Report of a Workshop

HUMAN RESOURCE MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

International Service for National Agricultural Research

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

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

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

ISNAR is supported by a number of the members of CGIAR, an informal group of approximately 43 donors, including countries, development banks, international organizations, and foundations.

Report of a Workshop

HUMAN RESOURCE MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

7 to 11 November 1988
The Hague
The Netherlands

isnar
International Service for National Agricultural Research

AGENDA

INTERNATIONAL WORKSHOP ON HUMAN RESOURCE MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

The Hague, Netherlands
7-11 November 1988

Monday, 7 November
THEME: OVERVIEW OF HUMAN RESOURCE MANAGEMENT IN NARS
Module Coordinator–Pammi Sachdeva

09:00-09:15	Introduction to Workshop
09:15-10:00	Recent Evidence on Resource Commitments to Agricultural Research
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12:00-13:30	Lunch

THEME: INFORMATION FOR HUMAN RESOURCE MANAGEMENT
Module Coordinator–Larry Zuidema

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13:45-14:15	Management Issues in the Collection and Use of Information on Research Personnel
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Module Coordinator–Byron Mook

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09:45-11:15	Working Groups: A Management Exercise Based on Data from Thailand
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THEME: CONSIDERATIONS FOR TRAINING IN NARS
Module Coordinator–Luka Abe

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Module Coordinator–Paul Bennell

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Module Coordinator–Paul Marcotte

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Module Coordinator–Paul Bennell

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Module Coordinator–David Kaimowitz

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15:15-16:00	Intergroup Relations between Agricultural Research and Extension
16:00-17:00	Human Resource Management in EMBRAPA: An Overview

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Module Coordinator–Paul Marcotte

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THEME: COMPUTER TOOLS FOR HUMAN RESOURCE MANAGEMENT
Module Coordinator–Krystyna Stave

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WORKSHOP PARTICIPANTS

Name	Country
Mario Allegri	Uruguay
Jaime Tola Cevallos	Ecuador
Lucas P. Gakale	Botswana
H.M.E Herath	Sri Lanka
Robert Kikopa	Tanzania
Onyembe Pene Mbutu Lolema	Zaire
Emilio Madrid	Chile
Cynthia R. Mamon	Philippines
James B. Matata	Kenya
Ndiaga Mbaya	Senegal
Oneas T. Mufandaedza	Zimbabwe
Daniel Ouedraogo	Burkina Faso
K.V. Raman	India
Mrs. Sumarsini	Indonesia
Nguyen Thanh Thuy	Vietnam
Liliana Vaccaro	Argentina
Dennis M. Wanchinga	SACCAR*
A.M. Yassin	Sudan

Observers	Institution
James Bingen	Michigan State University
Lawrence Przekop	ICARDA

ISNAR Staff

Alexander von der Osten, *Director General*
Howard Elliott, *Deputy Director General*
H.K. Jain, *Deputy Director General*

ISNAR Working Group on Human Resource Management

Paul Bennell
Howard Elliott
David Kaimowitz
Paul Marcotte, *Workshop Coordinator*
Byron Mook
Tarcizio Quirino
Paramjit Sachdeva, *Chairperson*

Other ISNAR Contributors

Luka Abe
Bonnie Folger
Krys Stave
Han Roseboom
Kathleen Sheridan, *Editor*
Joyce Ogiste, *Workshop Secretary*

**Southern African Center for Cooperation in Agricultural Research.*

Next page photograph:
Participants at the Workshop

FOREWORD

Annually, ISNAR holds an international workshop on management issues for leaders of national agricultural research systems (NARS). This workshop takes the form of an annual consultation with NARS leaders providing feedback on the relevance and applicability of our approaches, allowing us to refine our continuing collaboration, and providing input for incorporation of NARS needs and experience into on-going research activities.

In 1988, for the first time, the entire conference was organized around a single theme, human resource management (HRM). The selection of human resources as the first theme workshop was a reflection of the importance of the scientist and the recognition that the development, retention, and continued motivation of the scientist is one of the critical management functions that the NARS face.

This thematic approach had a multifold purpose. First, it was an opportunity to present ISNAR's general experience with research on human resources to NARS leaders and human resource practitioners. Second, it provided a forum for participants to compare their own experiences in human resource management with those encountered by their colleagues in other regions of the developing world. And, third, it was an opportunity for participants to discuss the applicability of the ISNAR approaches.

The workshop, itself, was divided into critical areas of human resource management that have emerged from ISNAR system reviews, research, and training activities. These include such areas as information management, staffing, training, performance appraisal, compensation, and performance improvement. Some special project experiences with human resource management issues in on-farm client-oriented research (OFCOR), research-extension linkages, and a case study of EMBRAPA were also included for deliberation and discussion.

I am pleased that the HRM working group and the workshop organizers have put together these workshop "proceedings". The proceedings include the papers and presentations used, as well as the feedback and suggestions received from NARS managers. The workshop was a worthwhile endeavor, and it is hoped that readers of these proceedings will be stimulated to thought and action on the various issues raised.

My appreciation goes to all the participants for their contributions to a productive workshop.

Alexander von der Osten
Director General, ISNAR

PREFACE

ISNAR's strategy is to improve the effectiveness and efficiency of national agricultural research systems (NARS) by providing a research-based service. It achieves this through three interrelated programs–advisory service, research, and training.

In accordance with its corporate strategy, ISNAR's research has focused on developing, synthesizing, and adapting management concepts for agricultural research, in addition to building a knowledge base on NARS. Research has been conducted on management themes and issues identified in collaboration with NARS leaders. These research projects, at the system and component levels, have applied a multidisciplinary perspective and new analytical methods and approaches to dealing with policy, organization, and management issues facing the NARS in developing countries.

In response to NARS needs, our mid-term plan has identified human resource management as a priority area for our research and training activites. ISNAR's forum for focusing research on the needs of NARS, as identified by advisory service work and training, are working groups. These working groups serve to define and prioritize areas of work, and facilitate peer review to ensure the quality of products and services.

In 1988, ISNAR's working group on human resource management (HRM) developed and refined its approach to HRM issues. This past year, the group highlighted the following topics: resource commitments to NARS, agricultural research information systems, performance appraisal, performance improvement, and a review of ISNAR's HRM experience and lessons. To date, our research has produced a number of synthesis papers, literature reviews, human resource inventory questionaires, case studies, and computer exercises. Examples of these materials were used at the HRM workshop and are included in these proceedings.

The working group has made available useful material within a reasonable time frame. Workshop participants considered the materials relevant and applicable to the problems faced by NARS managers. The HRM working group, workshop organizers, and participants are to be congratulated for a job well done.

In 1989, these products will be further tested and adapted to the needs of individual NARS. This will be done in close collaboration with NARS managers whose contribution is essential for ISNAR's continued development as an effective, research-based service offering problem-solving tools and approaches.

Howard Elliott
Deputy Director General
for Research and Training, ISNAR

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Paramjit S. Sachdeva, Paul Marcotte, and Bonnie Folger

INTRODUCTION

The Workshop. The scientific staff of a national agricultural research system (NARS) provides the knowledge and expertise on which the success of the NARS depends. An important management function in a NARS, therefore, is the development, retention, and continued motivation of its human resources. Accordingly, the purpose of the workshop was to provide policymakers with an overview of human resources management (HRM) in NARS. Within the context of that overview, ISNAR's research and advisory experience in improving HRM was presented.

Drawing on ISNAR's experience as well as the established literature, the workshop presented management approaches and tools developed at ISNAR. The main topics covered were:

- *Staffing.* Development of job descriptions and the practices that relate to recruitment, selection, assimilation, and deployment of personnel.
- *Development/training.* Improvement of the capacities of research personnel through formal and on-the-job training.
- *Compensation.* Development of grade structures, promotion policies, and monetary rewards which influence the performance of researchers and support staff.
- *Performance appraisal.* Setting performance goals for individuals, and assessing actual performance relative to goals.
- *Performance improvement.* Understanding and enhancing the nonmonetary factors that motivate research staff.
- *Information management.* The development and use of information for diagnosis, planning, and implementation of HRM activities.

The sessions were interactive, using lectures, case studies, exercises, group discussions, and working group presentations. The workshop was conducted in English, at the ISNAR headquarters in The Hague. It was intended to address the needs of NARS managers responsible for the key HRM functions outlined above. Eighteen participants and two observers attended the workshop from Africa, Asia, Latin America, and West Asia and North Africa (WANA).

Proceedings. These proceedings bring under one cover all the papers, case studies, and exercises used at the workshop. As noted in the workshop evaluation, participants found the materials and discussions useful and relevant for their work, and suggested follow-up action by ISNAR. Country representatives at the workshop also plan to undertake follow-up measures, as appropriate, in their respective NARS.
It is hoped that these proceedings will further stimulate the process of thinking and action in the NARS on some of the key HRM issues discussed at the workshop.

Paramjit S. Sachdeva
Chairperson,
HRM Working Group
Paul Marcotte
Workshop Coordinator

SESSION 1

OVERVIEW OF HUMAN RESOURCE MANAGEMENT IN NARS

RECENT EVIDENCE ON RESOURCE COMMITMENTS TO AGRICULTURAL RESEARCH

Howard Elliott and Johannes Roseboom

Introduction

In this workshop, our attention will be focused on the development and management of human resources in agricultural research. These human resources are of interest because of their presumed impact on agricultural productivity, and the productivity of scientists is contingent on many factors, such as the policy environment in which they work, the operating funds and infrastructure available to them, and the technical support staff upon which they can depend. Therefore, the purpose of this paper[1] is to present a global view of human resource commitments to agricultural research and their relation to the levels of financial support they require to be productive.

Before looking at the resources, let us consider the outcome that these resources are expected to produce: increased agricultural productivity. Agricultural productivity may be expressed in many different ways; we have chosen to plot the evolution of both land and labor productivity on the same graph (figure 1).

On the horizontal axis, we have labor productivity (natural log of agricultural GDP per unit of labor), while on the vertical axis, we have land productivity (natural log of agricultural GDP per unit of land).

For four major regions of the developing world (Asia and the Pacific, Latin America and the Caribbean, West Asia and North Africa, and Sub-Saharan Africa) and three developed regions (Europe, Japan, and the "new" continents), we have plotted productivity indicators by five-year averages over the period 1960-1985.

The following points are brought out in figure 1:

- West Asia and North Africa and Latin America and the Caribbean show increases in both land and labor productivity without noticeably increasing the amount of land per economically active person in agriculture. This means that they have achieved their increased labor productivity largely through yield-increasing technologies.

- Japan, Europe, and North America and Australia are increasing labor productivity by increasing the area that is farmed by an individual. Land productivity is rising in Europe, North America, and Australia but not as fast as labor productivity, while land productivity in Japan seems to have reached a plateau and farm incomes are increasing because of increasing land intensity (area per farmer has doubled as the population leaves the land).

- Asia and the Pacific have been increasing both land and labor productivity while increasing the labor intensity of production (land per unit of labor is becoming smaller).

- Sub-Saharan Africa seems to find itself in a downward cycle in which output per unit of labor is falling, land per farmer is declining because of population growth, and there is no evidence of increasing output per unit of land.

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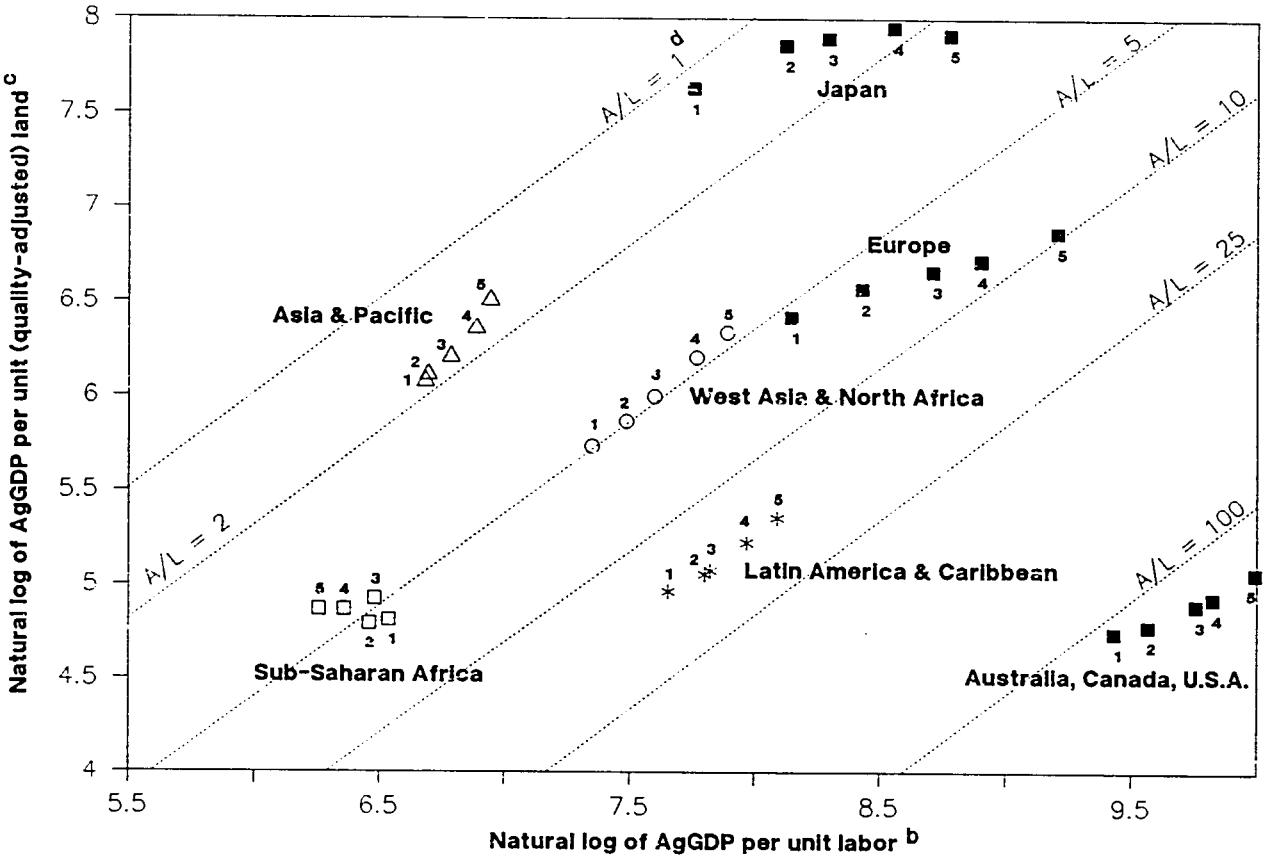
1. *This paper draws on the work of ISNAR's Indicator Series Project, particularly the work of Philip G. Pardey and Johannes Roseboom (1988a). All figures presented in this paper are of a preliminary nature.*

2. *Japan's contribution to this growth has been important (from $28,562 in 1960-64 to $69,173 in 1980-85).*

Figure 1. International comparison of (quality-adjusted) agricultural land and agricultural labor productivity indexes, regional averages, 1960-1985[a]



1 = 1960-64; 2 = 1965-69; 3 = 1970-74; 4 = 1975-79; 5 = 1980-85

a) Sample consists of 16 Asia & Pacific countries; 20 Developed countries; 26 Latin America & Caribbean countries; 35 Sub-Saharan African countries; and 13 West Asia & North African countries.
b) Labor is economically active agricultural population.
c) Agricultural land is arable land and permanent crops plus permanent pasture (hectares of quality-adjusted land).
d) A/L = Quality-adjusted land per unit labor.

SOURCE: Pardey & Roseboom (1988) calculations based on FAO and UN data.

Figure 2. Regional shares of agricultural research personnel and 'real' expenditures (1980 PPP U Dollars)

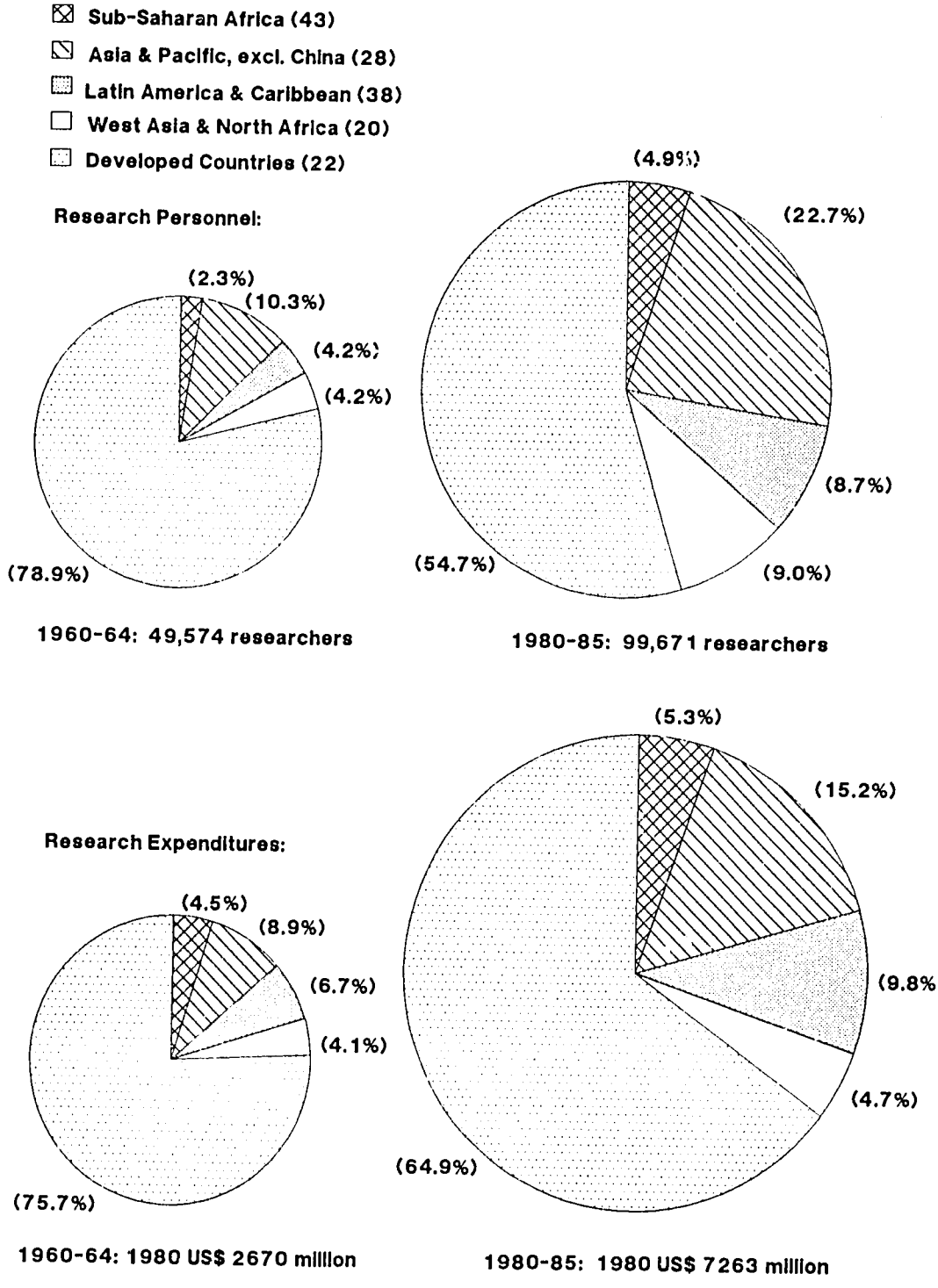


Figure 3. Percentage growth of the number of agricultural researchers and agricultural research expenditures between 1960-64 and 1980-85

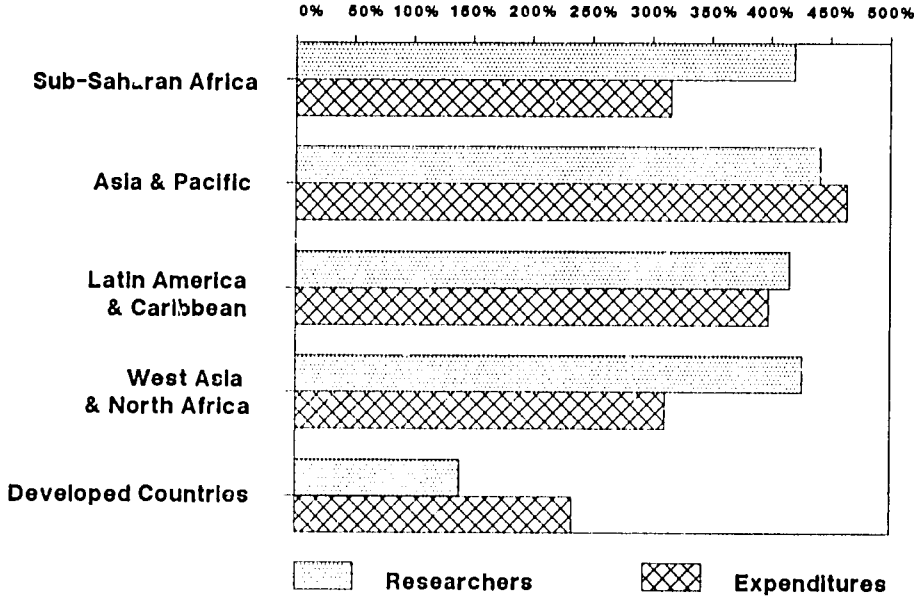
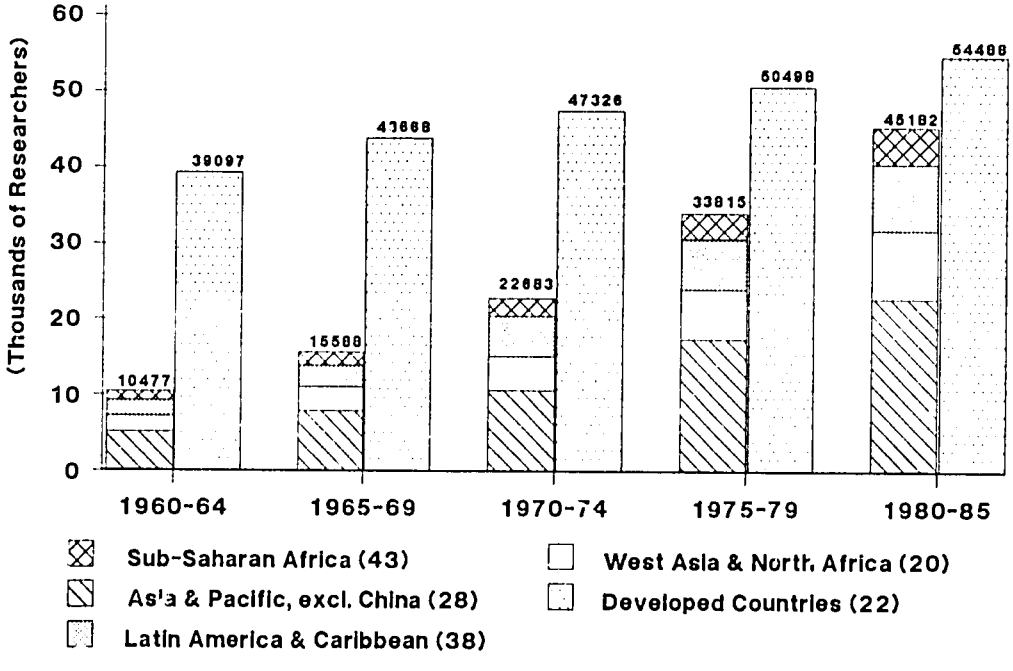


Figure 4. Development of the number of agricultural researchers (in full-time equivalent units)



It is clear that agricultural productivity will be increasingly science-based and that the nature and direction of productivity trends in the future will bear a direct relation to investments that are being made today in agricultural research. It is in this perspective that we turn to the nature of investments in human and financial resources devoted to agricultural research by comparing the periods 1960-64 to 1980-85.

