only to place the study in
its current physical, economic and social environments, but
also in its historical context. Data usually are collected
for limited periods of time during which the specific
conditions will be representative of only a limited set of
the conditions under which the system must function. Thus,
to understand the results, it is necessary to understand the
range of conditions under which the system operates. In
addition, the observed responses of the system operators and
users are a function not only of the conditions being
experienced, but of their anticipation of what is likely to
occur. This anticipation is based upon the history of their
experience with the system.

The combination of data needs for the core questions,
and the requirements for adequate specification of the
environments within which the individual systems are
functioning suggests that a limited set of standard research
protocols be used as starting points for the various types
of research questions.

5.2.2 Principle 3 indicates that the present
infrastructure of IIMI's research units is unbalanced, with
inadequate support to the senior scientists. This leads to
the following recommendations:

**5.2.2.1 Each research unit should have at three,
and ideally more senior scientists representing
different disciplines. (These would be a expected to
include both internationally-recruited and nationally-
recruited scientists.)**

In Bangladesh, Morocco, Nepal, the Sudan, and the
individual countries within sub-Saharan Africa where IIMI is
active, IIMI's research units are staffed with only one
senior scientist. In addition to their research
responsibilities, these individuals have a range of
additional responsibilities -- administrative,
representational, program development, etc. There would be a
more than a proportional increase in research productivity
with the addition of another senior scientist who could
devote **a** much greater fraction of time to the research.
This would be enhanced further by the recommended
restructuring of the supporting infrastructure. (see
recommendation 2 b, below)

As stated earlier, the IIMI research staff are to a
surprising degree interdisciplinary. Most have a
sensitivity to the multiple aspects of irrigation management
problems, and some have acquired a reasonable grasp of the

skills of other disciplines. However, there are limits to
the extent to which these skill are achieved, and there are
many times when the special contributions of other
disciplines would be valuable and important. Some of this
need can be met through contributions of input from the
other discipline specialists at other locations in the IIMI
system, but this cannot substitute for longer-term
participation. The one disciplinary area where IIMI has
disproportionately low representation has been economics; it
is clear that as IIMI extends its research more broadly into
the agricultural sector, **there will be a need for more
agricultural economic expertise, and it already has a gap in
this area.**

One problem can be anticipated, and to some extent has
already been experienced ·· that of resentment on the part
of nationally-recruited staff for their "inferior" position,
certainly with respect to salaries and "perks". This
problem occurs whenever two groups doing essentially the
same jobs are considered and rewarded differently. At the
International Center'for Integrated Mountain Development
(ICIMOD) in Nepal, all senior staff are recruited on the
same basis, and there is no differentiation of Nepalese from
other nationalities; at most other CG centers there is a
two tier system, though in some (perhaps most) the perks are
similar, even when there is a salary differential. What
will be appropriate for IIMI should be evaluated carefully.

5.2.2.2 Each research unit must include a spectrum of support staff, including intermediate and lower level research assistants.

Within the international irrigation research community
IIMI has a unique comparative advantage in carrying out
irrigation management research ·· it has resident capability
in a number of irrigation settings, by contrast to many
others who rely on short-term visits or intermediate-term
activities. This advantage is especially apparent in
relation to those questions that require the collection of
primary field data.

However, these types of studies usually are relatively
labor intensive. While it would be desirable, and was an
expectation that this labor would be obtained through
collaboration with the local irrigation agency and related
research units, in most instances this has not been
feasible. Even when labor support is provided, there is a
need for training and for close supervision during data
collection. The levels of skills required for the various
activities associated with field primary data collection
range from unskilled labor to university education. If many
these activities must be carried out be a senior scientist
the result is a very inefficient, and expensive research
activity.

5.2.3 Principle 4, in addition to principle 2 combine to suggest that there be major changes in the IIMI's <u>planning and support</u> of its research activity. Its revised organization implies this the former, but the proposed allocation of implied budgetary support does not.

The revised planning for a unified research program will be dependent upon the degree of cooperation between the Director of Research and the Director, International Cooperation as well as between the Program Leaders and the research staff in the country programs. This interaction would be fostered if the joint efforts place <u>greater emphasis on the planning of programs</u>, with the planning of projects left to a lower level.

The implied budgetary allocation suggest 75% of "country staff" time will be allocated to "complementary activities", with 25% core, and 90% of the "research staff" time devoted to core activities and **10%** to complementary. This leaves the country program in almost the same position as they currently experience -- a position that leaves them vulnerable to the vagaries of the donors, with limited ability to design the most effective program, and with no assurance that they will be able to provide the continuity essential for country-level impact. It also leaves IIMI with the problem of implementing the country research units with the appropriate size and makeup. Experience has shown that with the exception of Pakistan and Sri Lanka, donors have been unwilling to support larger units.