Growth of Research Personnel and Real Expenditures

In this section, we draw on ISNAR's Indicator Series to compare the relative shares in the number of researchers and real expenditures in developed and developing countries over the 27-year period 1960 to 1986. As described in greater detail in Pardey and Roseboom (1988b), the Indicator Series provides a fully sourced and extensively documented set of research and expenditure indicators for NARS. Its coverage of NARS is greater than other existing data bases, and the commensurability of data between periods has been improved by the method of collection and conversion of data.

All expenditure data were first collected in current local currency units and then deflated by country-specific deflators into 1980 constant local currency units. They were then converted into 1980 US Dollars, using 1980 purchasing power parity indexes.

Figure 2 shows the growing importance of developing country NARS in the world total of agricultural research personnel and expenditures. The following points are notable:

- Over the period 1960-64 to 1980-85, the developing countries increased their share in the total number of agricultural scientists from only 21% in the period 1960-64 to 45% in the period 1980-85.

- All developing regions participated equally in this growth by approximately doubling their percentage shares.

- The growth in the share of personnel, however, is not matched by a growth in their share in total expenditures. This has risen from 24% to only 35%, thus signalling a contraction in the resources per scientist.

- As shown in figure 3, there is some difference in regional patterns in the growth of research expenditures, with WANA and Sub-Saharan Africa seeming to experience greater difficulty in keeping up with the growth of personnel.

In short, large-scale investments in the development of human resource capacity run the risk of being unproductive because those very human resources find themselves limited by inadequate infrastructure and operating capital.

Figure 4 places the developing countries as a group beside the developed countries for comparison in the growth of researchers (full-time equivalents). It is easily seen that while there has been a steady linear growth in the number of scientists in the developed countries, the growth in the developing countries as a group has been almost exponential.

These trends, which have been clearly documented with an accuracy not possible up to this time, have several implications for global agricultural research:

- Developing country NARS are quantitatively becoming a large part of the global agricultural research system. The division of labor between them, the international agricultural research centers, and private international research is changing.

- The majority of developing country NARS, nevertheless, remain small, as shown in figure 5, in relation to the tasks facing them, and many cannot hope to achieve a critical mass. This means that horizontal cooperation among them is an important means to getting coverage of the broad number of problems facing them. This is especially so for the very small NARS (those with fewer than 50 researchers), which are nearly all located in the Caribbean, the Pacific, and throughout Sub-Saharan Africa.

As shown in figure 3, the growth of the number of researchers at the regional level has been fairly even between the developing regions. At the subregional level, however, there is quite a bit of variation, as shown in figure 6, which is even truer for individual countries.

Figure 5. Size distribution of 131 developing country NARS by number of researchers (1986-85 average)

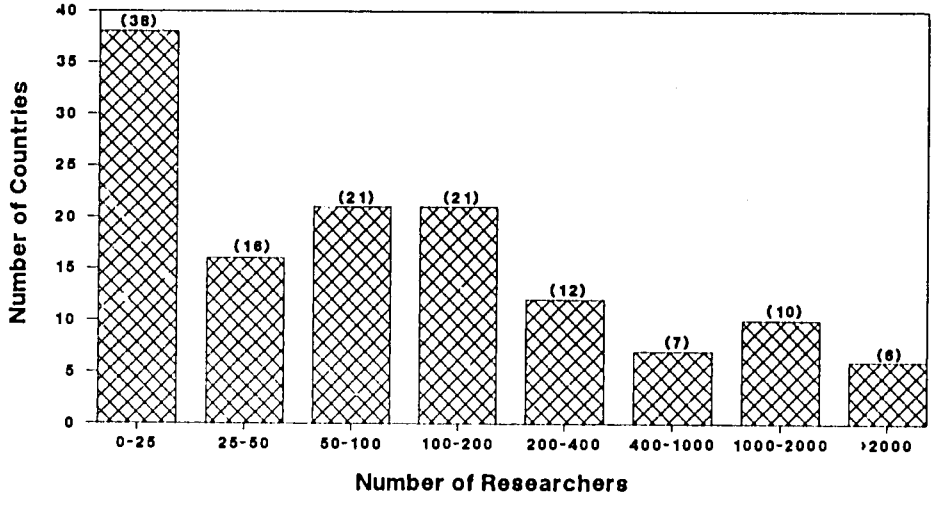


Figure 6. Percentage growth of the number of agricultural researchers between 1960-64 and 1980-85

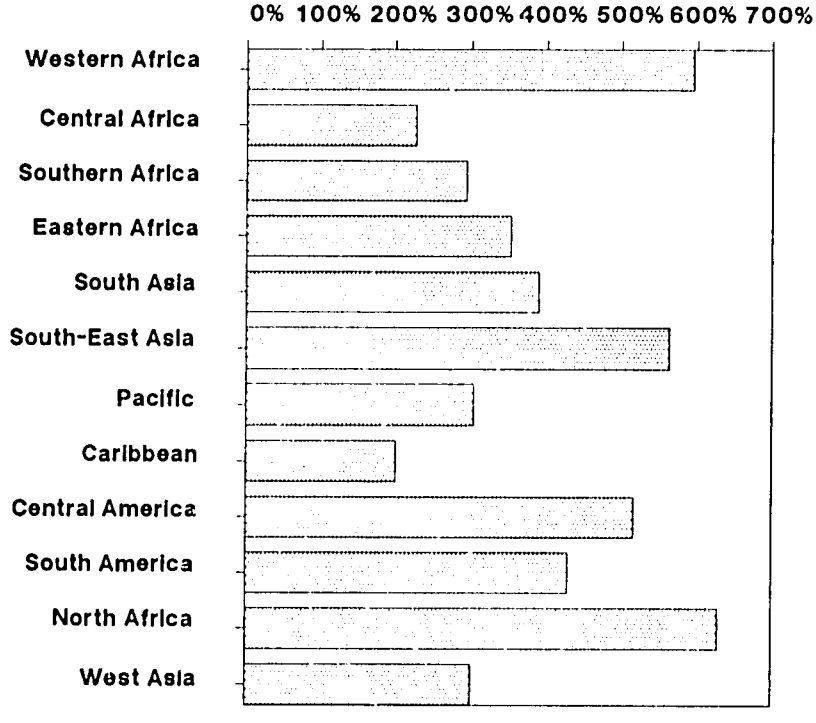
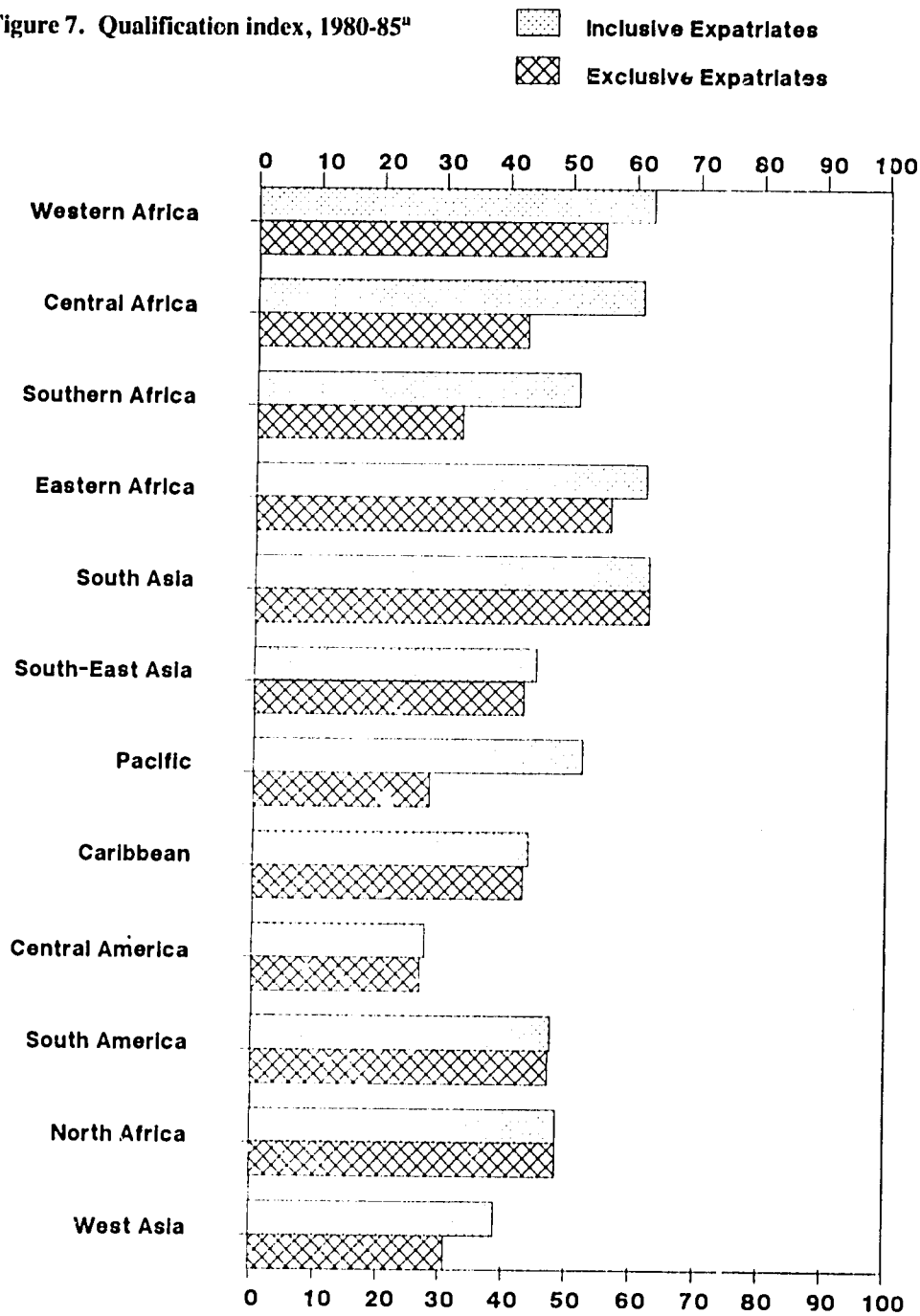
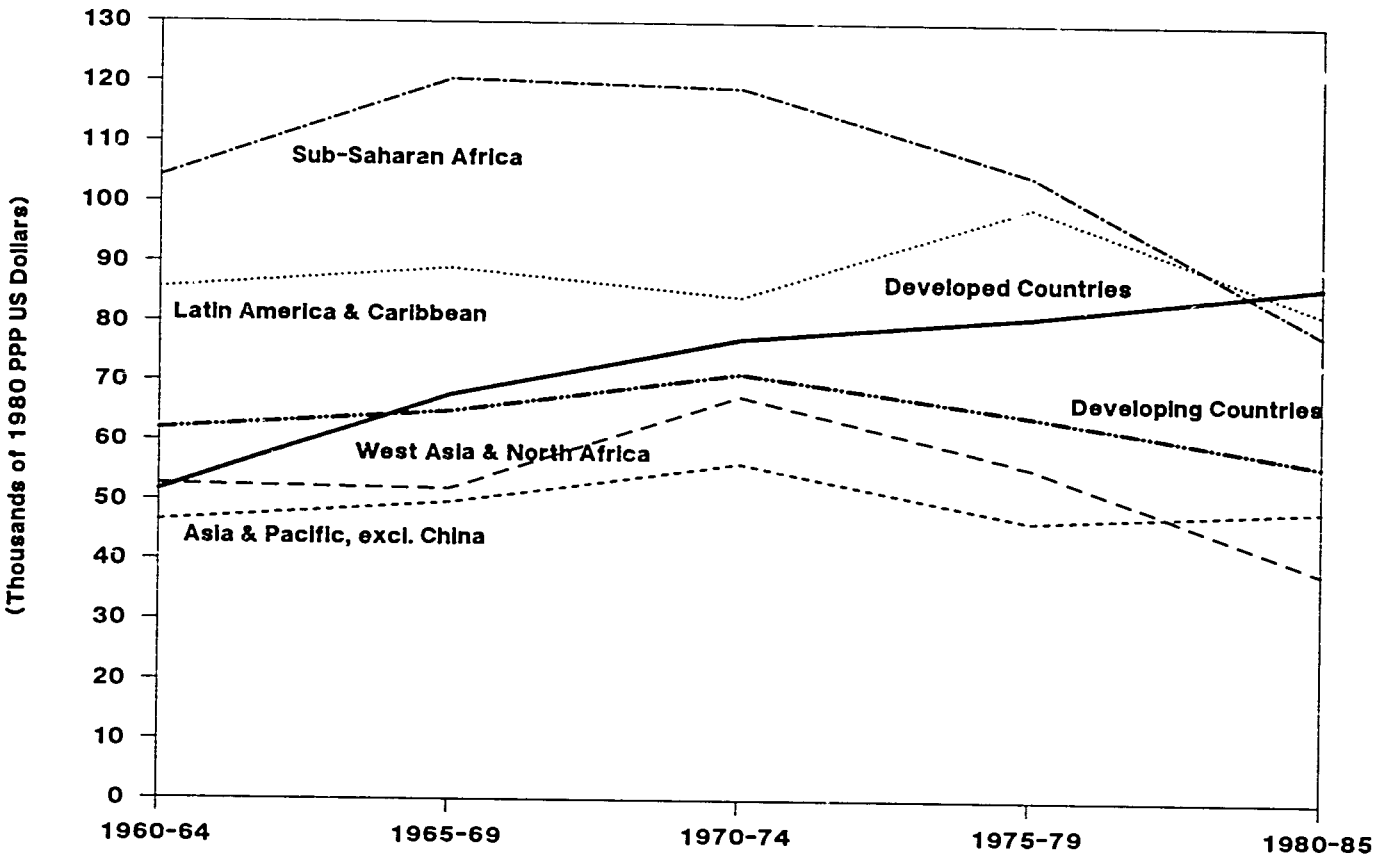


Figure 7. Qualification index, 1980-85[a]



[a] Qualification index = (PhD+MSc)/(PhD+MSc+BSc).
Expatriates are assumed to hold a PhD or an MSc degree.

Figure 8. Research expenditures per researcher (in thousands of 1980 PPP US Dollars per full-time equivalent unit)



The Qualification Index

It is not sufficient to look only at the number of agricultural scientists in a given country. One must also look at the levels of qualification of those scientists, both in terms of formal degrees and relevant job experience. The Indicator Series Project has made an attempt to add this dimension to the number of agricultural scientists on the basis of formal degrees. When possible, agricultural scientists have been classified by their formal degree into the categories BSc, MSc, and PhD. These terms have been used to refer to the first, second, and third university-level degrees that exist in most university systems.

On the basis of the data collected by the Indicator Series Project, qualification indexes have been constructed for the different subregions for the 1980-85 period, as shown in figure 7. The qualification index expresses the share of PhD- and MSc-level agricultural scientists in the total number of agricultural scientists. Data to calculate the qualification index are not available for all countries in the sample. The subregional qualification indexes are therefore based on subsamples of each particular subregion. For each subregion, two indexes have been calculated, one including expatriates and the other excluding them. The difference between the two indexes shows the importance of expatriates in each subregion.

The qualification indexes vary quite a bit between the different subregions, which adds an important qualitative dimension to the quantitative information given.

The Evolution of Research Expenditures

The rapid growth of research personnel must be matched with similar growth in the financial and physical resources if the new researchers are to be as productive as the old. A reduction in the ratio of expenditures per scientist may be a symptom of a system heading into difficulties. Interpretation of this figure is always difficult: at the bottom of the scale we commonly say that there is an irreducible minimum expenditure of approximately $10,000/scientist (largely in foreign-exchange items); at the top end of the scale, expenditure per scientist may be exaggerated because of the inclusion of major investment projects. This means that the mix of inputs such as labor, land, buildings, and equipment will vary over long periods of investment and reinvestment. For example, Pardey et al. (*in press*) show for the state agricultural experiment stations in the US that only 8% of total expenditures is currently spent on physical capital items. This figure had peaked at 29% of total expenditures in 1912, some 25 years after the establishment of the US NARS.

When growth in expenditure is juxtaposed with growth in scientists, we get figures for expenditures per scientist, as calculated in table 1 and graphically presented in figure 8. The developed country group shows a steady rise from approximately $52,000 per scientist in 1960-64 to more than $86,000 in 1980-85.[2] The developing countries as a group were spending more per scientist than the developed countries at the beginning of the period (perhaps indicative of the high cost of expatriates), but since reaching a peak in the early 1970s, this figure has declined significantly. This downward trend is most striking in sub-Saharan Africa and in West Asia and North Africa. Given its onset in the early 1970s, this decline may also reflect the fiscal crisis of most developing countries during the period of rising oil prices.

Bringing the discussion back to human resources, the key concern is productivity of scientists. The developed countries appear to have been steadily moving towards a more capital-intensive research system, capital intensity being measured in terms of both human and physical capital.

Researchers are getting higher levels of training, have more experience, and are matched with increasing financial and physical resources. This pattern is not apparent in most developing countries: with the exception of Asia, expenditure per scientist is not rising, and retention of scientists is universally considered a problem. This means that strengthening of the human capital base in agricultural research is not taking place at the desired pace.

Conclusion

This recent work by ISNAR has documented the increasing role of developing country NARS in total human and financial resource commitments to agricultural research. The effort is remarkable but it must be sustained so that the human capital, which has been built up at great cost, can be used productively and retained in the service of research. The decline in expenditure per scientist, which began in the mid-1970s, is threatening both the productivity and the commitment of scientists to research.

Table 1. Estimation of Expenditure per Scientist

Total Number of Scientists

Region	1960-64	1965-69	1970-74	1975-79	1980-85	Ratio 1980-85/ 1960-64
Sub-Saharan Africa	1159	1682	2242	3321	4870	4.2
Asia & Pacific	5123	7943	10639	17379	22625	4.4
L.A. & Caribbean	2095	2829	5297	6602	8720	4.2
W. Asia & N. Africa	2100	3134	4506	6514	8967	4.3
Developed Countries	39097	43668	47326	50498	54488	1.4

Agricultural Research Expenditures
(Millions of 1980 PPP US Dollars)

Region	1960-64	1965-69	1970-74	1975-79	1980-85	Ratio 1980-85/ 1960-64
Sub-Saharan Africa	120.879	202.817	267.161	347.858	381.940	3.2
Asia & Pacific	238.337	395.226	598.826	810.699	1105.523	4.6
L.A. & Caribbean	179.386	251.788	447.231	656.884	714.349	4.0
W. Asia & N. Africa	110.652	163.024	304.837	362.832	344.048	3.1
Developed Countries	2020.762	2955.308	3656.655	4090.231	4717.398	2.3

Expenditure per Scientist
(1980 PPP US Dollars)

Region	1960-64	1965-69	1970-74	1975-79	1980-85	Ratio 1980-85/ 1960-64
Sub Saharan Africa	104257	120592	119161	104757	78430	0.75
Asia & Pacific	46526	49756	56289	46649	48864	1.05
L.A. & Caribbean	85645	89011	84438	99494	81917	0.96
W. Asia & N. Africa	52687	52021	67659	55704	38366	0.73
Developed Countries	51685	67677	77266	80997	86576	1.68

References

Pardey, Philip G., and Johannes Roseboom. 1988a. An International Yardstick for Value-Based Indicators: An Application to National Agricultural Research Expenditures. ISNAR Staff Notes No. 88-10 The Hague: ISNAR.

Pardey, Philip G., and Johannes Roseboom. 1988b. A Global Evaluation of National Agricultural Research Investments: 1960-1985. Paper prepared for the workshop on The Changing Dynamics of Global Agriculture: Research Policy Implications for National Agricultural Research Systems organized by ISNAR, CTA, and GTZ, in Feldafing, Federal Republic of Germany, 22-28 September.

Pardey, Philip G., and Johannes Roseboom. *In press.* Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems. Cambridge: Cambridge University Press for ISNAR.

Pardey, Philip G., B. Craig, and M.L. Hallaway. *In press.* US Agricultural Research Deflators: 1890-1985. Research Policy Vol. 18.

HUMAN RESOURCE MANAGEMENT FOR NATIONAL AGRICULTURAL RESEARCH: ISNAR'S EXPERIENCE AND LESSONS

Paramjit S. Sachdeva

1. Introduction*

This paper briefly reviews ISNAR's experience in helping national agricultural research systems (NARS) better manage their human resources and identifies a few lessons from that experience. It presumes that ISNAR's cross-national experience can provide important lessons for individual NARS. The intended audience is senior NARS managers in developing countries. The purpose is to enable these managers to step back from the details of their own experience and to gain an overview of and perspective on some key human resource management (HRM) principles and their applicability to NARS.

The paper is divided into four parts: (i) overview and highlights of ISNAR's experience by major HRM area (manpower planning, training, etc),(ii) lessons from this experience, (iii) pending issues and possible actions by the NARS and ISNAR, and (iv) conclusion.

2. ISNAR's Experience

2.1 Overview

Since 1981, ISNAR has assisted 37 countries (see figure 1) better manage their agricultural researchers, thus covering over 13,000 researchers (excluding expatriates). This constitutes roughly 30 percent of the 45,000 agricultural researchers in the 129 developing countries included in ISNAR's global data base.[1]

Assistance provided by Bonnie Folger and comments received from Byron Mook and Paul Bennell are gratefully acknowledged.

The regional distribution of ISNAR's HRM work has been as follows: 16 countries in sub-Saharan Africa, eight countries in Asia, eight countries in Latin-America and the Caribbean, and five countries in Western Asia and Northern Africa (WANA). In more than 25 of these countries, the initial ISNAR reviews were conducted between 1982 and 1984, and most NARS have had follow-up missions since then, sometimes by HRM specialists.

In keeping with its global mandate, ISNAR has assisted NARS of various sizes. To date, the distribution of HRM activities has been as follows (see table 1 for countries covered): six countries with less than 30 researchers, nine with 30 to 100 researchers, nine with 100 to 200 researchers, seven with 200 to 500 researchers, and six countries with 1,000 to 3,000 researchers.

ISNAR thus has experience helping a fairly large and representative sample of NARS–with countries varying in size and thus in organizational complexity and program diversity, as well as in geographical location, administrative culture, and historical tradition.

The regional distribution of countries assisted by ISNAR's HRM activities, and the number of researchers covered, are shown in figures 2 and 3, respectively. Because of their relatively large size, the Asian NARS account for over 57% of researchers covered by ISNAR's work in HRM. However, the majority (51%) of countries assisted by ISNAR have been in Africa. Most of these countries have less than 200 researchers each and together account for almost 28% of the researchers covered.