<u>IIMI should consider seriously whether it can best serve with a smaller program in which it exercises greater control—ox—with a larger program substantially directed by others</u>.

5.2.3.1 **The Research Operations Unit should provide opportunity for scientific staff to compete for released time to pursue integrating activities addressing the generic issues.**

It is difficult to mobilize the integrating effort necessary for the synthesizing of the comparative data for development **of** the more generic answers **to** the thematic questions within the day by day responsibilities of the researchers in the field. Yet, <u>in many cases, these researchers are the most competent in attempting this synthesis</u>. A mechanism for achieving this objective would be to encourage the interested researchers to compete, individually, or preferably as small teams (than could, probably should include collaborating scientists/professionals) for "released time" from their normal responsibilities and for essential supplementary funds to engage in the synthesis activity. Depending upon the data locations, feasibility of long-distance collaboration, and costs, this effort might be carried out

at one of the field locations, at headquarters, at some
other appropriate location or through e-mail. This approach
should result in improved researcher morale, and greater
progress on the generic issues.

5.2.3.2 **There must be a formal, standard
procedure for archiving and protecting IIMI's data at each
of the field locations, with a central data base at
Headquarters.**

At the present time data are being stored at the
various field locations in a non-standardized way, resulting
in substantial inefficiency in attempting to use these data
for comparative purposes, and with significant opportunity
for loss. The field data have been, and are being gathered
at very substantial cost and they have the potential to
become increasingly valuable as the data mass accumulates.
Yet, there is no systematic procedure for ensuring that the
data entering the storage have been processed so they are
appropriate extended use, or for protecting this asset.
The Pakistan Branch has adopted elements of a data base
system, but there should be a consistent, comprehensive
system throughout IIMI's operation.

5.2.3.3 **There should be a research program data
base, at headquarters, that would serve both current
monitoring and reference purposes.**

At the present time, the program data base provides a
list of projects based upon the source of funds, but not
identified by research topic and specific questions or
issues, procedures, etc. It appears to be derived primarily
from an accounting need, rather than a research information
need.

6. Implementation

Implementation of some of the specific recommendations
from this report can be accomplished without inherent
difficulty, needing primarily agreement and allocation of
relatively modest resources of time and effort.
Specifically, the recommendations to identify the essential
thematic research questions, and related research protocols
require the interaction of the program leadership and the
scientific staff for this purpose. The recommendations for
development of an archiving process and appropriate data
bases may require some specialized consultant assistance,
but once established should require relatively limited
resources for maintenance.

The recommendations relating to the size and makeup of
the country research units, along with the recommendation
for a more integrated research program will be more
difficult to implement. The answer to the fundamental

question -- what is the appropriate proportion of a country
program's resources that must be provided from country-level
resources? -- will determine the probability that these
recommendations can be implemented. The 1993 Program and
Budget answer implies that they will not. The Medium-Term
Plan anticipates an increase in funding for complementary
activities, but experience suggests this is likely to be
expansion through project-related grants that in the past
have not been sufficient to provide the recommended staffing
levels and continuity. Implementation of the
recommendations probably would require the decision to limit
the number of research units and provide a larger proportion
of core funding.

There can be logical exceptions to the recommendations.
An effective research program could be carried out with a
smaller unit or in a non-resident mode in a few countries.
Egypt and Mexico are two countries where the research
infrastructure and scientific capacity are such that IIMI
input into a collaborative effort could be provided through
scheduled working visits from regularly participating staff
or a resident staff member. In this type of relationship,
IIMI should not expect to develop its full "presence", with
Consultative Committees and a comprehensive set of
activities, but should permit concentration on the
collaborative research effort.

Appendix 1

TERMS OF REFERENCE

<u>PART I</u> To examine:

1.   whether IIMI's research programs have adequately
      addressed the major problems in irrigated agriculture
      in developing countries;

2.   whether the objectives and goals of the research
      programs have been relevant and appropriately focused
      on the major issues in irrigation development;

3.   have the methodologies used been appropriate in the
      context of the research objectives and resources
      available;

4.   have the project protocols covered an appropriate
      literature search;

5.   have IIMI's research programs had appropriate linkages
      with policy-makers;

6.   what have been the principal management innovations
      resulting from IIMI's research in terms of products,
      processes and knowledge;

7.   to what extent have the accomplishments of IIMI'S
      research programs been recognized by national agencies
      and have been utilized to bring about improvements in
      irrigation management;

8.   who have been the principal beneficiaries of IIMI's
      research.