Figure 1. ISNAR's collaboration with NARS: Human resource management

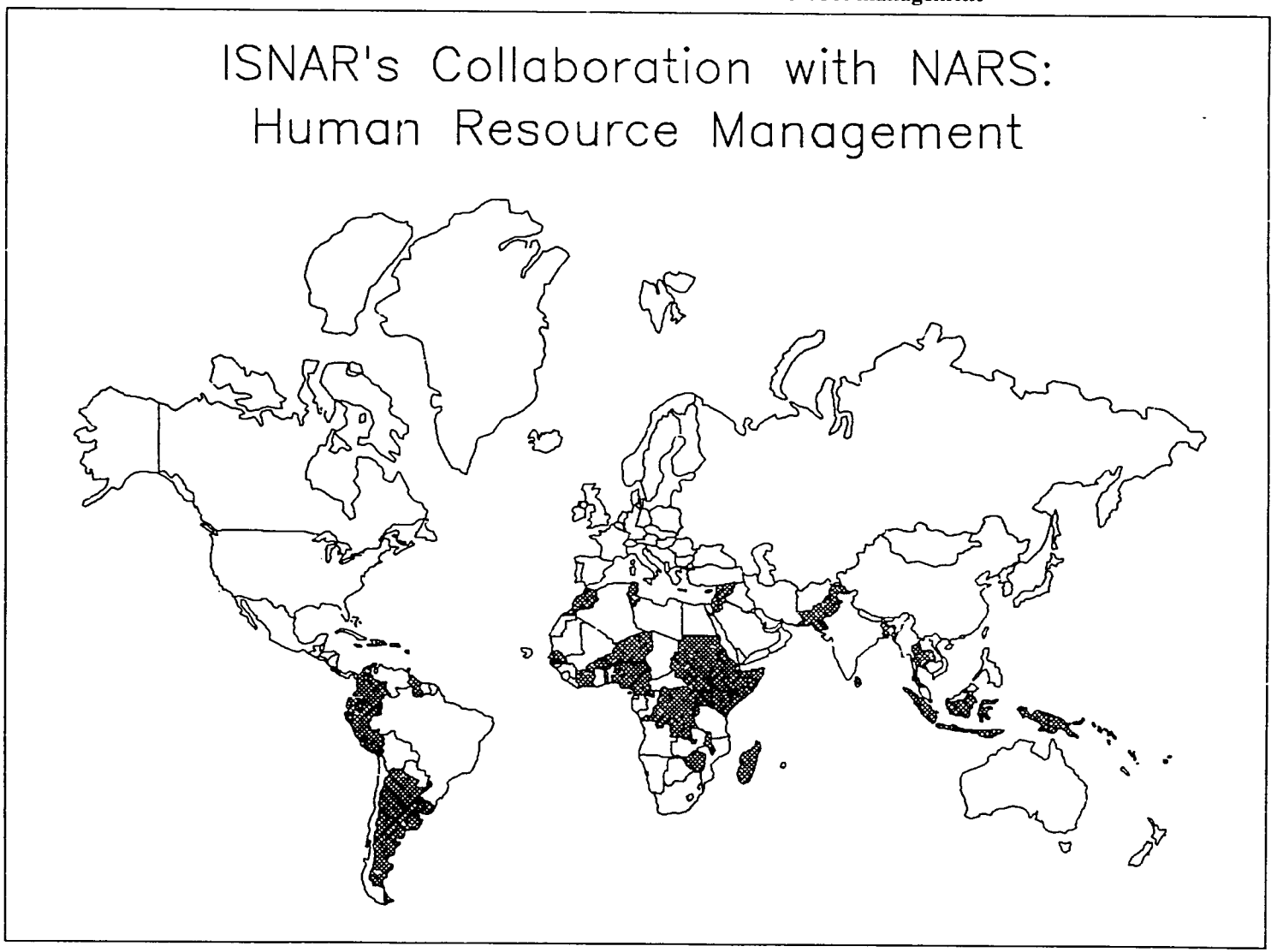


Table 1.

NARS Assisted by ISNAR in HRM–by Number of Researchers

Number of Researchers	*Number of Countries*	*Countries*
0-30	6	Fiji, Niger, Papua New Guinea, Rwanda, Somalia, Western Samoa
30-100	9	Burkina Faso, Gambia, Guyana, Ivory Coast, Jordan, Madagascar, Malawi, Uruguay, Zaire
100-200	9	Cameroon, Costa Rica, Dominican Republic, Ethiopia, Senegal, Sudan, Tunisia, Uganda, Zimbabwe
200-500	7	Colombia, Equador, Kenya, Morocco, Peru, Sri Lanka, Syria
1000-3000	6	Argentina, Bangladesh, Indonesia, Nigeria, Pakistan, Thailand
Total	37	

* Full-time equivalent units, 1980-85 averages excluding expatriates.
SOURCE: Adapted from Phil Pardey and Johannes Roseboom. Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems. London: Cambridge University Press for ISNAR. *In press.*

Worldwide, with regard to HRM, the more intensively assisted countries have been Argentina (1985), Cameroon (1987), Ethiopia (1986), Kenya (1982, 1984), Sri Lanka (1983, 1985, 1988), Thailand (1983, 1984, 1986) and Zimbabwe (1986). Selected aspects, particularly manpower planning, training or information systems have also been studied in depth in Bangladesh (1985-86), Indonesia (1980 to date), Senegal (1987), and Tunisia (1984), among others.

The HRM areas reviewed by ISNAR, both as part of a general NARS review and by specialist missions, are tabulated in table 2 by country. In almost all countries, aspects of manpower planning and training have been covered, though to varying degrees. Compensation-related issues have been examined in over 20 countries but have been studied in detail only in eight NARS. Appraisal systems and performance improvement measures have less frequently been examined in depth. ISNAR's work in human resource information systems dates back only a few years, and primarily covers a handful of countries in Asia.

Within each of the major HRM areas, the depth and scope of coverage has varied considerably from country to country. For example, in some reviews the study of manpower issues has encompassed not only planning but also recruitment and development, and compensation issues have covered conditions of service as well as career structures and promotion policies. The review of training requirements has generally focused on aggregate numbers of postgraduates needed in different technical disciplines over a 5- to 10-year plan period–but it has occasionally included a detailed assessment of management training needs and the design and conduct of in-service management training workshops.

The sophistication of analysis undertaken and the comprehensiveness of reports submitted have naturally depended on the specific terms of reference of the ISNAR review teams, their composition, the time allotted to HRM issues, and the information made available by NARS counterparts. The nature of recommendations made and follow-up action by NARS leaders and ISNAR has also varied from country to country. Although no systematic study of these aspects has yet been undertaken, an overview is given in table 3 by region and country. As can be seen, the list is long, varied, and quite impressive.

Supplementing the (primarily) advisory activities tabulated in tables 2 and 3, ISNAR has also provided training in human resource management, focusing mainly on performance improvement (or organizational behavior) aspects. A large number of management training workshops have been conducted, using both ISNAR staff, consultants, and local resource persons (and materials). In recent years, besides the national-level workshops in a number of countries, regional workshops have been held in the South Pacific (1987), Latin America (1987), and Southern Africa (1988).

In addition, in order to improve in-house capacity for advisory services and training in the HRM areas not previously emphasized–mainly performance appraisal, performance improvement, and human resource information systems–intensive research has recently been undertaken, based both on literature reviews and field work, including data collected through questionnaires.

Table 4 provides an overview of ISNAR's HRM activities to date, by program area (advisory, research, and training) and HRM area, for the period 1981-88. The intensity of ISNAR's work–in terms of depth and scope of coverage–varies enormously for different cells in the matrix. It is clear that ISNAR's experience in HRM is strongest in manpower planning and training, followed by compensation and information systems. Highlights of this experience are briefly reviewed below, by major HRM area.

2.2 Planning

As noted in table 2, ISNAR has helped a variety of NARS improve their manpower planning. Detailed planning has been undertaken for Bangladesh, Cameroon, Dominican Republic, Ethiopia, Kenya, Sri Lanka, Thailand, and Zimbabwe. In these and other countries, the unique circumstances of the NARS and the specifics of its request for assistance have largely determined the nature of analysis undertaken, the methodology used, the recommendations made, and the follow-up action taken. The diversity of approaches used by ISNAR is illustrated below by a few examples.

In Cameroon (1987), realizing that 75% of the recurrent funds for research went toward personnel costs, the review mission's primary concern was to determine the maximum sustainable size of the NARS.

Table 2.

HRM Areas Reviewed by ISNAR, by Country

COUNTRY	Manpower Planning	Training	Compensation	Appraisal	Information Systems
Argentina	x	xx	xx	xx	x
Bangladesh	xx	x			xx
Burkina Faso	x	x			
Cameroon	xx	xx	xx	xx	x
Colombia	x	x	xx	xx	x
Costa Rica	x	x	x		
Dominican Republic	xx	xx	x		
Ecuador					
Ethiopia	xx	xx			
Fiji		x	x		
Gambia		x	x		
Guyana	x				
Indonesia	x	x	xx		
Ivory Coast	x	x	x		
Jordan		x			
Kenya	xx	xx	xx		
Madagascar	x	x	x		
Malawi	x	x			
Morocco	x	x			
Niger	x	x			
Nigeria	x	x	x		
Pakistan	x	x			
Papua New Guinea	x	x			
Peru		x	x		
Rwanda	x	x	x		
Senegal	x	x	x	x	
Somalia		x	x	x	
Sri Lanka	xx	xx	xx		xx
Sudan		x			
Syria	x	xx			x
Thailand	xx		xx		xx
Tunisia	x	x	x		
Uganda	x				
Uruguay	x		xx	x	
Western Samoa	x				
Zaire	x		x	x	
Zimbabwe	xx	xx	xx		x

NOTE: Preliminary analysis.

Legend: xx Specialist review of HRM area by ISNAR staff or consultants.
x Part of general review of NARS by ISNAR.

Table 3.

Human Resource Management: ISNAR Reviews and Follow-up Action

REGION		MAJOR RECOMMENDATIONS AND ACTION TAKEN
AFRICA		
Burkina Faso	1982	Recommended increased role of research in institutions not currently involved; studied manpower needs, training needs and the possibility of establishing new research and training center.
	1987	Management training seminar held.
Cameroon	1983	Recommended improved management of research system; improved management decisions at ministerial and institute levels: training in strategic planning, programming, evaluation, information management, personnel management, management of physical resources, financial management, and budgeting.
	1984	Seminar on agric. research management held, based on findings of review.
	1986	Three workshops on communication and team building held.
	1987	Comprehensive review of major human resource management functions; with recommendations for each.
Ethiopia	1986	Review of the Institute of Agricultural Research (IAR) and of research program management and manpower planning. A quantitative, illustrative exercise sets out staff needs up to 1994, but IAR approval needed for a definitive plan to be prepared. Recommend that programs/stations should be expanded when additional manpower is available.
Gambia	1985	Recommended improved development and management of human resources.
	1986	ISNAR helps national task force prepare proposal for a scheme of service for scientific staff.
Ivory Coast	1982	Recommended formulation of a master plan for INIRA, with priority on manpower planning for national scientists and creation of a research-training center.
	1984	Training of scientific and technical personnel undertaken.
Kenya	1981	Recommended study of manpower development and training needs, and strengthening of appropriate national educational institutions; review schemes of service for research staff.
	1982	Formulated a comprehensive manpower recruitment and training plan for 1983-87.
	1983	Prepared manpower development and training plan, including fellowship and training and development of postgraduate training at Univ. of Nairobi. Prepared specific plan for postgraduate training in agriculture and veterinary medicine.
	1984	Prepared manpower and training plans up to 1994, as part of system review.
	1986	Training workshops held.
Madagascar	1983	Recommended preparation of manpower development plan, including training program, and development of management tools and techniques.
	1986	Developed training program.
	1987	Programs developed for overseas and national training (for action in 1988).

Table 3 (continued)

Malawi	1982	Recommended a crash program for training extra staff; developed longer term manpower plan; and reviewed the terms of service of research scientists.
	1985	Government implements changes recommended and establishes an agricultural research council.
	1986	ISNAR invited to arrange series of research management workshops.
	1988	SACCAR/ISNAR management training workshops held.
Niger	1986	Recommended that the fast-growing national institution should pay increased attention to staff selection and training.
Nigeria	1984	Research on conditions of service; case study prepared.
Rwanda	1982	Recommended recruitment and training plan with a 10-year time frame.
	1985	Two seminars held for identification of management training needs at different levels.
Senegal	1987	Prepared a manpower development plan; system review continuing.
	1988	Review of selected aspects of HRM.
Somalia	1983	Recommended manpower development; study of terms of service for researchers; securing of adequate and reliable funding.
Uganda	1986	Identification of critical mass of scientists needed at major research stations and of future manpower requirements.
Zaire	1985	A national task force assisted by ISNAR examined statutes of agricultural research personnel, and recommended implementation with ammendments.
Zimbabwe	1984	Prepared manpower training and development plan (1984-88) for Dept. of Research and Specialist Services (DR&SS).
	1986	Comprehensive review of HRM, as part of general diagnostic mission.
	1987	Implementation planning and follow-up continuing in 1988-89.
ASIA		
Bangladesh	1984	Agreement to work with ISNAR on program to improve the management of human resources.
	1985	Collection and organization of data in BARC, using micro-computers and methodology based on ISNAR's work in Thailand; training of local staff.
	1986	Workshop held, using information base developed with BARC. Senior officials introduced to micros. Two main results: an awareness of BARC's initiatives in the management of human resources; and ISNAR's commitment to work with BARC on this task. IBRD placed full-time person in BARC to continue this work in the BARC Training Division.
Fiji	1982	Recommended that after a research plan is approved, the manpower requirements (i.e., numbers and training) for implementation be assessed. More staff may be needed.
	1985	To implement the 9th Development Plan 1986-1990 and its research strategy, human resource components require donor support.
Indonesia	1981	Recommended that AARD prepare a detailed master plan for manpower.
	1985	Management information system developed, including human resource components as part of on-going work with AARD.

Table 3 (continued)

Pakistan	1982	Recommended new career structure for professionals and study of other HRM aspects, especially training requirements.
	1984	ISNAR provided staff inputs to IBRD-funded agricultural research project. Special emphasis on staff development and training administration.
	1987	Recommended that human resource planning follow program planning and be focused on improving efficiency of existing research staff. A well-developed computerized information system is needed for this.
Papua New Guinea	1982	Manpower development program proposed, based on the recommended reorganization.
So. Pacific Is.	1981	Recommended regional and international training of nationals.
	1987	Management training workshop held.
Sri Lanka	1983	Recommended general review of personnel policies, especially postgraduate training of agricultural research officers and conditions of service.
	1984	Review of manpower and training requirements for scientists, as part of 3-country case study.
	1985	Preparation of training component of IBRD funded project.
Thailand	1983	ISNAR provided staff inputs to a national commission whose mandate covers manpower planning in the Department of Agriculture (DOA). Collection of data on graduate employees of the DOA begun.
	1984	Collection of data and verification completed, with substantial assistance from staff of DOA. Three working papers prepared.
	1985	Four additional working papers prepared and presented. Plans for information system for HRM drawn up.
	1986	Preparation of draft project proposal for the Civil Service Commission and the DOA to strengthen the DOA's personnel management capacity and introduce the use of microcomputers in managing personnel information. Ditto for the civil service as a whole.
Western Samoa	1983	Recommended systematic needs assessment as part of the planning and programming exercise and formulation of an interim training program.
	1984	Prepared manpower development and training project.
LATIN AMERICA		
Argentina	1985	Review of manpower and training requirements, as part of 3-country case study. Prepared a comprehensive plan for managing and developing professionals in INTA, including review of conditions of service. Workshop on agricultural research management held.
Colombia	1985	General review of HRM system, including review of conditions of service.
Costa Rica	1981	Recommended introduction of in-service training for research and extension staff and improvements in conditions of service for staff.
	1987	Recommended continuation of efforts to improve manpower utilization.

Table 3 (continued)

Dominican Rep.	1983	Identified as a central limiting factor the inadequate personnel policies of the research department (IDIA) in Ministry of Agriculture. 1986 ISNAR paper, giving complete analysis and summary of the redesign of IDIA, presented to IDIA and donor.
Ecuador	1988	ISNAR reviewed HRM issues, using questionnaire on human resources.
Guyana	1982	Recommended an institute within or closely associated with the University of Guyana, with staffing patterns that maximize use of resources.
Peru	1985 1986	Recommended sustained support for personnel development in a largely effective system. A new career structure developed.
Uruguay	1986 1987	Exploratory review. Assistance in the design of a human resource development plan.
WANA		
Jordan	1984	Review of manpower and training requirements, as part of 3-country case study.
Morocco	1984	Recommended preparation of a manpower development and training plan.
Sudan	1983 1986 1987	Development and management of human resources considered essential. Requires a survey of training needs to improve the management of research. Action deferred; for inclusion as a component of proposed IBRD project. ISNAR requested to assist in the design and implementation of a research management training program for senior research administrators. Training at ISNAR of a Sudanese officer, to develop training courses in planning and managing agricultural research. National workshop on planning and agricultural research management held, using a specially designed human resource development questionnaire.
Syria	1985 1988	Identification of training needs for cotton research program. Human resource analysis, as part of the review of the Directorate of Agricultural Research.
Tunisia	1984	Prepared a five-year manpower training and development plan for the specialized institutes.

NOTE: Based, in part, on Fred Haworth's content analysis of ISNAR's mission reports. 1988 (draft, mimeo).

The research system's expansion plans and its current pattern of manpower utilization were reviewed, so as to improve the match between future program requirements and the staff likely to be available. Redundancies were identified in some job categories, and recommendations were made to improve recruitment procedures and to upgrade staff quality through better training and career planning.

In Kenya (1982, 1984), on the other hand, an anticipated shortage in the quantity and quality of manpower was the main impetus for formulating a long-term manpower (and training) plan, and this involved a detailed assessment of future manpower needs. The planning exercises took account of a variety of considerations in estimating demand, including (i) comparison with international "norms" (for expenditure, PhD-to-MSc ratio, and researcher-to-technician ratio), (ii) the scientists' "requirements" unconstrained by financial limitations, (iii) past and projected trends in recruitment and attrition, (iv) "constrained" demand (i.e., affordable numbers considering the likely constraints of finance and facilities), and (v) the need for maintaining critical masses of scientists for various programs and disciplines.

In Zimbabwe (1984), manpower planning started with an aggregate (macro-level) assessment. The planners first estimated the number of researchers that could be supported by an (assumed) increase in financial support of 5% (in real terms) over the 5-year plan period, and then determined how the total projected manpower strength of PhDs and MScs could best be utilized for various commodity and disciplinary research programs.

In Tunisia (1984), planning started with an estimation of manpower requirements (in full-time equivalent units) for the projected 10-year research program for each commodity and discipline, assuming stable funding and an appropriate organizational structure. In Ethiopia (1987), in contrast, the manpower assessment was primarily concerned with ensuring that the recently reorganized structure had at least the minimum critical mass of qualified scientists and technicians at each agroecological and commodity research center.

Despite this diversity of approaches, however, the central aim of ISNAR's manpower planning activities in the various NARS has been the same: to provide accurate and realistic estimates of future manpower needs and to devise feasible plans for meeting these needs.

2.3 Training

Table 2 provides an overview of ISNAR's advisory experience in training. In many countries, ISNAR has helped identify training needs (by commodity or disciplinary research programs) and has helped determine the mix and level (PhD, MSc) of specializations needed. In some countries (Argentina, Cameroon, Dominican Republic, Ethiopia, Kenya, Sri Lanka, and Zimbabwe) detailed 5- to 10-year training plans have been prepared as a logical follow-up of long-term manpower planning.

In a number of countries, ISNAR's reviews have been followed by management training workshops (e.g., in Burkina Faso, Cameroon, Ivory Coast, Malawi, and Zimbabwe in Africa; Bangladesh in Asia; Argentina and Costa Rica in Latin America; and Jordan and Sudan in the WANA region; see tables 2 and 3). These training activities have primarily been organized by the nationals themselves, in close collaboration with ISNAR.

Many NARS have thus undertaken, with ISNAR and other donors' assistance, systematic upgrading of the educational qualifications and technical skills of their newly recruited young scientists. A variety of training strategies and approaches have been used, combining apprenticeship, university, on-the-job, and in-service training, and using a mix of twinning, contractual, and technical assistance arrangements.

Because long-term training is expensive, government budgetary resources for training have often been supplemented by financial support from other sources. Over the years, many researchers have invested their time and effort in improving their qualifications and competence, expecting that this would increase their research productivity and improve their career prospects. System-level managers have also shown keen interest in training.

In terms of pay-offs, ISNAR's experience in a number of countries has shown that long-term training plans have generally been ambitious but reasonable, and have yielded the desired benefits. As a result, training has probably become a well-established–possibly even a favored–function within many developing-country NARS.

Thus, in a number of these NARS, a great deal has already been accomplished in training, or is well on its way to being achieved. Most interested parties believe

Table 4.

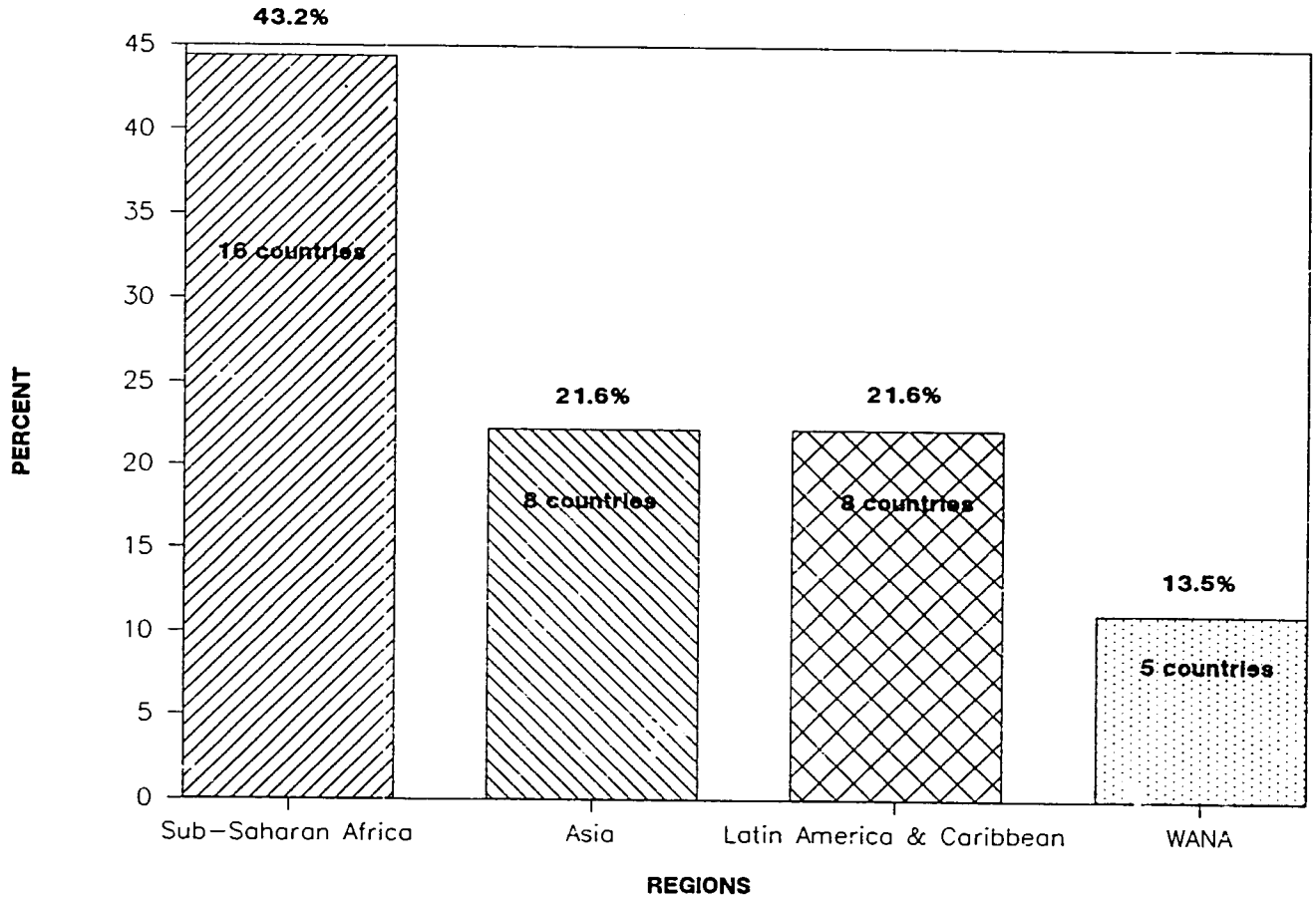
ISNAR's Activities in Human Resource Management, 1981-88

	Manpower Planning	Training	Compensation	Appraisal	Performance Improvement	Information Systems
Advisory Service						
* General Reviews	XX	XX	X	X		X
* Specialized Reviews	XXX	XXX	X			XX
* System Design/ Implementation	X	XX				XX
Research				X	X	XX
Training					XX	

NOTE: This index is a composite indicator of depth and scope of coverage. The table is based on the author's subjective assessment of ISNAR's HRM work to date.

Legend: XXX : High intensity.
XX : Moderate intensity
X : Low intensity
: Little activity.

Figure 2. Regional distribution of countries assisted by ISNAR's HRM work



that the substantial investment in training has largely been worthwhile.

Yet, recent ISNAR experience indicates a few pending concerns:

- First, managers are becoming justifiably concerned about the relevance, quality, responsiveness to local needs, and cost-effectiveness of training undertaken by their national systems.

- Second, now that the numbers of people trained and training programs conducted seem largely satisfactory, questions of evaluation and impact of the training received are relevant and timely.

- Third, the appropriate balance between training in purely technical subjects and in management topics, and between training for improving individual capacities and for building system capabilities is yet to be established.

Other general issues relating to in-service training in NARS are also of interest. Some of these are noted below:

- Notwithstanding the highly encouraging response by NARS managers to management training workshops, there is concern that training of individuals (in such areas as strategic planning, priority setting, program formulation, organizational options, monitoring and evaluation, and human resource management) might not readily lead to system-level improvements–unless organizational and management procedures and practices are simultaneously reformed.

- A related but broader concern is that the training received–both technical and managerial–might not be properly utilized because of system-level deficiencies in finances, facilities, and planning. As a result, even good training might yield meager tangible benefits.

- The efficiency of training administration, and the selection, placement, reentry, and follow-up of trainees is another problem area. In most NARS, long-term university training is less susceptible to ad-hocism (perhaps due to the involvement of large sums of money and foreign institutions) than short-term in-service training–which often suffers from a lack of integration of disparate efforts.

- The design of training programs, the content and contextual relevance of training materials used, the match between training pedagogy and audience, and the effectiveness of training delivery are other important concerns. While improvements have undoubtedly been made in these areas in recent years, much more needs to be done.

2.4 Compensation

As indicated in table 2, ISNAR also has considerable experience in compensation-related issues in NARS. Advisory work has been done in Argentina, Cameroon, Colombia, Kenya, Sri Lanka, Thailand, Uruguay, and Zimbabwe. Selected aspects have also been reviewed in Indonesia, Somalia, Tunisia, and Zaire, among others (see tables 2 and 3).

In many of these countries, the conditions of service of researchers have been reviewed in detail, with attention given to such items as grade structures; personnel costs as a proportion of the recurrent budget; salary differentials between scientist categories and managers; external parity with university-based researchers; shape of the present and anticipated salary profiles; relationship between salary, age, and years of service; and (financial) incentives for performance. The relationship between performance and rewards (especially promotion) and between salaries and career structures have also been examined in a few NARS.

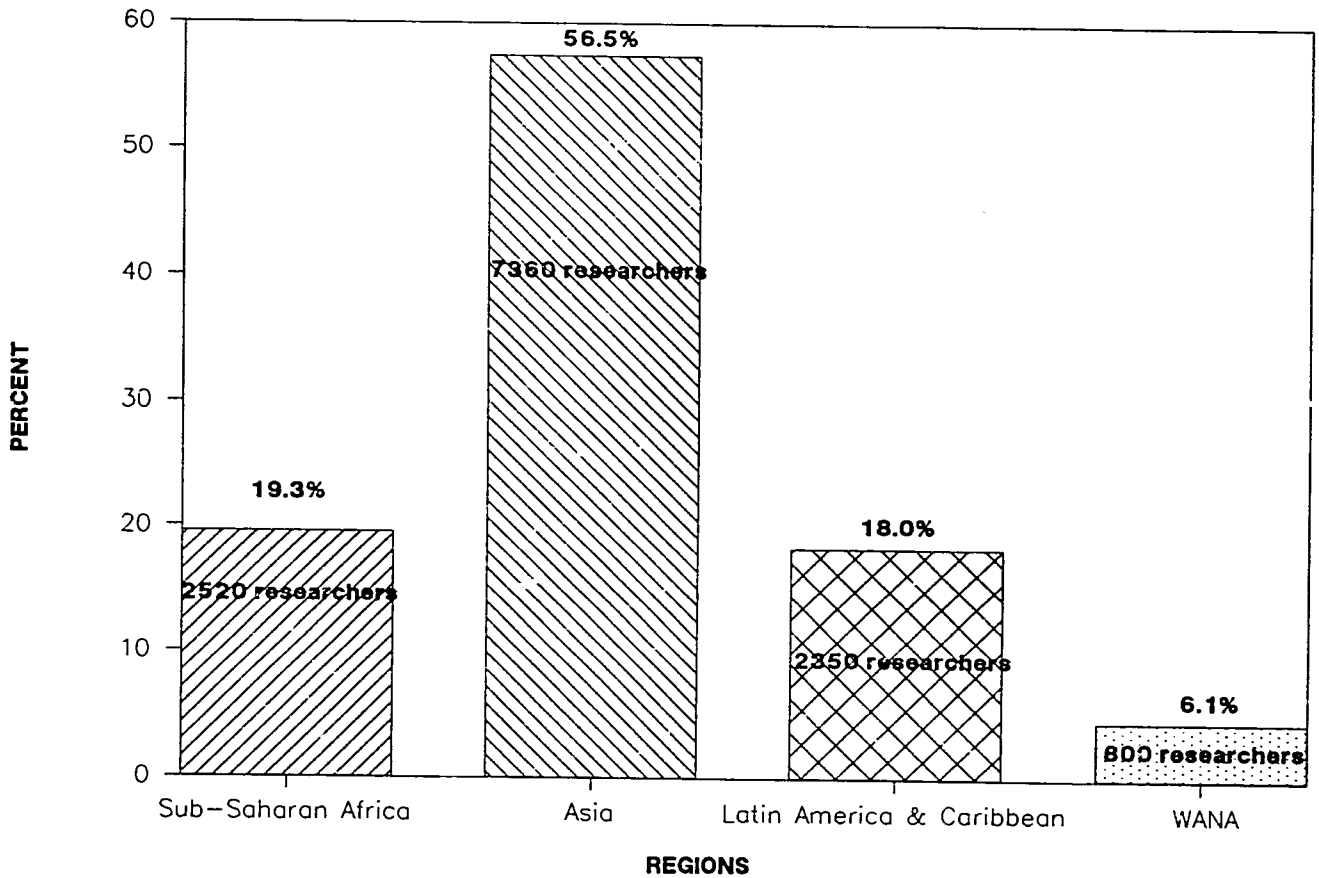
Most NARS are understandably sensitive to publicly disseminating any data and analysis relating to compensation issues. Despite this, ISNAR's reports have made recommendations for changes in grades and career structures. In a number of countries, these recommendations have sought to improve the compensation and incentive packages offered to researchers and technical support staff.

ISNAR's work in this area has involved both general and specific reviews, and has been based on sound principles of HRM common to all NARS. These considerations and issues are fairly straightforward and are outlined in ISNAR's working paper No. 15.[2]

2.5 Information systems

As noted earlier, ISNAR's advisory work in human resource information systems has mostly been in Asia–in Bangladesh, Indonesia, Sri Lanka, and

Figure 3. Regional distribution of researchers covered by ISNAR's HRM work



Thailand. In these and a few other countries, ISNAR has been asked to help determine the minimum data needed for key personnel decisions, and to help devise a computerized system for continually updating and effectively utilizing such a data base.

In addition, over the past year, ISNAR staff and consultants have designed a standard information system and software package for HRM in agricultural research institutions. This package is now being field-tested in a number of countries.

Although ISNAR's experience in this HRM area is somewhat limited, it is already clear that the information system approach suggested by ISNAR is viable, inexpensive, and implementable–provided the gouvernment "starts small and simple".[3] However, as should be expected, the task of designing a new system and making it work in a typical government organization is hard and time-consuming–and there are no shortcuts. The long-term pay-offs can of course be substantial.

2.6 Performance appraisal and improvement

ISNAR's experience in these two areas of HRM is rather limited. Most reviews have briefly touched upon these aspects, but except in a few cases, a detailed examination has not been undertaken. To bridge this experience gap, research on performance appraisal has recently been initiated (a literature review has been completed), and questionnaire data on performance improvement issues have been collected from a few NARS (and are being analyzed).

A few case studies on these (and other) HRM topics have also been written, notably, (Kenya) planning, (Thailand) recruitment, (Nigeria) conditions of service, (Indonesia) information systems, performance appraisal, and research-extension conflict management. In addition, selected organizational behavior topics (such as leadership, delegation, communication, motivation, etc.) have been included in a number of management training workshops. In-house discussion of further work to be done in these areas is continuing.

3. Lessons of Experience[4]

3.1 Planning

The methodological approaches used by ISNAR for making manpower estimates and plans are fairly straightforward, as are the major considerations that must be kept in mind. Some of these considerations are outlined in an ISNAR working paper (No. 15). The main difficulty lies in applying general tools and considerations to particular situations and in making the necessary subjective assessments of financial feasibility and administrative practicality.

To facilitate the work of senior NARS managers responsible for manpower planning, a few lessons of ISNAR's experience are noted below.

- First and foremost, organizational and program-related matters need to be resolved before any serious manpower demand projections are made. If this is not done, the manpower projections can easily become outdated.

- Second, even when the proper sequence of program strategy, master-planning, and (re)organization has been followed, detailed program planning is necessary before credible demand estimates of specializations, experience, and training requirements can be obtained.

- Third, is the need for hard numbers and a sound information base for determining present manpower inventories, past trends, and future possibilities. Planning undertaken by ISNAR illustrates the benefits of a thorough assessment of demand and supply. Because the usefulness of results depends on the accuracy and credibility of the data used, "informed guesses" need to be supplemented by rigorous analysis of numbers.

- Fourth, the basis of this analysis is crucial. Analysis of historical trends and past experience is a good starting point for planning, but since future circumstances–especially availability of funds–can deviate substantially from past trends, realism is needed in estimating future constraints of manpower, money, and facilities. "Constrained" demand-and-supply analysis is therefore essential, and requires that the scientists' wish lists of research requirements be tempered with senior managers' judgments of political and administrative feasibility. This golden mean could perhaps be termed "cautiously optimistic" planning.

- Fifth, planning for manpower should also include categories often left out–mainly technicians, technical staff, and administrative support staff. These nonscientist categories are essential for

effective research and are not always available when needed. The inclusion of technical staff in several ISNAR reports draws attention to an often neglected area.

- Sixth, it is obvious that responsibility for sound manpower planning–that includes all relevant agencies and personnel categories and that connects manpower issues with strategic, program, and organizational considerations–can not be left solely to an isolated manpower and training office at ministry headquarters. Unless the planning task is taken seriously by the researchers themselves and by their line managers–both in terms of providing the needed inputs and in interpreting and revising the tentative results of analysis–the exercise can become quite meaningless.

Other more general lessons can also be stated. These relate primarily to the scope, processes, and methodology of planning.

The scope of manpower planning has to be broad enough to cover the major sources of supply (local universities, regional and international labor markets, etc.) as well as the potential competitors for the available manpower (parastatals, private agro-industry, nonresearch employment, etc.). In other words, the matching of demand and supply presupposes a good fix on both sides of the equation. At the same time, the scope of planning should be narrow enough to be manageable within the resource and skill constraints of NARS managers. Assistance from specialists in

ministries of planning or from technical assistance agencies can, at times, be a good investment.

While undertaking this detailed organizational and program planning, unanticipated shortfalls (or less likely, surpluses) of skills and training can become apparent, requiring revisions in previously determined master plans and organizational structures. The process of planning must thus be iterative and continuous, so that the plans remain realistic and realizable.

The benefits and necessity of this iterative approach are obvious to anyone who has attempted systematic strategic and master planning, even as a training exercise. The need for commitment and participation of high-level NARS leaders is therefore imperative. The benefits (though not the necessity) of involvement of knowledgeable outsiders can also be considerable, if properly managed by the nationals.

- Even when suitable participatory processes for planning are used, the long-term manpower implications of strategic shifts in program and organization can seldom be accurately estimated in advance of events. The need for combining experienced judgment with quantitative estimation of requirements is obvious.

- And finally, each NARS must be treated as a unique case. For detailed manpower analysis, the larger and more complex NARS (say, with more than 100 scientists and a diversity of research institutes and programs) require relatively more complicated tools than the smaller, less diversified NARS. However, despite this difference, the basic principles of sound manpower planning apply equally in all cases.

3.2 Training

Many of the concerns/issues in training, listed earlier, stem from an appreciation of the requirements and preconditions of effective in-service training. A few of these are noted below, based on ISNAR's experience. The purpose is to draw attention to some key features of effective training and to provide guidelines for the future.

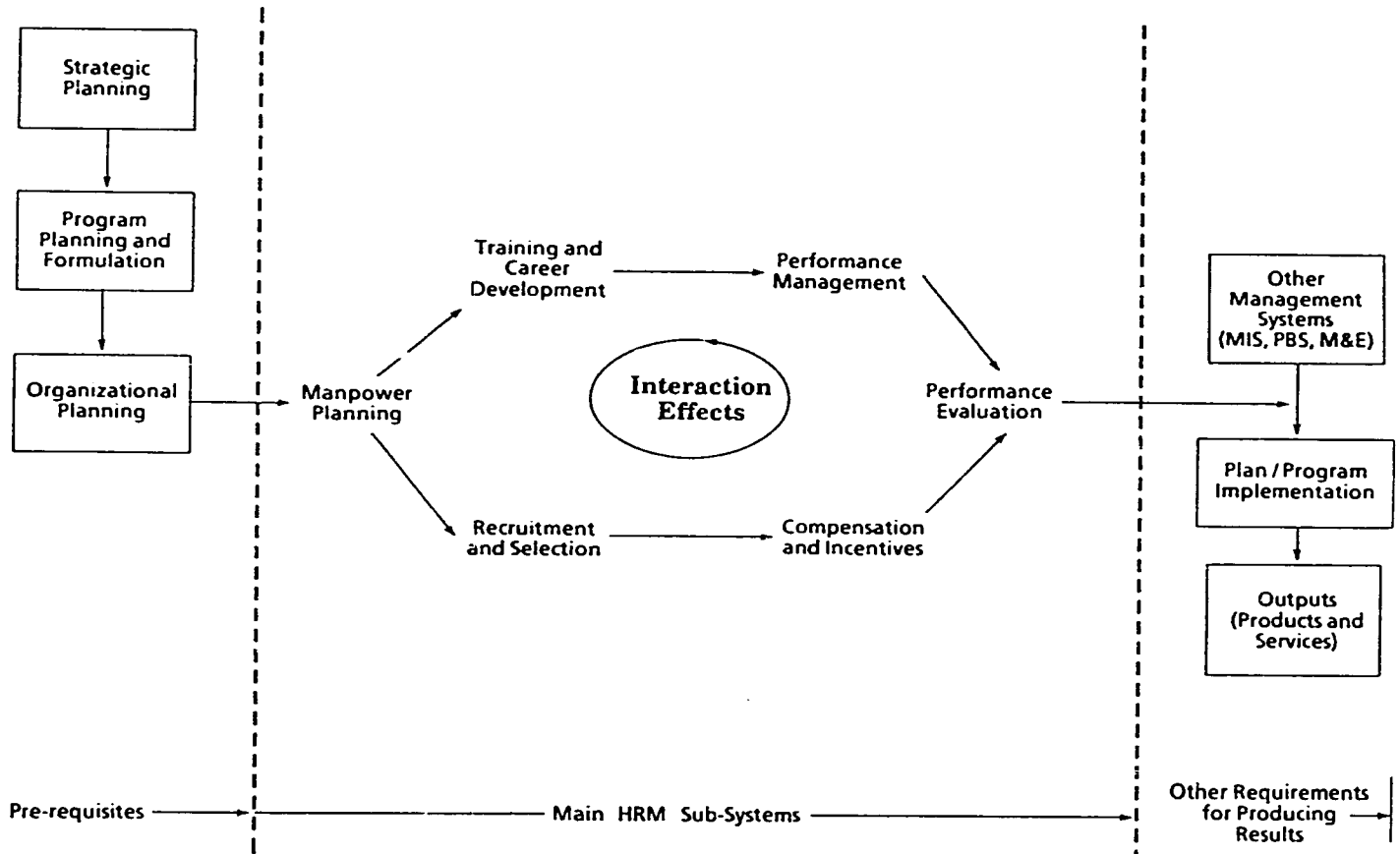
- First, training gets visible and substantial support from top echelons. The trainees are motivated to improve their performance and are rewarded for such improvements.

- Second, as the needs of the organization become more specialized, the training needs of different categories of employees are identified more systematically and with greater precision. Training is also more selective: key personnel groups are trained in key areas of their work.

- Third, training content is tailored to audience needs. Skill- and knowledge-oriented courses are given to junior staff, while the senior managers are provided a broader appreciation of concepts and techniques.

- Fourth, responsibility for training is shared between line managers and the training department. While the latter is responsible for designing and delivering effective training programs, the former are held responsible for ensuring that this training is put to good use.

Figure 4. The human resource management system: Interactions



And fifth, it is accepted that training is not a cure-all. Top management acknowledges that nontraining interventions (such as administrative changes, work redesign, salary improvements, and appraisal mechanisms and feedback) can sometimes improve employee productivity more easily, quickly, and inexpensively.

Other general lessons of experience are also relevant: effective in-service training–in the NARS, as elsewhere–is need-based, relevant, specific, and goal-oriented. Priorities are determined in advance, and vigorous follow-up action is taken. A strategic plan and time-bound action program are prepared. Because the training effort has a clear direction and focus, training administration does not take precedence over training content, and course design is based on a detailed needs assessment.

More specifically, in relation to training design and evaluation:

- The training objectives, content, and pedagogy are well matched. Distinction is made between changes sought in awareness, understanding, and skills. Except in initial introductory courses, breadth of coverage is sacrificed for depth of understanding.

- The cost of training is judged both in relation to the total investment in human resources and to the opportunity cost of not training. Although a strict cost-benefit approach cannot be followed, investment in training is expected to yield sufficient payoffs in the long run.

- Periodic evaluation of training is conducted so that timely corrective action can be taken. In evaluating training, a distinction is made between evaluating the trainees after training, evaluating the training courses themselves, and evaluating the impact of training on the entire organization, both in the short and long run.

of these simple lessons are well known. Training specialists can undoubtedly expand the list further and should be encouraged to do so. The result would be a much-needed assessment of present practice and a delineation of guidelines for further improving the existing (satisfactory) state of affairs.

3.3 General

It is clear from ISNAR's experience of HRM in NARS that planning and training are necessary–but not sufficient–for effective management of human resources. Also needed are well-designed and properly administered systems for recruitment, deployment, and utilization of staff. These require appropriate policies, regulations, and procedures for hiring, compensating, appraising, counselling, promoting, rotating, and firing people. A further requirement is good organization, leadership, direction, incentives, communication, conflict management, and control.

Some of the prerequisites of effective HRM, and the connections among the HRM "subsystems", are noted in figure 4. Because of subsystem interactions, weaknesses or changes in any particular (specialized) area can have a ripple effect throughout the HRM system.

For example, an insufficient or inadequate manpower pool can

- lead to unfilled vacancies
- increase salary demands by those hired
- lead to hiring of under-trained staff
- reduce actual performance
- facilitate condoning of poor performance
- increase the need for training
- lead to unduly quick promotions

Similarly, improvements in conditions of service (salaries, incentives, rewards, promotion policies) can help increase research productivity by

- attracting better qualified and more experienced staff
- improving staff motivation and morale
- reducing training needs (and costs)
- reducing turnover of competent staff
- facilitating long-term career and succession planning
- rewarding merit rather than seniority
- linking performance (outputs) and rewards
- providing opportunities for individual growth and development

Because ISNAR's reviews of NARS typically start with broad questions of program strategy, policy, organization, and management, the logical sequence between these topics (see figure 4) has generally been maintained in ISNAR's HRM work. Even when specialized reviews of a part of the HRM system have been undertaken, the close connection between human resource and program issues has been kept in mind to ensure the relevance and feasibility of the recommendations made.

However, a strict order of priority or sequence is not appropriate among the specialized HRM areas. Although long-term planning for manpower and training are usually the first steps in an ISNAR systems review, detailed assessments of particular HRM areas can be conducted in any order–provided the interaction effects on the remaining HRM subsystems are not overlooked.

In general, however, the complexity of the interactions among HRM areas, and the need for dovetailing HRM activities into other areas of management–for example, program planning, MIS, monitoring and evaluation, etc.– make the management task rather daunting, at least for some managers.

In a typical NARS, the difficulties are compounded by the characteristics of the internal and surrounding administrative environment. A NARS is a small part of a much larger government system and usually has limited discretion in devising its own HRM system (even in a semiautonomous parastatal). The general strengths and weaknesses of civil service rules and regulations prevail, with minor concessions made to the special requirements of managing highly qualified scientists and to creating a work environment conducive to high levels of creativity and productivity.

In addition, individual and organizational performance are adversely affected by such factors as weaknesses in (top level) system governance, policy formulation, and planning; funding uncertainties and shortfalls; outdated and bureaucratic civil service procedures for recruitment, appraisal, and salary administration; low salaries and insufficient incentives; weak linkages between performance and rewards; and generally inadequate management.

An in-depth discussion is not appropriate here. Even though the problems are many, a few general guidelines are available and some possibilities for action exist. Equally important, no universal solutions are possible in HRM, and each NARS must devise its own response to its unique set of constraints and opportunities. ISNAR's review reports–and lessons derived from them–can only help sharpen the issues so that suitable action can follow.

4. Pending Issues and Possible Action

4.1 Planning

ISNAR has recently documented fresh evidence that the number of researchers in developing countries has more than doubled in the past 20 years, well ahead of the growth in recurrent expenditures for agricultural research during the same period.[5] In many countries the need for additional scientists remains substantial, but the potential supply from academic institutions is variable in quality (and sometimes in quantity as well). Furthermore, the money for researchers and their operational requirements often remains quite inadequate.