<u>PART II</u>

Based on the above, to provide clear guidelines to
strengthen IIMI's research programs and outputs in the
future.

Appendix 2

QUESTIONNAIRE MEMO

Memo

TO: IIMI Research Staff   COPY: K. Mohtadullah

RE: Research Review

DATE: July 23, 1992

Some of you are already aware of the fact that I have been asked by Khalid to assess IIMI's research for the purpose of suggesting ways in which it can be strengthened. The assignment is a challenging one, but with the potential for an important contribution to IIMI's planning for the future. However, while I have reasonable familiarity with IIMI's research in general, and more depth of understanding in a few locations, I lack much of the detail that is required for this study. Hence, this note to you, and a request for assistance.

My (our?) terms of reference are to determine the answers to the following questions:

1.   Does IIMI's research program address the major problems of irrigated agriculture in the developing countries?

2.   Are the objectives and goals relevant and focused on the major issues in irrigation development?

3.   Are the methodologies used appropriate, given the objectives and resources available?

4.   Has the research considered the available literature?

5.   Has the research program had appropriate linkage with policy makers?

6.   What are the principal management innovations (knowledge, processes, products)?

7.   To what extent are IIMI's research accomplishments been recognized and utilized by the national agencies?

8.   Who have been the principal beneficiaries of IIMI's research?

Answering these questions is difficult, in part because of the multiple-objective nature of IIMI's research program, including knowledge generation, knowledge application, capacity building and institutional change. There is added difficulty in making the assessment because of the varied roles of the Consultative Committees in the different countries. However, I will try to place the research work in sufficient context that the Board (for whom the report is intended) will have an appropriate picture.

While I know you all have your time more than fully occupied, I would very much appreciate essential information on your research program. I have obtained some information at headquarters, but it is not adequate for the task -- which points to an area for improvement. To facilitate provision of the information I have prepared the following form which I hope you can use for each project that has either been completed or is currently being conducted. If the information is already available in your research and/or annual reports, I would appreciate receiving copies of the reports. The assessment is due to Khalid around mid-October, so I would greatly appreciate your rapid response.

I would also welcome any of your additional thoughts on IIMI'S research program since this is an important opportunity to provide input to IIMI's future.

For Each Research Effort, please answer and/or provide the following:

A.   Project Title:

B.   Project Starting and Ending Dates:

C.   Project Sponsor: (funding source)

D.   Project Budget: (total, and major categories, if possible)

E.   Project Collaboration -- Type and Agency, Mode: (there are a variety of types of collaborations and I have taken the liberty of defining the following:

> tolerance -- the Irrigation Department permits you to work in the system, but does little to assist [IIMI does all the research];
>
> coooeration -- the Irrigation Department provides modest level of support, in the form of occasional labor, usually within their normal budgetary allocations;
>
> partial oartnershio -- the Irrigation Department (or associated research institution) provides substantive input, including participation in the research planning and implementation;
>
> full partnership -- in which the Irrigation Department (and/or associated research institutions) participates fully in the research effort, from planning to analysis).
>
>
> Associated with the type of collaboration is the mode of carrying out the research:
>
> IIMI only, where IIMI is both responsible for the research and carries it out;
>
> IIMI contract, where IIMI is responsible, but contracts with another party to carry out the research;
>
> IIMI assist, where IIMI is not basically responsible, but assists **in** carrying out the research.

F.   Project Objectives:

G.   Project Methodology:

> 1. Was a literature review made prior to implementation? (formal/informal?)
>
> 2. Were meteorological measurements made?   If so which?
>
> 3. Were water measurements made?   If yes, what type?

4. For studies utilizing questionnaires, were the questions pretested?

5. Was the research design amenable to statistical analysis? If yes, was such an analysis carried out? Which?

H. Project Reports:

1. Were the results reported locally? If yes, how? (informally/workshop/publication in English/publication in vernacular), to whom?

2. Were the results reported more broadly? (written report to sponsor/IIMI publication/scientific-technical meeting/scientific-technical journal)

3. Report citations:

I. Degree of Achievement of Objectives: (full, most, limited, small)

(Relatively few research efforts succeeds in achieving all the objectives originally envisioned, for a variety of reasons. It would be helpful to have both your estimate of the degree of achievement, and your identification of the cause of the shortfall -- e.g. over-optimism about collaboration, data not available, etc.)

J. Technical/Scientific Quality: (high, moderate, low)

(While all of us strive for the highest quality work, IIMI's research is being carried out under very difficult conditions. There are constraints on the degree of control IIMI can exert; financial and human resources have been limited; occasionally, security is a problem, etc.. It will be very helpful to have your candid evaluation, along with comments on cause.)