Hence, the matching of supply and demand will remain a problem in the foreseeable future. To overcome this difficulty, a serious effort in priority setting will be required for properly channelling available manpower. In addition, as emphasized earlier, planning and training will have to be closely integrated with program management, so that manpower projections and training goals remain realistic and feasible.

In the future, it will be essential that the NARS first undertake strategic planning and then set priorities, formulate programs, and estimate manpower requirements. It will be necessary to fully involve researchers at each stage. Since this might require a substantial change in current practice in most NARS, a general planning issue is: how to move from what *is* to what *should be*.

In other words, although the principles are known, and some useful planning tools and guidelines are available, we need to develop (and use) simple but sensible methods of demand estimation under conditions of financial and technical uncertainty and unpredictability.

As a first step, the development of international norms–as for numbers of researchers per one million population in agriculture, agricultural research expenditures as a proportion of agricultural GDP, ratio of PhDs to total researchers, and ratio of researchers to technicians, etc.–could provide preliminary "benchmark" figures. (This is being attempted by such agencies as the World Bank, FAO, and ISNAR.)

However, detailed demand estimation (by program, discipline, qualification, training, and experience)–and the establishing of relationships between these

estimates and the specific output goals of program plans--must inevitably remain the responsibility of experienced researchers and managers. The main requirement therefore is to devise guidelines for credible estimation of manpower needs without imposing inflexible norms or mathematical formulae on research scientists.

Furthermore, to the extent adequate techniques are as yet--or are even unlikely--to be developed, appropriate organizational mechanisms will be needed for disaggregating strategic and master plans into program activities, jobs, and scientist-years, and for further estimating the disciplinary inputs needed for delivering the specified quantity and quality of outputs.

The simultaneously top-down and bottom-up planning process required for this would be difficult to institutionalize in any traditional government system--and a NARS is no exception. However, such a process might be a precondition for reconciling the available money and manpower with the scientists' minimum needs for effective research.

Viewed in this fashion, the main issue pending can be stated in organizational terms: i.e., how to introduce collaborative, bottom-up planning without unduly diluting the legitimate hierarchical and budgetary authority of top managers. Here again, an international organization such as ISNAR can assist NARS managers in finding their own solutions.

4.2 Training

The pending issues and possible actions in training are relatively straightforward. First, university-based training has to be made more relevant and cost effective. In most agricultural universities in developing countries, such constraints as heavy teaching loads, poor research facilities, lack of incentives for research, and perennial budgetary shortfalls have to be tackled urgently.

For this, bilateral and multilateral donor assistance as well as collaborative and cooperative programs with foreign universities are useful. In addition, the involvement and commitment of senior policymakers in the concerned national ministries and institutions are needed. Unless these are forthcoming, the efforts of external agencies cannot lead to tangible results.

With regard to in-service training, many of the concerns noted earlier stem from the need to focus more clearly on the relevance and quality of training--rather than on the numbers trained and courses held. The general principles of good training are well known. What is now needed is to conduct a thorough review of existing efforts in the NARS so that suitable improvements can be made.

In addition, ISNAR could perhaps ensure closer integration of its advisory and training activities in various regions and countries. Greater emphasis is already being given to developing materials for training in agricultural research management. Both of these steps will help improve the impact of training provided by ISNAR.

4.3 General

In terms of the broader HRM concerns, problems of efficiently managing growth--of manpower, research programs, and training institutions--are likely to remain high on the agenda of most NARS.

Under conditions of scarce financial resources--coupled with the pressing need for producing and delivering useful research--some hard choices involving shifts in strategy, reduction of marginal programs, redeployment of personnel, restructuring of organizations, and rationalization of research station networks will be inevitable.

Each of these has direct implications for managing human resources. A greater appreciation of these linkages at early stages of system building would help.

In addition, lessons of experience from the established NARS could prove instructive for countries hoping to expand (and eventually stabilize) their systems. Donors and international organizations in the business of facilitating institutional strengthening in agricultural research (e.g., ISNAR, World Bank, USAID, the SPAAR group) could catalyze this learning process by documenting and sharing their cross-national experience.

Within each NARS, a useful starting point would be to take stock of the available personnel (using an improved HRM information system), assess the institution's educational and training staff, and review the organizational mechanisms used for planning and utilizing manpower.

For each of these areas, detailed questions can be formulated, based on the principles of effective human

resource management (some of which have been discussed above). Upon completion of these reviews, further steps could be taken to build on present strengths in policy, organization, and management.

Because human resource management encompasses many aspects--of supply, demand, acquisition, retention, and utilization of manpower--it is unavoidable that the HRM reviews conducted by the NARS (and others) should also selectively examine aspects of strategic and operational planning and management.

The necessarily broad scope of these reviews could, however, be both an opportunity and a challenge. The opportunity is to set things right in a systematic fashion, but this requires a serious commitment in the NARS to face up to the key issues and to engage in a long-term, management-intensive process of diagnosis and reform. Once this top management support has been obtained, however, the sustainability of the effort could be improved.

More specific management issues also need to be addressed, perhaps jointly, by ISNAR and the NARS. These include, among other things, determination of the minimum "critical mass" of scientists needed for certain kinds of research; determination of the minimum (required) operating expenditure per researcher; determination of policies and practices for attracting, retaining, and motivating sufficient numbers of qualified scientists; determination of measures suitable for improving the numbers, technical competence, and professionalism of fresh graduates; determination of strategies and measures for strengthening educational and in-service training institutions; determination of measures for improving the quality and relevance of training programs; and determination of policies and administrative measures for improved HRM, in general.

The list can be extended fairly easily. Most of these issues are not easy to deal with--nor can completely novel solutions be found through brief debate in international fora. Progress on these issues therefore requires a well-planned and prioritized program of field research, involving in-depth sharing of views and experiences by NARS managers and ISNAR staff in a collaborative, problem-solving mode.

5. Conclusion

This paper is intended for the generalist agricultural research manager and discusses some key concerns and lessons. The underlying premise is that all managers and supervisors need to become adept at managing their human resources effectively and efficiently.

This management task involves two types of interactions: (i) direct, through face-to-face contact with individuals and their work groups, and (ii) indirect, through managerial systems established by HRM specialists for the organization or the civil service as a whole. Most of ISNAR's advisory work in HRM has focused on the latter, i.e., on the NARS or organization-level activities.

Based on a broad diagnostic review of the NARS, the strengths and weaknesses of the existing HRM system (or sometimes specialized area--planning, training, etc.) have been analyzed by ISNAR, and recommendations for improvement have been made. In a number of countries, the next phase in ISNAR's diagnosis-planning-implementation (DPI) sequence has involved detailed design of the proposed system. The changes suggested have then been implemented by the NARS leaders, sometimes with assistance from ISNAR.

The lessons of the "ISNAR experience" presented in this paper are thus--indirectly--based on the experience of the NARS themselves. However, much of the NARS' direct experience of HRM remains undocumented and unanalyzed. This experience is very relevant for developing practical guidelines for NARS managers, and could provide the basis for field research by the NARS and ISNAR.

Thus, the need (and potential) for continued collaboration between ISNAR and the NARS on HRM issues remains considerable. This collaboration can lead to further development of ISNAR's experience and that of the NARS in HRM. The extraction of additional lessons from this experience could lead to a more complete understanding of human resource management in NARS.

Notes

1. Phil Pardey and Johannes Roseboom, Agricultural Research Indicator Series: A Global Data Base on National Agricultural Research Systems. London: Cambridge University Press for ISNAR, *In press*. Preliminary ISNAR data base averages for 1980-85. The number of researchers is measured in full-time equivalent units. The data base covers 129 developing countries, excluding China, Cuba, and Eastern Europe. It includes expatriates (who,

according to 1986 World Bank figures for Eastern and Southern Africa, constituted 17% of the scientists in that region).

2. Paul Bennel and Larry Zuidema. Human Resource Management for Agricultural Research: Overview and Issues. ISNAR Working Paper No.15, 1988.

3. Byron Mook. Management Issues in the Collection and Use of Information on Research Personnel. ISNAR, 1988 (mimeo).

4. Adapted from the author's paper (Human Resource Planning, Development and Management for Agricultural Research) presented to the SACCAR Workshop on Manpower Planning and Development for Agriculture and Natural Resources, 1988 (mimeo).

5. Howard Elliott and Johannes Roseboom. Recent Evidence on Resource Commitments to Agricultural Research. ISNAR, 1988 (mimeo).

SESSION 2

INFORMATION FOR HUMAN RESOURCE MANAGEMENT

MANAGEMENT ISSUES IN THE COLLECTION AND USE OF INFORMATION ON RESEARCH PERSONNEL

Byron Mook

The Most Valuable Resource of an Agricultural Research Organization Is Its People

True. Yet, many research managers pay minimal attention to the management of their human resources. It is actually the exceptional agricultural research organization which does recruitment planning on a regular and continuing basis. Very few such organizations have rolling training plans. Almost none has career plans. The evaluation of personnel is often a formalized, bureaucratic, and not very useful process.

The management challenge is clear. . . . Most national agricultural research systems (NARS) today put at least 60% of the public funds they receive into personnel. Many NARS actually put more; figures of 80%-95% are not uncommon in sub-Saharan Africa. Yet the information on these people available to management is often fragmentary. Who are they? How many of them are there, what are they working on, what are their training needs, and what decisions regarding careers and postings will management likely have to make in the years ahead? Such information is a prerequisite for planning and evaluation.

The discovery of answers to these questions requires a commitment to action from research managers. The planning and management of "human resources" and/or "personnel" should be near the top of their lists of priorities.

Why, therefore, have most research managers tended to pay so little attention to human resources? The answer may be both semantic and organizational. In the minds of many research managers, *human resource management* equals *personnel management*; i.e., a function which is administrative, routine, and often troublesome. Similarly, personnel divisions in most research organizations are concerned with salaries, pensions, and leaves–not subjects on which a senior manager would like to spend much time. As a result, an important item on the agenda of the progressive research manager is to upgrade the status and importance of the "human resources/personnel management" function.

The following general facts and principles are therefore worth stating at the beginning:

1) Human resources are the biggest asset of any research organization.

2) Senior research managers should therefore give more attention to managing these resources.

3) Conscious attempts should be made to remove bureaucratic stigma attached to the term *personnel management*.

4) Senior research managers should try hard to strengthen existing "personnel divisions" and to broaden their mandates.

The Importance of Good Information on Human Resources

Why is good information on human resources a critical resource in the hands of the research manager? There are three reasons:

1) The most important is to provide the basis for good recruitment, training, and career planning–and for good personnel evaluation. Without information, the performance of these critical management functions is impossible.

Figure 1

MIS

	PLANNING & PROGRAMMING	MONITORING & EVALUATION
PROJECTS	STRATEGY TACTICS	OUTPUT IMPACT
PEOPLE	RECRUITMENT CAREERS TRAINING	PERFORMANCE
MONEY	BUDGETING	ACCOUNTING / AUDITING
THINGS	PROCUREMENT	STOCK CONTROL

2) Information on human resources is also necessary to strengthen the case for more resources. Policymakers are more likely to authorize more and better personnel for research when they can base their decisions on well-researched, well-documented, and well-argued cases. "Wish lists" are not likely to be persuasive.

3) This information can also be used to present a case for reform. Similarly, policymakers are not likely to be impressed with vague calls for organizational change, for improved service conditions for researchers, or for more regular budgeting and financial disbursement procedures. The burden of proof is on research managers to make strong arguments.

Development of a Human Resource Information System

A Human Resource Information System (HRIS) may or may not be part of a wider Management Information System (MIS). If it is, a full MIS would be likely to have at least four clearly identifiable components. Figure 1 summarizes these four. The two columns show the *uses* to which good information can be put, while the four rows show the *subjects* an MIS ideally covers.

1) *CRIS*–Current Research Information System. What projects are actually being carried out? What are their objectives, where are they taking place, when did they begin, when will they end, and what are their expected outputs?

2) *HRIS*–Human Resource Information System. The subject of this paper.

3) *FRIS*–Financial Resource Information System. How much are different programs and projects actually costing? One of the major challenges to a research manager is to allocate to specific activities the budget which most NARS spend on personnel.

4) *PRIS*–Physical Resource Information System. What buildings and equipment are available for the implementation of research?

What does one of these component information systems, for example, a HRIS actually consist of? What is an *information system*? The best answer is *a database*, which in turn is really nothing more than a fancy word for *file*. If a research manager keeps an address book in which names, addresses, and telephone numbers are written–then s/he is already managing a database. Whenever s/he wants to find the address or telephone number of someone in the book, s/he usually looks under the appropriate last name. In computer terms, s/he is "searching the database by last name".

Management Issues in the Development of a Human Resource Information System–An Overview

A research manager must deal with four main issues in the development of a HRIS. Each is summarized here and then discussed more fully in the following Sections.

1) *Content.* Many research managers want to include in a HRIS more data than they can realistically use. Personnel managers, particularly, often want to collect and store data on all subjects now covered in individual personal files. Such an approach means that they may wind up with 75 to 100 variables on family background, education, career progression, and civil service status. The alternative is to pare such a "wish list" down to 15 to 25 of the most essential variables.

2) *Data collection and updating.* These two issues are clearly interrelated. First, any good HRIS requires valid and reliable benchmark information. But second, whatever information is collected must be updated at appropriate intervals. The following questions will therefore require answers.

   a) Source. Where are most personnel data likely to be found?
   b) Methods. What are the best ways to get at these data?
   c) Personnel. What are the staffing implications of decisions over how HRIS data are to be collected and updated?
   d) Nonpersonnel costs. What inputs other than personnel are needed to make a HRIS operational?

3) *Data management.* What happens to information after it has been collected (or updated)? Two issues are likely to be particularly important under this heading.
   a) The organizational home for HRIS activities. What are the relative merits (and demerits) of locating HRIS work in a central personnel

division, in a planning division, in a separate MIS unit, and/or in a data-processing unit?

b) Centralization vs. decentralization. Where in the NARS should most data checking and entry occur?

4) *Data use.* The end-product of all HRIS work. Who are the main users? What types of reports and data are officials outside the research organization likely to want? How can institutes/stations be encouraged to be both suppliers and users of information?

The Content of a HRIS

The starting point here must be a commitment to "begin small". Lots of things about research personnel are interesting to know. But the manager has to ask hard questions about his/her ability to collect data, to manage them, and–most important–to use them.

Specifically, what human resource management functions must be performed–and what data are needed to perform them? The following list of functions is a basic one:

* recruitment planning;
* training planning;
* career planning;
* personal evaluation;
* training administration;
* salary/benefits administration;
* pension/insurance administration;
* leave administration.

Each of these functions requires different data. The lists of data that follow are intended to be illustrative and *not* definitive. Each research organization must decide what it wants and needs to know. Information that may be required at the national level may not be required at the institute/station level – and vice versa.

Furthermore, as noted above, the research manager responsible for deciding on the content of a developing HRIS should not try to include too much. His/her focus must be on basic or minimum information. There are likely to be enough problems in just getting the database established and running, and new and more detailed information can always be added later. *THINK SMALL.*

Basic information for RECRUITMENT PLANNING. This part of the HRIS includes information on current research personnel. Research managers need to analyze whom they have before they can make judgments about whom they need. Only seven main variables are likely to be needed:

1) *Names.*

   a) Pimary name. In some countries, this name will be the last one. In others, it will be the first name or one in the middle.
   b) Secondary name(s).

2) *Age.* It is usually best to list by birthday. Sorting is likely to be easier if years are listed first. Therefore 18 July 1942 becomes 42.07.18.

3) *Sex.*

4) *Highest degree.* The planner is usually more interested in the highest degree than in lower degrees.

5) *Discipline.* The subject in which the highest degree was earned.

6) *Commodity or subject specialization.*

7) *Current assignment.*

   a) Institute/station.
   b) Department/program.

Basic information for TRAINING PLANNING. This part of the HRIS includes all the above information (seven main variables) plus information on most recent training.

8) *Most recent short-term training.*

   a) Subject.
   b) Year.
   c) University/institute.

Basic information for CAREER PLANNING. This part of the HRIS includes variables 1 through 7 above plus more detailed information on career and current position.

9) *Date entered service.* This date may be that of entry to government service or that of entry to the agricultural research organization.

10) *Past postings.* This information is useful in the assignment of staff to "more favorable" vs. "less favorable" geographic locations. For each past posting record the following information:

    a) Location.
    b) Years (e.g., 1979-1983).
    c) Total years at this location (e.g., 4).

11) *Current posting.*

    a) Title.
    b) Grade.
    c) Step-in-grade (e.g., basic salary).

Basic information for PERSONAL EVALUATION. This part of the HRIS includes variables 1 through 7 and 11 above plus the following information on activities in the period under review. Many of these last data are fairly subjective.

12) *Service.*

    a) Committees.
    b) Other institute/station management tasks.

13) *Leadership.*

    a) Projects headed.
    b) Training given.

14) *Output.*

    a) Papers written.
    b) Presentations made.

The final four management functions on the original list (*administration of training, salaries/benefits, pensions/insurance,* and *leave*) have data requirements that are specific to each NARS. Standard lists are therefore difficult to draw up. The research manager must decide what he needs to know about each of these subjects, how often he needs to know it, and what the costs are likely to be of trying to enter this information into a HRIS.

In general–again–the basic attitude of a manager must be: "THINK SMALL". The above list of 14 variables is not a long one.

Data Collection and Updating

Source. Where are most data on human resources likely to be found? The most obvious location is personal files. All NARS maintain such files, often with considerable breadth and depth of detail. It is not unusual to find in them data on family members (including parents), school records, military and religious service, and even maps showing where one lives.

Rigorous collection of basic data from files is the first step in the establishment of a new HRIS. Much of the information listed above–variables 1 through 14–is likely to be there somewhere.

Nevertheless, dependence on personal files presents three problems with which the manager must deal:

1) *Completeness.* Some data are always missing from personal files. Data to be used for personal evaluation–that is, variables 12 through 14–are particularly likely to be insufficient.

2) *Currency.* Some information in files is always out of date. Most NARS do not give institutes/stations/scientists incentives to provide data at regular intervals. If rewards like salary increases and promotions do not depend on keeping a personal file current, the chances are very high that updating will not be systematic.

3) *Location.* Personal files at national headquarters are always different from those at institutes/stations. In some NARS, information at national headquarters may be of good quality. But in others, institute/station information may be better because most personnel administration is handled there and/or because incentives to provide data to national headquarters are weak.

In addition to personal files, the next most accessible source of data is scientists themselves. They are the most complete sources of information about their own backgrounds and careers–though, of course, not necessarily the most reliable or unbiased ones. Collection of data from scientists is discussed immediately below.

Methods. The process of gathering data from personal files can be laborious. In some NARS, such files are well organized–in which case the time required to pull out information on all or most of variables 1 through 14 above may be short. But the usual situation is that

personal files are somewhat chaotic. In addition to information that should be included in a HRIS, files may also contain letters, certificates, petitions, requests for leave, etc. In such cases, the amount of time required to locate even basic data may be considerable.

The alternative to dependence on personal files is questionnaires. Two kinds of questionnaires are likely to be important. The first collects baseline (benchmark) data on variables 1 through 11 particularly. The second is for periodic updates and for variables 12 through 14.

Just as with personal files, however, questionnaires present several problems with which the research manager must deal.

1) *Distribution.* Who should be responsible for distributing questionnaires and for ensuring returns? One possibility is the national headquarters of the research organization–although then considerable travel by headquarters staff may be necessary. The other is institutes/stations themselves–although then considerable time will have to be spent at the beginning in involving institute/station managers in HRIS activities.

2) *Incentives.* What incentives can be given to individual scientists to encourage them to fill out questionnaires? Experience suggests that scientists are often very reluctant to participate in what they regard as "useless surveys". The response rate from mailed questionnaires is likely to be low.

   Financial incentives are one possible solution but are not likely to be administratively possible. In most civil service environments, money cannot be paid for such a purpose–unless, for example, the provision of "travel costs" to go somewhere to fill out the questionnaire is feasible. Salary and career disincentives may hold promise–that is, salaries will not be paid until questionnaires are returned. The problem with this last approach is that civil service rules in most NARS will not allow such "punishments" without a more major cause.

3) *Frequency.* How often should questionnaires be sent out? The most common answer is once a year. Only in exceptional circumstances will the research manager need more frequent updates of HRIS information.

Personnel. What are the staffing implications of how HRIS data are to be collected and updated?

The answer to this question depends on answers given to the "source" and "methods" questions immediately above. If primary dependence is to be placed on personal files, the amount of staff time will be heavy at the beginning, when each file must be gone through to extract basic data. After that initial search, however, staff work will be less. Only new data will have to be dealt with. The potential problem, as noted above, is that both the original data in these files and these new data may be incomplete and/or out of date.

Reliance on questionnaires requires more staff work. Not only must personal files be gone through at the beginning to collect basic data, but questionnaires must then be designed and responses monitored. The division of labor between the national headquarters of a NARS and institutes/stations will determine how much staff time needs to be spent.

If interviews with individual scientists have to be carried out, either at the beginning (to collect benchmark data) and/or annually (to collect new data), then staff costs may be considerable.

Nonpersonnel costs. What resource inputs other than personnel are needed to make a HRIS operational?

Once again, answers to this question depend on answers given to the "source" and "methods" questions raised above. Three obvious categories of potential nonpersonnel expenses are involved in setting up a HRIS.

1) *Travel.* If a decision is made to emphasize questionnaires as a means of collecting data, then a significant amount of staff travel is likely to be unavoidable. Questionnaires must be explained and distributed, both functions often best performed in person. Nonrespondents must be chased. And if the updating process is to be an annual one, then data collection can become almost a continuous activity.

2) *Training.* A related point. If institutes/stations are to take a major role in data collection and use, then officials of those institutes/stations must be involved right from the beginning. They should participate in the design of the HRIS, in the trials of it, and in the ongoing management of it.

3) *Microcomputers.* A HRIS in the early stages is likely to be based on both paper-and-pencil records and micros. But most NARS will want to think about making the transition to micros as soon as possible. The manager of a HRIS that uses micros will be able to operate much more quickly in searching for data, producing tables and charts, and updating information.

   The costs for micros are not large. One high-capacity micro is enough to handle a HRIS for most NARS and the cost will be under $10,000. Smaller micros for use at institutes/stations will cost less than $4000 each.

Data Management

Two important organizational issues must be resolved under this heading. The first is one of an organizational "home" for HRIS work at national headquarters. Should the focal point for HRIS activities be in the personnel division, in the planning division, in the data-processing division, or in a separate MIS unit?

The second is one of centralization vs. decentralization. Should HRIS data be checked and entered (onto either cards or into a microcomputer) at the national level or at the institute/station level?

An organizational "home" for the HRIS. This issue is without doubt one of the most important ones facing the research manager responsible for a HRIS. How s/he deals with it will be an important determinant of the success or failure of *all* HRIS activities.

There are at least four possible locations for HRIS activities:

1) *The personnel division.* Probably the best home for a HRIS. Most of the data are likely to be in this division–as are most of the users and uses.

   But there are two disadvantages to locating a HRIS in the personnel division. The first is that coordination with any NARS-wide MIS may be difficult. For example, a NARS-wide MIS will contain information on project content and output which the manager will need for evaluating the activities of his/her personnel. But if the MIS and the HRIS are in different offices, then communication between them will become an additional management problem.

   The second disadvantage is an attitudinal one within many personnel divisions. As noted above (Section I), such units are often concerned primarily with salaries, pensions, and leaves–and not with planning or evaluation. If a personnel division is to be given responsibility for a HRIS, therefore, NARS management will need to make special efforts to move it away from attention to such purely administrative functions.

2) *The planning division.* The advantages of locating a HRIS in such a unit are reverses of the disadvantages of having it in a personnel division. The HRIS will be closely integrated into a NARS-wide MIS, and the primary uses of data will be more for planning than for administrative purposes.

   On the other hand, most of the uses of a HRIS should be for functions performed mainly in the personnel division. Recruitment, training, careers, and evaluation are all issues which fall within the mandate of such divisions.

   Whichever of these first two options the manager chooses–the personnel division or the planning division–the important task is to establish good communication procedures between them. Once again, microcomputers provide a practical means of achieving this goal. A HRIS can be headquartered in the personnel division and can provide data on floppy disks to a NARS-wide MIS located in the planning division. The only requirement is that both MIS components use the same hardware and software.

3) *A MIS unit.* Almost certainly not the best home for a HRIS (or, in fact, for any kind of MIS work). There are likely to be two major problems if such an approach is adopted. First, a separate MIS unit will be cut off from most users of its products–who are most likely to be in the planning, personnel, and finance divisions. And second, a separate MIS unit will usually lack the organizational authority to work with institutes/stations and with individual scientists to collect good data and to encourage effective use.

4) *The data-processing division.* Probably the least desirable home for a HRIS. The same arguments made immediately above against a separate MIS unit apply here also. The collection and use of

information for planning, programming, monitoring, and evaluation are substantive issues and therefore the legitimate responsibilities of officials in planning, personnel, and finance divisions.

A DP division need not become involved in information systems simply because microcomputers are being used. Micros are today becoming simpler and simpler for professionals to use. The research manager should therefore be sure that they are on the desks of his/her planning, personnel, and finance people and not located exclusively in DP divisions. Micros are tools, and information is a means and not an end.

Centralization vs. decentralization. The performance of two distinct management functions is at issue here.

1) *Checking.* Once data have been collected (see the Section on the content of a HRIS above), they must be checked for both completeness and accuracy. Where should this checking function be performed? There are three general possibilities: at the national level (using personal files), at the institute/station level (using a combination of personal files and individual contacts), and/or at the individual level.

   A strong case can be made for checking by the individual scientist. As noted above, personal files may be less than complete and up to date. If managers make decision to put their HRIS on a microcomputer, however, then the generation of a one-page printout for each scientist in the organization is easy. This printout can be sent to each scientist for additions, deletions, and/or corrections.

2) *Entering.* Where should the entry of data onto either cards or into a microcomputer occur? The manager must be certain that information is being entered in standard formats which will facilitate later compilation and analysis.

   There is almost certainly an issue of timing here. At the beginning, when a HRIS is just being established, entering of data should probably be done at the national level. Staff there can be trained more easily, unexpected problems can be dealt with more readily, and quality control can be assured. But once the system is established, data can be entered at the institute/station level. Information can then be kept close to some of its primary users and only that information which national headquarters requires needs to be sent up.

   Once again, a decision to use microcomputers for a HRIS brings specific advantages. Data entered on a micro at the institute/station level can be brought to national headquarters on a single floppy disk for immediate inclusion in a national database. Perhaps even more important, managers and scientists at the institute/station level can use their own data immediately.

3) *Maintaining security.* Except for variable 11e (step-in-grade), there is no other information on the basic list which either scientists or managers are likely to see as confidential. But if the HRIS is later expanded to include other data, privacy and security issues may arise. The HRIS manager will then need to devise procedures which will limit both the number of people who collect and input such information and the number of people with access to it.

   The first restriction is actually more difficult to organize than the second. Once data are in a microcomputer, it is relatively easy–from a technical point of view–to close off complete files or parts of files to unauthorized users. The more demanding management challenge lies in controlling access to information in hard copy, when it is being collected and while it is being entered.

Data Use

Users of information from a HRIS fall into two broad categories:

1) National. Organizations in this category include planning ministries, finance ministries, special commissions, secretariats to cabinets or parliaments, and foreign donors.

   NARS managers are continually being asked to provide information to such organizations. The purposes vary: planning, monitoring/evaluation, and project identification/preparation. A complete and functioning HRIS can facilitate the provision of such information, thereby both decreasing the workload of the NARS and building up its image as a progressive and well-managed operation.

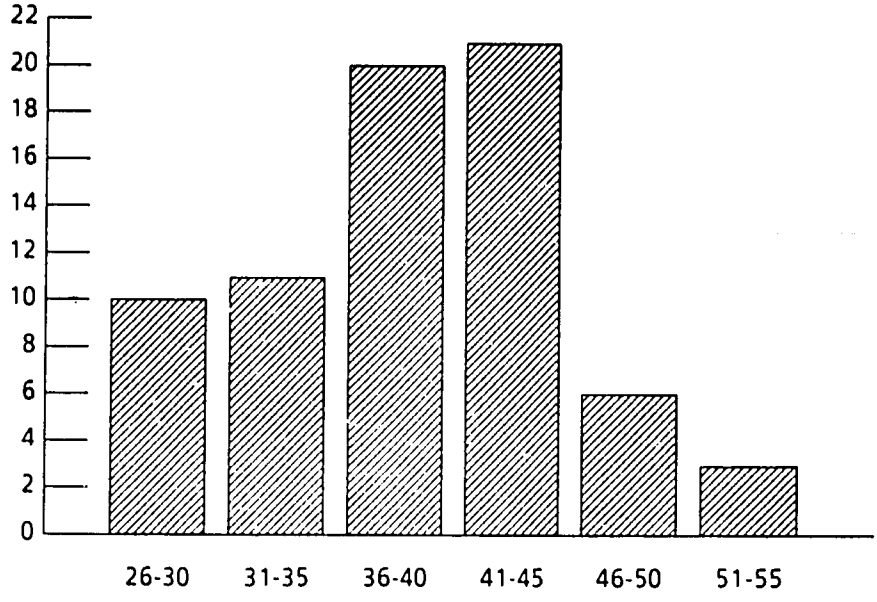


Figure 2

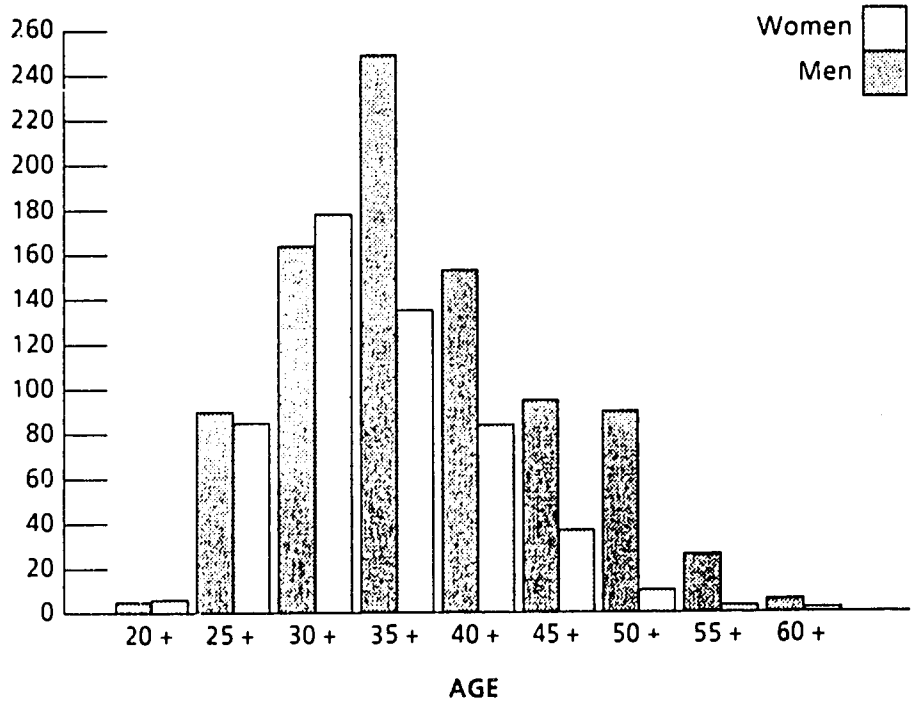


Figure 3

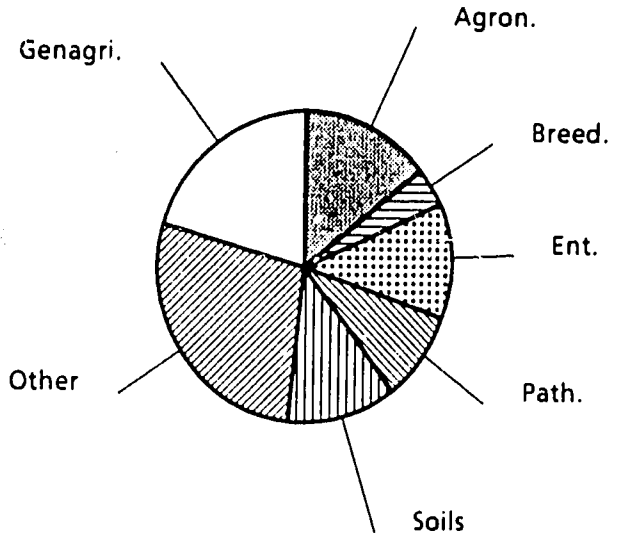


Figure 4

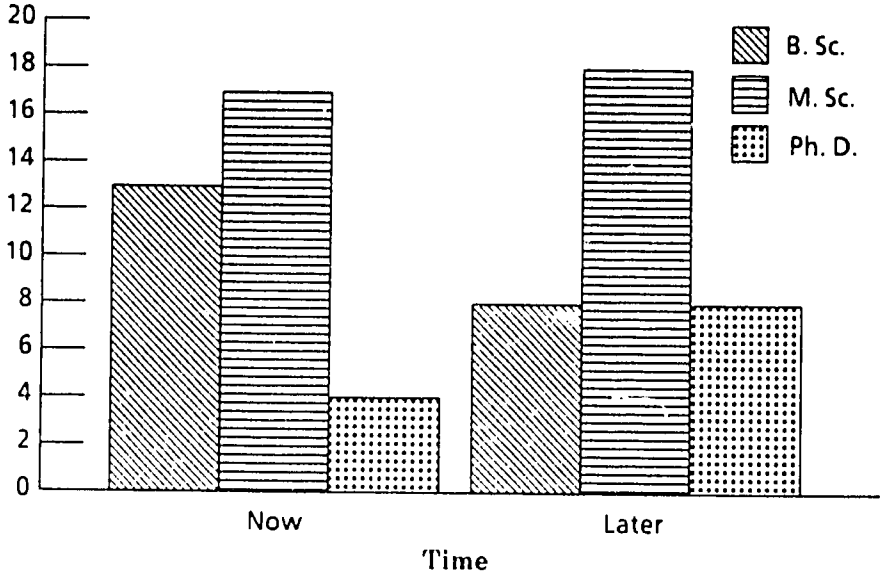


Figure 5

2) Institute/station. In large NARS particularly, a big part of planning, monitoring/evaluation, and project identification/preparation functions must be performed on a decentralized basis. Research institutes/stations therefore need the information and organizational support provided by a national HRIS.

The uses of a HRIS are best discussed through examples. The remainder of this paper therefore provides a sample of HRIS outputs. All data come from NARS in Asia. The purpose of including these samples is to give a flavor of the many and varied uses to which a good HRIS can be put.

Recruitment planning

Figure 2 shows the current age distribution of scientists at one research institute.

For the recruitment planner, this graph should cause concern. There is clearly a bulge in the middle. Fifty-eight percent of the scientists are between ages 36 and 45.

Why are there not more young scientists? Most important, what will the age profile of this institute look like in 10 years? Is there a danger that probable government restrictions on new recruitment, perhaps for budgetary reasons, will mean that the age distribution will increasingly become an inverted pyramid? How might such an inversion affect promotions? Might some scientists choose to leave the NARS because their promotions are blocked?

Figure 3 shows the current age and sex distributions of scientists in one NARS.

For the recruitment planner, the most striking characteristic of this graph is the high percentage of women (38%). Many of these women are young–50% of them are under 35, as compared with only 20% of men. Even in absolute terms, there are more women under age 35 than men (269 vs. 259). Recent recruitment has been biased in favor of the most able young scientists–who, in this NARS, have been mostly women.

If such trends continue, the percentage of female scientists will most likely have grown to at least 44% by 1994. Such a figure is likely to be important, as it affects postings and disciplinary balance (and therefore the type of research actually done).

For the planner, the dilemma is clear. If more women are recruited, the NARS may have problems in assigning them to rural areas. But if preference is shown to men, the new recruits may not be the most able available scientists.

Training Planning

Figure 4, the pie chart, shows the distribution of MSc and PhD scientists by discipline in one NARS.

Such data are useful to both recruitment and training planners. What disciplines are under- and overrepresented?

Figure 5 shows the distribution of scientists by educational qualification at one research institute–as well as the distribution after current trainees have returned.

For the training planner, the "later" portion of the graph should be particularly worrisome. Will 8 PhDs (24% of the scientific strength of the institute) have sufficient research funds and subordinate personnel to do efficient and effective research? Will there be scope for MScs to aspire to become PhDs without beginning to invert the professional staff pyramid? And might BScs increasingly come to be regarded simply as "super technicians"?

Career Planning

Figure 6 shows the distribution of scientists in one NARS by grade in 1983 and in 1990.

The ominous feature of this graph is the changing balance between junior and senior scientists. In 1983, the ratio was more than 6:1. But by 1990–because of limited recruitment and largely automatic promotions (on the basis of seniority)–there will actually be more senior than junior staff. The personnel pyramid will have become top-heavy.

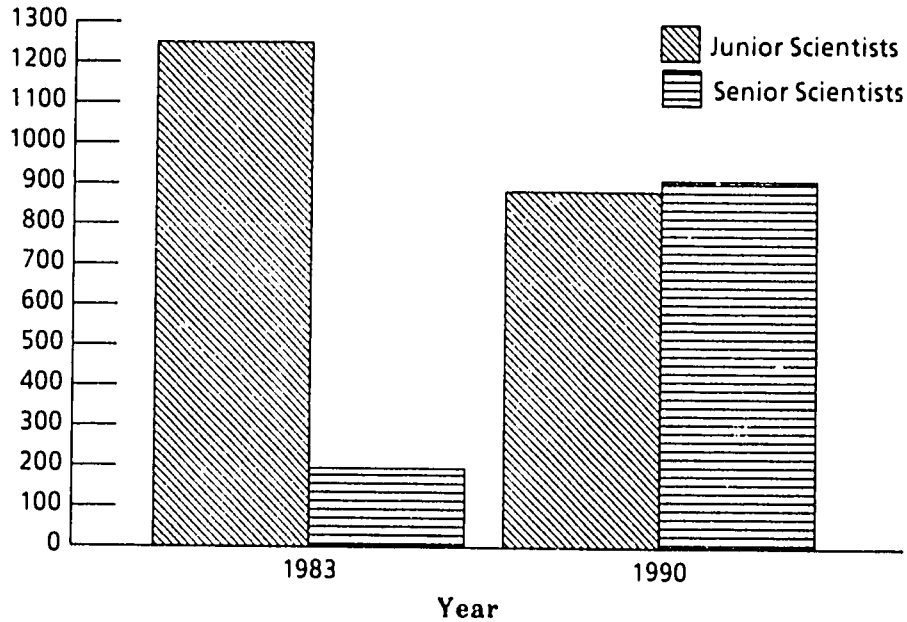


Figure 6

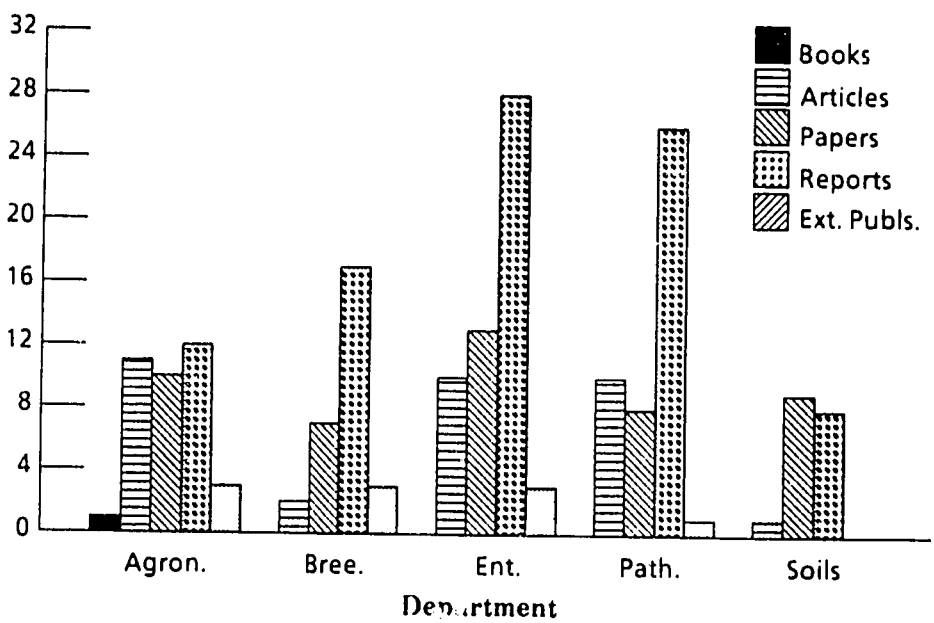


Figure 7

What might the research manager do to deal with this situation? A first step could be to get agreement on the ideal shape of the NARS staff pyramid and to specify what percentage of staff should be at each grade level. A second step could then be to develop job descriptions and to specify the criteria for movement between grades.

Personal Evaluation

Figure 7 shows the published output of scientists by department in one research institute.

Both the institute director and the department heads might use such data in the evaluation of their personnel. Why are some departments apparently more productive than others? Is the balance between books, articles, papers, reports, and extension publications the right one?

Further–since these data are aggregated from individual scientist data–which scientists are writing the most? Are those scientists who do write the most really the most valuable and productive members of the research team? What other criteria for evaluation should be considered?

Conclusion

The above examples illustrate how a HRIS can be used to generate data on four of the basic human resource management functions. Recruitment planning, training planning, career planning, and personal evaluation are at the center of good human resource management. Such functions cannot be performed in the absence of information. GOOD DATA ARE AN ESSENTIAL PREREQUISITE FOR GOOD DECISION MAKING.

This paper provides a *CHECKLIST* of decisions a NARS manager responsible for building a HRIS must take. It contains few prescriptions. Each NARS is different–and each NARS manager operates in his/her own political and organizational environment. The emphasis in the paper is therefore on issues rather than on solutions.

1) ***Strategy*** Agreement on the place of a HRIS in a wider management information system.

2) ***Content*** Definition of priority HR management functions to be performed; eight listed.

   Identification of basic information required to perform these functions; 14 suggested variables. Importance of beginning small.

3) ***Data collection and updating*** Identification of sources of information; personal files vs. surveys; national headquarters vs. institutes/stations.

   Determination of efficient methods to collect and update information; personal files; distribution and frequency of questionnaires, and incentives for scientists to fill them out.
   Planning for personnel and nonpersonnel costs of data collection and updating; travel, training, and microcomputers.

4) ***Data management*** Identification of an organizational "home" for a HRIS–the personnel division, the planning division, an MIS unit, the data-processing division.

   Agreement as to how centralized or decentralized HRIS operations are to be; data checking, data entering, data security.

5) ***Data use*** Establishment of procedures to encourage use at both the national and institute/station levels.

   Examples of data use for recruitment planning, training planning, career planning, and personal evaluation.

ARIS
AN AGRICULTURAL RESEARCHER INFORMATION SYSTEM FOR HUMAN RESOURCE MANAGEMENT: GUIDE FOR RESEARCH MANAGERS

Larry Zuidema

Introduction to ARIS*

ARIS has three components:

1. *Guide for Research Managers* (this document), which contains information about the implementation of ARIS and the interpretation of information generated from its 32 variables. It is primarily for use by research managers and those responsible for information management on human resources in agricultural research institutions.

2. *Guide for Users of the Computer Program*, which consists of two parts: (1) a user's manual and (2) technical documentation. It is primarily for those who will directly operate the computer program.

3. *The ARIS Computer Program*, which is a diskette containing the ARIS stand-alone, data-base management application program designed for micro-computer use.

This guide describes a computerized information system for human resource management in agricultural research institutions. Called the *Agricultural Researcher Information System* (ARIS), it is a planning and management tool designed primarily for managers of national agricultural research systems (NARS) and the units within these systems.

The purpose of ARIS is to improve the quality of research management decisions related to agricultural researchers. Improving the utilization and productivity of researchers to meet program objectives requires continual resource-related actions by research managers. The goal of these actions is to create a stable, responsive research organization which benefits from the accumulated experience of its researchers and, thereby, maintains program continuity.

Design. ARIS is designed to produce basic and useful information about human resources in a routine and timely manner. The data collected, the analysis applied, and the reports generated are predetermined and, therefore, standardized. This allows managers to aggregate data from the smallest unit in a center or institute to an entire national system. It also permits managers to compare the status of human resources between diverse units within a system and with other systems. Eventually, it is possible to develop a sense of statistical norms for key factors relating to human resources for agricultural research. By matching information from any one unit with that from another or with that of several units combined, the research manager has a stronger basis for judgment and decisions.

The value of ARIS increases over time. Summarized data can be stored from one year to the next, allowing for a review of trends. These trends can be compared between units at any level in the research system.

**ARIS was developed as an ISNAR research project by Larry Zuidema and Krystyna Stave. Larry Zuidema initiated the development of ARIS and was primarily responsible for the preparation of the guide for research managers. Krystyna Stave developed the computer program and the guide for its direct users (not yet available) and contributed to the overall development of ARIS. This document and the ARIS computer program are preliminary and were developed for use at the ISNAR Human Resource Management Workshop, November 7-11, 1988. Some features of the computer program are still under development. Reader comments may be directed to Larry Zuidema or Krystyna Stave.*

Positive trends can, thereby, be reinforced and attempts can be made to reverse or halt negative trends.

Variables. ARIS is based on *32 variables* classified in four categories:

1. Researcher Profile: General Statistics
2. Researcher Profile: Qualifications
3. Researcher Activities
4. Unit Dynamics

See "ARIS Variables" for a listing. Detailed information about the significance and use of data relating to these variables is given under "Interpretation of ARIS Variables." ARIS uses a basic data set that includes limited personal data, highest degree, current employment, recent employment actions, annual activities, documentation of research, and persons supervised. It does *not* include family data, career histories, education and training histories, compensation data, or complete performance data.

Computer program. The ARIS computer program is a *self-contained application program* that requires no knowledge of computer programming. It may, therefore, be utilized in situations where computer capacity and experience are limited. As computer capacity grows within a NARS, the value of ARIS increases since the data can be transferred from the ARIS application program. It can then be analyzed and reported in other forms using other software programs, including statistical packages.

Uses of ARIS

There are at least five ways in which ARIS can be used. The first three utilize ARIS data and reports. The last two utilize ARIS data only and require transfer of data to generate the reports desired. The five uses of ARIS are as follows:

1. *Routine agricultural research management.* ARIS is designed primarily for routine management of agricultural research institutions at all levels. The summary reports provide basic information for management decisions primarily relating to human resource planning, staffing, and development, and they contribute to decisions about compensation, motivation, and evaluation. In addition, ARIS can be particularly useful when data collection is timed to produce information for the preparation of annual program plans, budgets, and program reviews and evaluations. With the availability of annual summary information about agricultural researchers, managers can quickly respond to inquiries from planners, budget officers, legislators, and other relevant government agents about the stock, use, and deployment of agricultural researchers.

2. *Preparation of special project, loan, and grant proposals.* Internal and external development agencies and donors require basic information about agricultural research organizations as part of the documentation for proposals for funding research projects, staff training, capital construction, and components of an agricultural research organization. Data collected on a routine basis provide time-series information which is often required by these organizations.

3. *External management reviews.* From time to time, agricultural research organizations undergo management and organization reviews. These may occur in association with on-going institution-building projects, on the basis of an internal decision to improve the efficiency of the organization or as a routine practice. Often, reviewing organizations fail to clarify information requirements and appreciate having organized information in advance. In cases where an information system like ARIS is not being employed, ARIS can be utilized by the reviewed and/or reviewing organization as a one-time means of collecting and summarizing relevant information about human resources in a relatively short time period.

4. *A core data base for other data bases relating to researchers.* ARIS provides information relating to the characteristics of researchers, their activities and outputs, as well as the dynamics of human resources from one point in time to another. Other information-based reports related to human resources include training needs assessments, performance reports, compensation reviews, and motivation factors. While these are not included in ARIS, with a knowledge of data base software it is possible to utilize the information generated by ARIS as a core data base for these other human resource reviews.

5. *Detailed analysis of human resources in agricultural research.* The ARIS program is designed to generate information that can be aggregated from the lowest to the highest levels. The data, however, are very useful for further analysis using the data base

program and statistical programs. To do this, it is necessary to have the expertise to move the data out of ARIS and to utilize other software programs. The collected data then can be used for occasional or routine research relating to agricultural researchers. For example, the data on human resources can be analyzed in connection with other organizational performance measures to derive improved staffing patterns.

Data Collection

Data for ARIS are collected on a three-part RESEARCHER RECORD FORM as follows:

Part 1. Permanent record

This part contains relatively permanent data that can be stored from year to year. Data that may require an occasional update relate to "highest degree." Revisions can be made by an administrativer office or the researcher. The information in this part of the form is generated from the computer program and provided on the form given to the researcher each year. For the first year, it is recommended that this section be completed by an administrative officer using personnel files. The researcher can fill in missing details.

Part 2. Annual employment record

Included in this part are data on employment actions during the year and details about the current position of the researcher within the organization. This is normally completed by an administrative officer by revising the previous year's record and providing the data to the researcher for review each year. For the first year or where centralized data are not complete or accessible, it may be appropriate for the researcher to complete this part of the form.

Part 3. Annual work activities

This part can only be accurately completed by the researcher since it requires a judgment about the amount of time utilized during the year for various work activities, a summary of documents produced, and number of staff supervised. Only in the absence of a researcher should a supervisor attempt to complete this form.

The primary use of ARIS is for routine agricultural research management. For this purpose, the collection of data on agricultural researchers is normally done on an annual basis to coincide with other management functions such as program planning or evaluation. The 12-month period selected should be appropriate for planning and management purposes. The terminology on the researcher record form may be customized for use in any system. In so doing, care should be taken to ensure that the nature of the requested data is not altered.

As indicated in the previous section, the researcher record form may also be used on a one-time basis for a management review or for data collection for the preparation of a proposal. In these cases, it is recommended that an administrative officer complete sections 1 and 2 and then send the form to the researcher for checking and for completion of section 3. This will increase the accuracy of reporting since terminology will be consistent and office records may be more precise than a researcher's recollections. If necessary, the form may be entirely completed by a researcher, but this will require an administrative officer to review each form to ensure accuracy and consistency of unit names and other standard terminology. The goal is to obtain information that is as accurate as possible in order to get summary reports which reflect the situation in the research unit(s) under review.

Regardless of how ARIS is used, the following procedures are recommended:

- Data collection, storage, and analysis are managed by a senior person.
- The universe of researchers is well defined and understood.
- Data are recorded for all researchers, including new hires and those on leave.
- A partial form is completed for those who terminated during the year.
- All record forms are checked for accuracy, completeness, and consistency of terminology before data are entered into the computer program.

The *researcher record form* is shown in appendix 1. A sample screen format of a computer entry is shown in appendix 2.

Data Management

The ARIS program maintains the data base of current NARS researchers, stores a set of summary records

Figure 1. ARIS Data Management Program

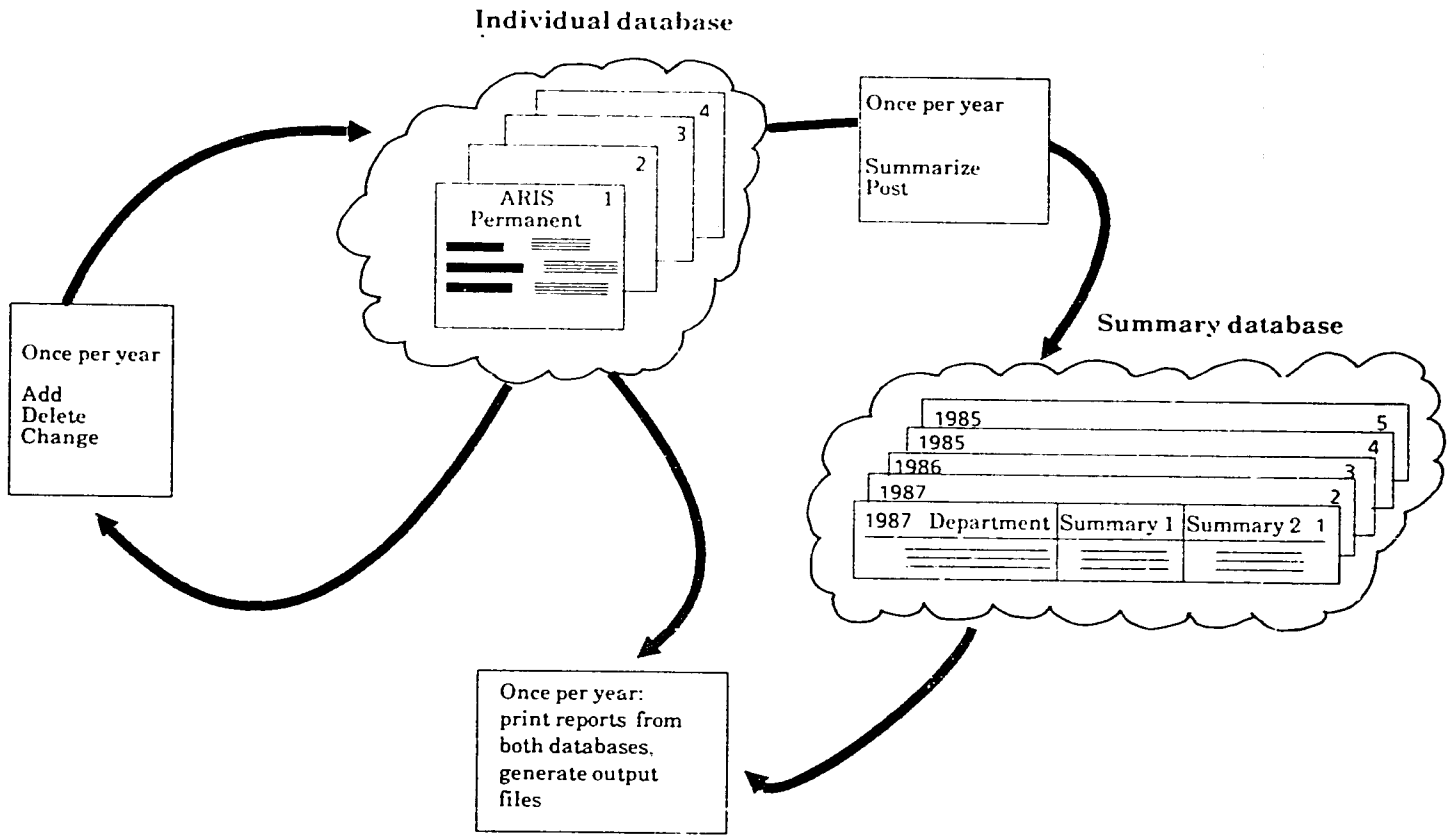
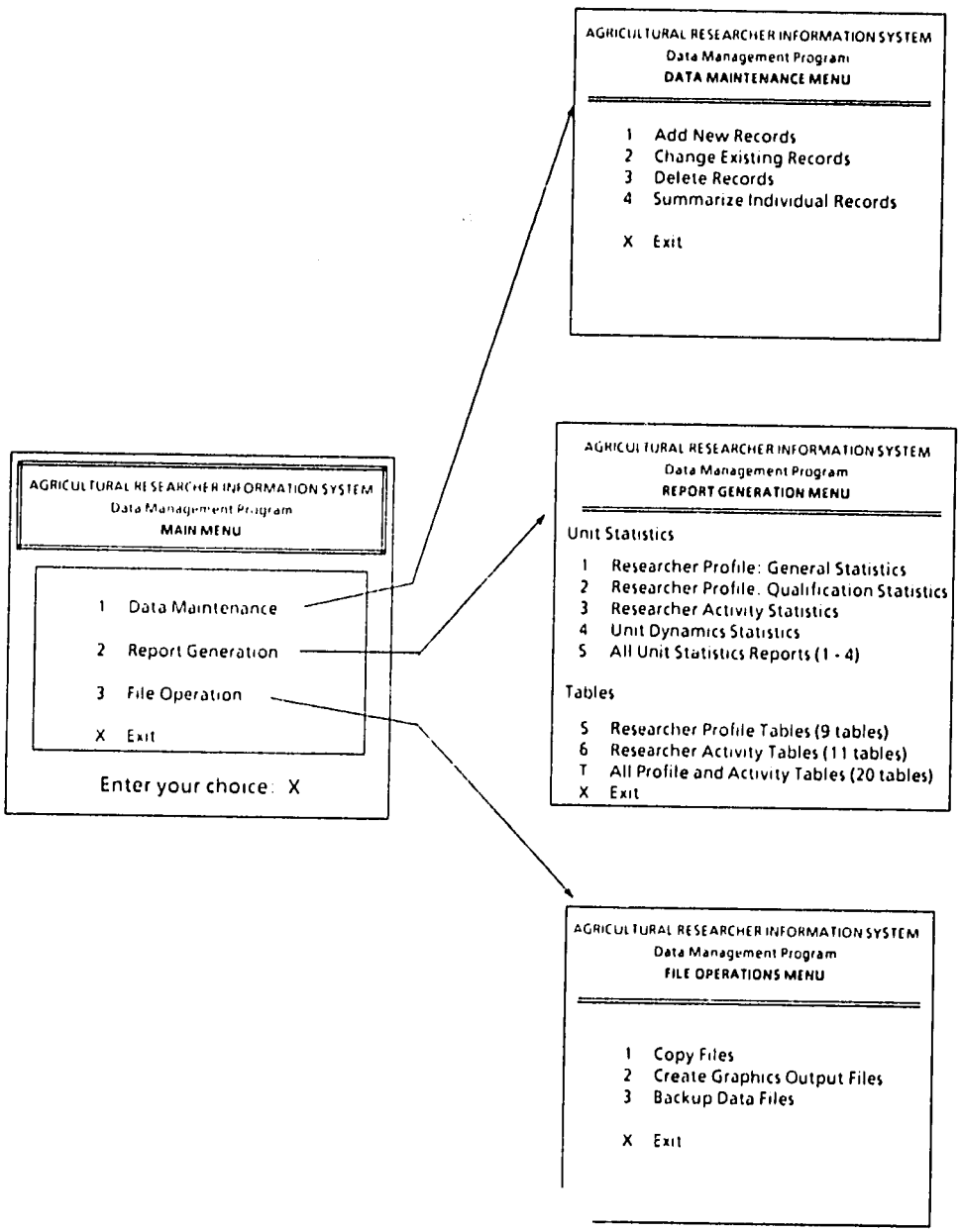


Figure 2. ARIS Date Management Program (Menu Diagram)



from year to year, and produces reports describing the status of human resources in the current year and how they are changing over time.

The ARIS data management program has three basic functions: data maintenance, report generation, and file operations.

The *data maintenance function* allows the input, update, and deletion of information records from the data base containing records of individual researchers. Records are entered and displayed for editing using a screen format that looks like the data collection form. Individual records are updated once each year to reflect changes in a staff member's status. Records are added for new staff members, and records for staff members who left the system in the past year are deleted. After individual records are updated, selected data items are summarized by department and the summary records are written to another data base. Summary records are saved from year to year and are used to generate time-series reports.

The *report generation function* produces standard reports, selected from a menu, from both the individual data records and the summarized departmental records. Yearly and time-series reports can be printed for aggregation levels from the lowest, or department, level to the highest, or NARS, level.

The *file operations function* allows users to produce copies of data files for data backup. Data files can also be copied for further analysis using commercial data base or statistical programs. The file operations function also generates spreadsheet files for use in commercial graphics packages.

The program uses two permanent data bases for storing data. One data base contains individual data records for all research personnel currently in the NARS. The second data base contains one summary record for each department for each data collection period. Records in the individual data base contain all data items requested on the data collection forms. Records in the summary data base contain only data items that are used to generate time-series reports.

Figure 1 shows the relationship between the two permanent data bases. Figure 2 is a diagram of the ARIS program menus. The diagram shows the three main program functions together with the subsidiary menu options.

ARIS Variables

The following is a list of ARIS variables in four information areas. The numbers shown correspond to the statistics and tables shown under "ARIS Summary Reports."

1. *Researcher Profile: General Information (1)*

   Number of researchers (1.1)
   FTE number of researchers (1.2)
   Permanent researchers (1.3)
   Part-time staff (1.4)
   Expatriates (1.5)
   Gender (1.6)
   Age (1.7 and 5.1)

2. *Researcher Profile: Qualifications (2)*

   Postgraduate degrees (2.1 and 5.2)
   Foreign degrees (2.2, 7.1, and 7.2)
   Degree sponsor (2.3, 5.3, and 7.3)
   Duration of degree study (5.4)
   Field of study (5.5)
   Pre-NARS employment (2.4, 5.6, and 7.4)
   NARS experience (2.5, 2.6, and 5.7)
   Primary specialization (2.7 and 5.8)
   Terminations (5.9)

3. *Researcher Activities (3)*

   Employment time (3.1, 3.2, 6.1, and 6.2)
   NARS work activities (3.3, 3.4, 3.5, and 6.3)
   NARS work location (3.7, 3.8, and 6.4)
   Research type (3.6 and 6.5)
   Sector focus (6.6)
   Research subjects (6.7 and 7.7)
   Research documentation (3.9, 3.10, 6.8, 6.9, and 6.10)
   Staff supervision (3.11 and 6.11)

4. *Unit Dynamics (4)*

   Recruitment rate (4.1)
   Attrition rate (4.2)
   Quit rate (4.3)
   Career mobility (4.4)
   Inter-unit mobility (4.5)
   Development orientation (4.6 and 3.2)
   Growth rate (4.7)

ARIS Summary Reports

The reports generated by ARIS provide research managers with indicators of the educational levels, experience, deployment, program activities, and output of researchers in any unit or group of units in a national system. They also show the dynamics or flows of human resources by providing rates for recruitment, attrition, mobility, development, and growth. The following is a listing of statistics and tables which can be generated from ARIS.

1. *Researcher Profile: General Statistics–Table 1*

1.1 Number of researchers
1.2 Full-time equivalent (FTE) researchers
1.3 % Regular, permanent
1.4 % Full Time
1.5 % Expatriate
1.6 % Male
1.7 Average age

2. *Researcher Profile: Qualification Statistics–Table 2*

2.1 % Postgraduate degrees
2.2 % Foreign degrees
2.3 % Education sponsored by government
2.4 % Pre-NARS experience
2.5 Average years of NARS service
2.6 % with 5 or fewer years of NARS service
2.7 % with specialization in socioeconomics

3. *Researcher Activity Statistics–Table 3*

3.1 Average % time for NARS work activities
3.2 Average % time for study leaves (degree / nondegree)
3.3 Average % NARS time for research
3.4 Average % employment year for NARS research
3.5 Average % NARS time for management/administration
3.6 Average % research time for applied/adaptive research
3.7 Average % NARS time at educational institution
3.8 Average % NARS time at on-farm/field site
3.9 Average # of scientific publications, foreign and domest
3.10 Average # of technology transfer products, foreign and domestic
3.11 Average # technical staff supervised, field and laborato

4. *Unit Dynamics Statistics – Table 4*

4.1 Recruitment rate (% new hires)
4.2 Attrition rate (% terminations)
4.3 Quit rate (% voluntary resignations)
4.4 Career mobility (% promotions)
4.5 Inter-unit mobility (% transfers)
4.6 Development orientation (% with degree study leaves)
4.7 Growth rate (% change from previous year)

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5. *Researcher Profile Tables (annual reports only)*

5.1	Age	# % < 30 | %30-39 | %40-49 23 %50-59 | % > 59
5.2	Highest degree	# % PhD equiv. | % MS equiv. | % BS equiv. | % < BS
5.3	Sponsor	# % Self | % Government | % Other
5.4	Duration of degree study	# Ave.Mos PhD equiv | Ave.Mos MS equiv | Ave.Mos BS equiv |
5.5	Major field of study	# 12 Categories (see form)
5.6	Pre-NARS employment	# 7 Categories (see form)
5.7	NARS service	# % < 1yr | %1-5yrs | %6-10yrs | %11-15yrs | %16+yrs |
5.8	Primary specialization	# 12 Categories (see form)
5.9	Terminations	# % Retired | % Voluntary resig. | % Nonvoluntary resig. |

6. *Researcher Activity Tables (annual reports only)*

6.1	Employment time	# Average % time for each of 6 categories
6.2	Non-NARS work activities	# % for each of 4 categories
6.3	NARS work activities	# Average % time for each of 7 categories
6.4	NARS work location	# Average % time for each of 6 categories
6.5	Research type	# Average % time for each of 4 categories
6.6	Sector focus	# Average % time for each of 6 categories
6.7	Research topics	# FTE researchers for top 5 subjects
6.8	Research Doc. — (Domestic)	# Average # documents for each of 1 categories
6.9	Research Doc. — (Foreign)	# Average # documents for each of 10 categories
6.10	Research Doc. — (Total)	# Average # documents for each of 10 categories
6.11	Staff supervision	# Average # staff supervised in 5 categories

7. *Frequency Lists (annual reports only)*

7.1 Institutions where highest degree obtained
7.2 Countries where highest degree obtained
7.3 Sponsors of degree program
7.4 Pre-NARS employers/countries
7.5 Job titles
7.6 Grades + steps
7.7 Research subjects

Interpretation of ARIS Variables

As can be seen from the previous section, ARIS generates information in the form of averages, frequency distributions (mostly percents), and lists of data. The reports generated are based on the 32 variables discussed in this section. Numbers in this section (e.g., 5.3) relate to those shown in the section on "ARIS Summary Reports."

The interpretation and application of the information summarized from ARIS is best done by managers in relation to the characteristics, mandate, and programs of their institution. Since ARIS provides standardized data collection, analysis, and summary reports, managers have the opportunity to compare the information in one unit/institution with that in a range of other units/institutions. With an opportunity to review norms and ranges of statistics for a number of other units/institutions, judgments can then be made as to the appropriateness of any human resource situation in that unit/institution. Repeated use of ARIS provides opportunities to observe trends and, thereby, to assess the effectiveness of past management decisions on organizational performance levels.

The following are comments about the interpretation and application of various statistics generated by ARIS. They are presented in the spirit of identifying issues, not to make absolute judgments which may not be appropriate for any one situation.

1. Researcher profile: General information

Number of researcher (1.1)
The total number of researchers in a department, institute, or system is significant with respect to the breadth of program activities that can be undertaken and the type of research which is possible. Issues relate to critical mass of research staff, program leadership patterns, interdisciplinary interaction, linkages with other research organizations, support staff, etc. In general, small numbers of researchers pose special problems for research managers, particularly those with broad program mandates.

FTE number of researchers (1.2)
Knowing the full-time equivalent (FTE) number of researchers is important for understanding the level of effort expended in relation to program requirements. To obtain the FTE of research staff utilized, calculations are made about the time periods of employment of nonpermanent staff and the percent of time of part-time staff. Program planning exercises must consider FTE research numbers as well as total numbers of staff.

Permanent researchers (1.3)
The percent of regular, permanent research staff may be significant with respect to the stability of the research program and the institution itself. Large projects and rapid program expansion often result in the hiring of large numbers of contractual, temporary employees. Sometimes this becomes institutionalized outside of the regular budgetary and civil service processes. In such cases, the staffing of agricultural research institutions can become vulnerable to policy changes and loss of external revenues. Not only are programs and staff reduced, but the morale and motivation of remaining staff may be adversely affected. A further issue may be the differences in salaries and benefits between the two groups if the nonpermanent staff numbers are significant. Circumstances, however, may require the hiring of some nonpermanent staff (often called contractuals). The use of nonpermanent staff may be the only way to meet critical new program needs and may form the basis of obtaining approvals for institutionalized growth in numbers of researchers.

Part-time staff (1.4)
The percentage of part-time staff raises still other issues relating to program continuity, critical masses of researchers, effective deployment, etc. The hiring of some part-time staff may be the only way in which a research institution can obtain scarce skills and maintain critical programs. However, a high percentage of part-time staff usually poses special problems for research managers related to researcher commitment and program continuity.

Expatriates (1.5)
Many research institutions were developed in colonial periods when they were staffed primarily by expatriates. Where large numbers of expatriates

remain in NARS, issues relate to researcher motivation (inequities of salary and benefits), staffing patterns and staff development. In this situation, research managers have the opportunity to focus on the utilization of expatriates for staff development. Small numbers of expatriates may actually facilitate the in-service development of young staff, provide temporary leadership for critical program areas, and supply critical skills.

Gender (1.6)
The gender of researchers may pose special problems, depending on cultural mores and values. Deployment practices, compensation, motivation factors, and training plans may need to take account of the gender differences within a culture in order for both sexes to be productive in agricultural research.

Age (1.7 and 5.1)
The distribution of age of researchers is important to understand with respect to nearly all management functions. Large numbers of young staff, as is the case in many NARS, raise issues about training, supervision, deployment, motivation, performance appraisal, etc. A large number of older staff has implications with respect to the high average cost of researchers, pending retirements and the need to recruit replacements. Average age may not be the best measure of maturity of the researchers where, for example, a NARS has had both a post-colonial and a more recent growth period (bi-modal). Many of the issues relating to age are better handled in the context of years of experience of researchers, which is a more relevant statistic.

2. Researcher profile: Qualifications

Postgraduate degrees (2.1 and 5.2)
The percentage of researchers with postgraduate degrees is particularly significant since these are the staff who are trained to conduct research. Institutions with few staff with postgraduate degrees may have difficulties in developing and maintaining a productive research program. They certainly lack the scientific leadership for developing commodity-, resource-, and theme-based research programs. Such a situation has implications for recruitment and training. Having large numbers of staff with postgraduate degrees does not ensure successful research programs, however, since policies may not be favorable for effective utilization, or reward structures may cause job dissatisfaction. The ISNAR Agricultural Researcher Indicator Series of NARS researchers from 84 developing countries shows that 12% have a PhD degree, 35% an MSc degree, and 53% a BS or lower degree (or their respective equivalents). The percent with MSc or PhD degrees (called the qualification index) are shown for NARS by region, with and without expatriates, in appendix 3.

Foreign degrees (2.2, 7.1, and 7.2)
The institutions and countries where staff have obtained their postgraduate degrees may have a significant impact on the nature of the research program, expectations of researchers, and even program linkages. The numbers of researchers with foreign degrees is usually a function of the availability of postgraduate education in the country and the conditions and nature of external financial support for staff development. Large numbers of staff with foreign degrees may mean that expectations about salaries and advancement, the availability of equipment, transportation, and supplies, and family living conditions may be higher than can possibly be provided by the system. This may cause morale problems. A review of the frequency list of institutions where degrees were obtained may show the need for diversity. It may also indicate where opportunities for strong collaborative research linkages are possible.

Degree sponsor (2.3, 5.3, and 7.3)
The cost of postgraduate education is a relatively high investment for a government. A foreign degree is often 10 times the cost of a local degree or more and is almost always paid from donor or loan funds. Knowing which sponsors have been providing funds for postgraduate education helps in planning for future investments in staff development. The percentage of cases of government sponsorship demonstrates a level of commitment and ability to support the continued development of research capability.

Duration of degree study (5.4)
Many researchers receive their highest degree while in the employ of a NARS. The time they are on leave for training usually means some sacrifice in program development and continuity. Knowing the average duration of degree study for each degree level helps in program and staff development planning, financial planning, and in recruitment.

Field of study (5.5)
A total of 12 categories of major fields of study have been identified for characterizing the primary

discipline training of research staff. Appendix 4 shows how the 12 categories relate to the CARIS Index of Fields of Science. It is possible to examine the congruence of staff training with task requirements relating to the overall research program. This broad review of researcher education helps managers when planning for shifts in program emphasis, recruitment, and deployment of staff.

Pre-NARS employment (2.4, 5.6, and 7.4)
In most NARS, research staff are recruited directly following their degree programs. Where there is significant recruitment from other employers, it is important to know what type of institutions are supplying researchers to the NARS. For example, the extent of the flow from university employment to NARS employment may be due to relative conditions of service, perceived status, or the nature of the respective research programs. Also, the flow of staff from government extension to a NARS may have implications for the development of adaptive and on-farm research. A frequency list of institutions is provided to assist managers in assessing the source of researchers and in making decisions about the nature of future recruitment.

NARS experience (2.5, 2.6, and 5.7)
While researchers may have other professional experience, NARS research experience is clearly important and relevant to future research activity. Since many NARS researchers are recruited directly from a university degree program, the average total research experience of NARS researchers is often not significantly different from their *average years of NARS service* (2.5). Also, experience is inclusive of educational programs undertaken while in the service of a NARS since this is considered to be important professional experience. A relatively immature research institution is one with researchers having less than five years of experience. As with age, however, averages can be deceiving.

The percent of researchers with *less than five years of NARS service* (2.6) provides a more accurate picture of the situation. Those institutions where over 40% of researchers have less than five years of experience may have program leadership problems.

Much more can be learned from the frequency distribution of *years of NARS service* (5.7). Those with less than one year of experience are the new *recruits* for which special orientation activities may be necessary. Researchers with from one to five years are essentially *apprentices*, but often have the most sophisticated training and the highest expectations for their careers. Deployment with more experienced researchers is often necessary for improved productivity. It is expected that those with six to 10 years of experience will be able to work independently as *professionals* and provide guidance to less experienced researchers. Those with 11 or more years of service can be expected to be program *leaders* and *managers*.

The distribution of researcher experience for many NARS is skewed to the left. This means that staff development (education and training) is still an important activity for the NARS and program leadership may be weak. As this situation changes, research managers will need to focus on other issues of development (obsolescence), compensation, motivation, and evaluation.

Primary specialization (2.7 and 5.8)
The same 12 broad fields of science categories are used for identifying the *primary specialization* (5.8) of NARS employees as are used for categorizing the major fields of study for the highest degree. This allows for a comparison to see what percentage change their field over time. A review of the distribution of staff by primary specialization allows managers to broadly relate researcher experience to the program priorities of the institution. It also allows managers to make better decisions about recruitment, staff development, and redeployment.

The *percent with a socioeconomic specialization* (2.7) is singled out since many agricultural institutions have recognized the value of research involving farmer participatory approaches. The number of economists, sociologists, and other social scientists employed may have some influence on the ability of institutions to maintain such programs. Limited data show a range of 0 to 7 percent of researchers with a specialization in socioeconomics is the usual.

Terminations (5.9)
Past experience has shown that the extent of researcher attrition is significant at many agricultural research institutions. Given the fact that agricultural research often requires years of commitment and effort, this is a serious problem for research managers. The reasons for terminations are often unclear, but it is usually possible to distinguish between retirements, voluntary resignations, and involuntary resignations (including death). High

percentages of voluntary resignations may indicate a serious problem with compensation and other management practices. Further detailed analysis in these cases is recommended.

3. Researcher activities

Employment time (3.1, 3.2, 6.1, and 6.2)
Varying terms of employment and policies of a research institution create the environment for the allocation of employment time of researchers. Here, researchers are asked to specify in percentage terms just how they use their entire employment year. While the primary purpose is to identify the amount of time committed to NARS work activities, managers can review time committed for non-NARS work, education and training, and professional and personal leaves. Details about the use of NARS work time are provided in the next two sections.

How researchers spend non-NARS work time may be of special interest to managers. Consulting assignments would normally indicate a level of expertise and professionalism that is desirable for a NARS. Policies regarding this activity may limit these opportunities and, therefore, may need to be reviewed since consulting is considered to be an effective staff development activity. The same is true for teaching. Many NARS include staff at teaching institutions. Those that are asked to teach at postgraduate degree levels are in fact contributing to the education of potential future NARS researchers. Private business activities may or may not be relevant to the efforts of a NARS and may in fact be distracting for researchers. Those involved in special projects (a common occurrence in many countries) are usually employed for their research expertise. The average amount of time spent by researchers in degree and nondegree programs may be related to personnel policies and funding opportunities for staff development. While there is no formula for determining the appropriate average amount of time for training, those NARS with low levels of postgraduate degree researchers would normally be expected to be investing heavily in staff development.

The ARIS report provides percentages for each employment year category. For non-NARS work activities, the percentage of occurrences of consulting, teaching, private business, and special projects is given. The percentage of time for both degree and nondegree training is combined in a single statistic to focus attention on investment in staff development, particularly to record changes from year to year. The number of weeks of degree and nondegree training is used as a check of the information given in percentage terms.

NARS work activities (3.3, 3.4, 3.5, and 6.3)
The allocation of a researcher's NARS time is usually a function of both employee and management decisions as well as organizational policies and procedures, particularly in relation to the availability of support staff. These data provide a rough task analysis for researchers in any unit analyzed.

The critical factor is the amount of time for *research*. From past reviews, this amount may be considerably lower than that perceived by most research managers (60 to 70 percent is common). The amount of time for *management/administration* is always a concern since most NARS want to minimize this. The amount of time for *teaching/training* may be a function of the type of institution within the NARS as well as its proximity to educational institutions. Time devoted to *extension/demonstration* activities reflects the nature of the program of the institution. While a certain amount of researcher time for *support and service* activities is inevitable (e.g., soils analysis), an excessive amount may indicate the need for more technicians and other support staff or a restructuring of the institution. The same is true for time allocated for *production and farming*. Time for *conferences/workshops* is positive professional behavior, but should not be excessive.

A more precise calculation of time spent for NARS research is obtained by multiplying the percent of time for NARS activities times the amount of time for NARS research for each researcher and then averaging this for a unit (figure in 3.4).

NARS work location (3.7, 3.8, and 6.4)
The distribution of work location of agricultural researchers normally reflects both the structure of the organization and the nature of the program. For example, if a NARS system includes research staff employed by educational institutions, one would naturally expect a high percentage of staff time at that location. Also, if a program emphasizes farmer participatory research, one would expect a high percentage of time at farm/field sites. Comparisons of an institute's structure and programs with the information about actual researcher time in these

and other locations may allow managers to see if staff are deployed appropriately.

The data also provide another opportunity to determine if too much time is spent in administrative units relative to research stations and field locations. The average amount of time for travel will be related to conference/workshop participation and the physical location of units of the research institution.

Research type (3.6 and 6.5)
Most institutions have mandates and self-images that relate to the types of research in which they are involved. An analysis of the time allocation of researchers for basic, strategic, applied, and adaptive research will give research managers an indication of whether or not actual human resource utilization matches that which is expected in relation to research objectives.

The classification of type of research is as follows (CGIAR):

- *Basic research*–designed to generate new understanding (e.g., how the partitioning of assimilates is influenced by plant height).

- *Strategic research*–designed for the solution of specific research problems (e.g., a technique for detecting dwarf genes in wheat seedlings).

- *Applied research*–designed to create new technology (e.g., breeding new varieties of dwarf wheat that can respond to high levels of nitrogen without lodging).

- *Adaptive research*–designed to adjust technology to the specific needs of a particular set of environmental and human conditions (e.g., incorporating dwarf wheat into farming systems of a specific rainfed area).

The percentage of time that researchers spend in applied and adaptive research is combined in a single statistic in order to assess the emphasis given by the agricultural research institution to technology development and testing.

Sector focus (6.6)
Characterizing researcher time allocation by sector focus gives research managers a quick reference for comparison with the mandate of the institution. Information about researcher effort devoted to crops, livestock, fisheries/wildlife, natural resources, and policy and management can be compared with program plans, projects, and budgets. Multisector institutions will find this information to be of particular importance.

Research subjects (6.7 and 7.7)
Research programs are supposed to reflect priorities accepted by the research institution. The allocation of resources, including researchers, is a rough way to determine if these priorities are receiving appropriate attention. Researchers are asked to identify the amount of time they are allocating to specific commodities (e.g., sweet potatoes), resources (e.g., water resources), and themes (e.g., farming systems). This will generate a frequency list with the FTE number of researchers devoted to each subject. When compared to declared priorities, research managers may make appropriate adjustments in terms of recruitment, redeployment, budgets, etc. The ARIS program also provides a table showing the FTE number of researchers for the top five subjects for quick reference.

Research documentation (3.9, 3.10, 6.8, 6.9, and 6.10)
Performance criteria for researchers and research organizations are not easily established and are certainly difficult to measure. The most objective means is documentation of research efforts, but quality is still based on subjective assessment. Here, researchers are asked to enumerate their output for the year for nine categories and to distinquish between foreign and domestic media and audiences. While, in some cases, foreign media may be more rigorous in accepting materials for production, the focus of the research on which the output is based may or may not be relevant to the domestic environment. The use of domestic media may, in fact, have a higher impact on agricultural production. Further assessment is required.

In addition to tables showing the average production of domestic, foreign, and total documentation per researcher by category, the program provides a statistic showing the average total production of *scientific publications* per researcher. These include books and book chapters, journal articles, research reports, and research abstracts. A statistic is also provided showing the remaining output which may be characterized as being more related to *technology transfer*.

Staff supervision (3.11 and 6.11)
The numbers of various staff assigned to work with researchers is significant with respect to effective levels of researcher support and span of control. Knowing the average numbers of other researchers, technical staff, and other support staff supervised by researchers allows managers to develop standards and to build arguments for budget and civil service support for any new positions required. The statistic showing the average number of technical staff supervised per researcher is important, but it does not take account of all technical support persons.

4. Unit dynamics

Recruitment rate (4.1)
The rate of recruitment is a function of growth, attrition, and availability of trained researchers (often reflected in the number of vacancies). Therefore, the rate is best understood in relation to other statistics. In absolute terms, high rates of recruitment (over 5% per year) indicate the need for special efforts to assimilate staff into the organization. New staff will need to be deployed with more experienced staff and staff development activities may be fairly intensive. Low recruitment rates may mean that the organization is reaching a stagnation point. New recruits are usually the best trained and are the future of any organization. The rate is calculated based on the number of researchers at the end of the year.

Attrition rate (4.2)
Attrition of researchers is caused by retirement, involuntary resignations (death and dismissals), and voluntary resignations. The most significant cause in most NARS is voluntary resignations caused by poor compensation (conditions of service) and superior alternative employment opportunities. High attrition rates (over 5% per year) are very expensive to a research organization. More important, it is very difficult to maintain the continuity and long-term thrust of an agricultural research program with this high an attrition rate. Managers will need to use whatever options they have to improve compensation packages for researchers and to motivate them to maintain their program interests while still meeting organizational goals. It is important to note that low attrition rates may not necessarily mean high job satisfaction, but simply the lack of alternative opportunities. The rate is calculated at the end of the year based on the number of researchers at the beginning of the year.

Quit rate (4.3)
The quit rate is used here to express that component of the attrition rate that can be attributed to voluntary resignations (discussed above). When the rate is high and close to the rate of attrition, managers need to make concerted efforts to increase job satisfaction and increase salary levels to meet those of alternative employers. The rate is calculated at the end of the year based on the number of researchers at the beginning of the year.

Career mobility (4.4)
Career paths and promotion opportunities are considered important by researchers regardless of the structure of the research organization. The percentage of staff receiving merit-based job promotions (not step changes or annual increments) gives an indication of career mobility. Rates under 10 percent may be indicative of low mobility and result in job dissatisfaction. The rate is calculated based on researchers at the end of the year.

Inter-unit mobility (4.5)
Responding to ever-changing priorities and maintaining client-oriented research programs may mean mobilizing researchers to serve in different locations. The percentage of researchers who are transferred to other units may give some indication of the responsiveness of the research institution to program needs and priorities. High transfer rates, however, may cause job dissatisfaction, particularly among mature researchers with families. In some cases, transfers are a means for achieving promotions, particularly where institutions are small.

Development orientation (4.6 and 3.2)
The amount of investment in staff development is an indicator of the potential growth and vigor of a research institution. The percentage of staff with *degree study leaves* (4.6) may give an indication of investment in staff development. Normally, high percentages will be correlated with loan and grant programs for training or institutional development and will be related to the stage of development of the research institution. Low percentages, in cases where the numbers with a postgraduate education are low, will indicate a need for increased investment in staff development and an opportunity for donor involvement.

Another indicator of investment in staff development is average *percent of time for study*

leaves (3.2), both degree and nondegree. This is calculated on the basis of the average time all researchers indicate that they spend in any kind of training as a percentage of their activities in an employment year. This percentage (which can be converted to weeks in training per researcher) can be compared from institute to institute.

Growth rate (4.7)
The change in number of researchers actually employed from one year to the next gives an indication of where management needs to direct its attention. High growth rates are usually associated with capital investment, diversification of programs, the establishment of new regional and local centers, etc. They also mean intensive activities to orient, deploy, and train new researchers. Negative growth rates can be seen in situations where position numbers increase, but vacancies are high due to hiring freezes and budget constraints.

ARIS APPENDIX 1

I S N A R
AGRICULTURAL RESEARCHER INFORMATION SYSTEM (ARIS)
RESEARCHER RECORD

Period: From ___/___ to ___/___
Employee No.: ________
NARS: ________
Country: ________
Date: ________

(1) PERMANENT RECORD

NAME, Family: ________________ Given: ________________

DATE OF BIRTH (mm/yy): ___/___ Male: ___ Female: ___

COUNTRY OF CITIZENSHIP: ________________

EDUCATION (highest degree only):
Highest degree (check one):
___ (01) Lic ___ (04) DVM ___ (07) DEA ___ (10) Dr d'Etat
___ (02) BS ___ (05) P.G.Dip. ___ (08) III^{e}Cycle
___ (03) Ing ___ (06) MS ___ (09) PhD

Educational institution: ________________ Country: ________

Sponsor: ___ (01) Self ___ (02) Government ___ (03) Other (specify) ________

Date studies began (mm/yy): ___/___ Date studies ended: ___/___ Date degree awarded: ___/___

Major field of study: ________________ Classify in one category below:
___ (01) Plant production ___ (05) Animal health ___ (09) Socioeconomics
___ (02) Plant breeding ___ (06) Basic & support sciences ___ (10) Agricultural engineering
___ (03) Plant protection ___ (07) Soil science ___ (11) Food & nutrition
___ (04) Animal production ___ (08) Natural resource management ___ (12) Management/administration

EMPLOYMENT:
Employed prior to joining any unit of NARS? Yes_____ No_____
If yes, name of most recent previous employer ________________ Country: ________
Classify most recent previous employer in one category below:
___ (01) University or college -- staff
___ (02) University or college -- graduate assistant
___ (03) Private company
___ (04) Government extension
___ (05) Other government agency (including parastatals)
___ (06) Self-employed
___ (07) International organization

Date of first job appointment to any unit of NARS: (mm/yy): ___/___

- -

(2) ANNUAL EMPLOYMENT RECORD

Employment actions this 12-month period:
Terminated: Yes___ No___ If yes, date ___/___ Reason: ___ (01) Retirement
___ (02) Voluntary resignation
___ (03) Involuntary resignation
New hire: Yes___ No___ If yes, date ___/___
Promoted: Yes___ No___ If yes, date ___/___
Transferred: Yes___ No___ If yes, date ___/___ To: ________
Long-term leave: Yes___ No___ If yes, period from ___/___ to ___/___

Current Position:
Date of appointment to current job title (mm/yy): ___/___
Job title (e.g., "principal scientist II"): ________
Official grade or rank and step: ________/________
Discipline title (e.g., "plant breeder"): ________
Department/Division: ________
Station/College: ________
Center/University: ________

Permanant, established position? Yes___ No___. If no, ___ weeks worked in this 52-week period.

Full-time position? Yes___ No___. If no, ___% time of appointment.

Primary specialization ________________. Classify in one category below:
___ (01) Plant production ___ (05) Animal health ___ (09) Socioeconomics
___ (02) Plant breeding ___ (06) Basic & support sciences ___ (10) Agricultural engineering
___ (03) Plant protection ___ (07) Soil science ___ (11) Food & nutrition
___ (04) Animal production ___ (08) Natural resource management ___ (12) Management/administration

Period: From ___/___ to ___/___
Employee No.: _____
NARS: _____
Country: _____
Date: _____

(3) ANNUAL WORK ACTIVITIES

1. For the above TOTAL EMPLOYMENT YEAR (52 weeks), please specify the % of time spent for the following:

% Time spent at:

_____ NARS WORK ACTIVITIES (detailed in item 2)
_____ Non-NARS work activities (check all that apply)
  ____ Consulting ____ Private business
  ____ Teaching ____ Special project
_____ Degree study leave. Number of weeks in this 52-week period ___
_____ Nondegree study leave. Number of weeks in this 52-week period ___
_____ Sabbatical leave
_____ Personal leaves (vacation, sickness, etc.)
100%

2. Of total time for NARS WORK ACTIVITIES, estimate the % of time for work activity and work location:

WORK ACTIVITIES

% Time spent on:

_____ RESEARCH (detailed in item 3)
_____ Management/administration
_____ Teaching/training
_____ Extension/demonstration
_____ Support/services
_____ Conferences/workshops
_____ Production/farming
100%

WORK LOCATION

% Time spent at:

_____ Educational institution
_____ Administrative office
_____ Central station
_____ Substation
_____ On farm/field site
_____ Travel
100%

3. Of the time spent on RESEARCH, please specify the % of time for types, sector focus, and subjects:

RESEARCH TYPE

% Time

_____ Basic (generate new understanding)
_____ Strategic (solve specific problems)
_____ Applied (create new technology)
_____ Adaptive (adjust technology to specific needs)
100%

SECTOR FOCUS

% Time

_____ Crops
_____ Livestock
_____ Forestry
_____ Fisheries/wildlife
_____ Natural resources
_____ Policy and management
100%

RESEARCH SUBJECTS

% Time	Specific commodity, resource, or theme (list if identifiable)
_____	_____
_____	_____
_____	_____
_____	_____
_____	Support/Services
100%	

4. Please indicate the number of each of the following produced by you in this 12-month period:

RESEARCH DOCUMENTATION

Number		
Domestic	Foreign	
_____	_____	Books + book chapters
_____	_____	Journal articles
_____	_____	Research reports
_____	_____	Research abstracts
_____	_____	Extension publications
_____	_____	Conference reports/papers
_____	_____	Radio, TV, video tapes/programs
_____	_____	News articles
_____	_____	Position papers
_____	_____	Other: _____

5. Please indicate the full-time equivalent (FTE) of each type of staff supervised:

STAFF SUPERVISION: FTE of staff supervised (e.g., one half-time person equals ".50")

_____ Other Researchers
_____ Field Technicians
_____ Laboratory Technicians
_____ Laborers
_____ Clerical

ARIS APPENDIX 2

I S N A R
AGRICULTURAL RESEARCHER INFORMATION SYSTEM (ARIS)
RESEARCHER RECORD

Period: 10/87- 9/88
Emp. No.:
NARS: NIAR
Country:
Date: 10/21/88

(1) PERMANENT RECORD

NAME, Family: Given:
DATE OF BIRTH (mm/yy): 9/54 Male: N
COUNTRY OF CITIZENSHIP:

EDUCATION
Highest Degree: 6
Educational institution: UNIV OF MICHIGAN Country: USA
Sponsor: 3 Other (specify) UNITED NATIONS
Date studies began (mm/yy): 9/77 Date studies ended: 8/79
Major field of study (code): 8

EMPLOYMENT
Employed prior to joining any unit of NARS? Y
If yes, name of employer: MINISTRY OF EDUCATION Country:
Classification (code): 4
Date of first job appointment to any unit of NARS (mm/yy): 10/81

(2) ANNUAL EMPLOYMENT RECORD

Employment actions this 12-month period:
Terminated: N If yes, date 12/99 Reason:
New hire: N If yes, date 12/99
Promoted: N If yes, date 12/99
Transferred: N If yes, date 12/99 To:
Long-term leave: N If yes, period from 12/99 to 12/99

Current Position:
Date of appointment to current job title (mm/yy): 10/81
Job title: SENIOR RESEARCH OFFICER
Official grade or rank and step: /
Discipline title: CHEMIST
Department/Division: CHEMISTRY AND SOILS
Station/College: NATIONAL STATION
Center/University:

Permanent, established position? Y If no, 52 weeks worked
Full time position? Y If no, 100% time of appointment

Primary specialization (code): 6

(3) ANNUAL WORK ACTIVITIES

1. TOTAL EMPLOYMENT YEAR

97 NARS WORK ACTIVITIES
2 Non-NARS work activities
N Consulting N Private Business
N Teaching N Special project
0 Degree study leave
0 Non-degree study leave
0 Sabbatical leave
1 Personal leaves (vacation, sickness, etc.)
100%

2. WORK ACTIVITIES

30 RESEARCH
1 Management/administration
1 Teaching/training
1 Extension/demonstration
65 Support/services
2 Conferences/workshops
0 Production/farming
100%

WORK LOCATION

0 Educational institution
0 Administrative office
98 Central station
1 Sub-station
1 On farm/field site
0 Travel
100%

3. RESEARCH TYPE

5 Basic
75 Strategic
10 Applied
10 Adaptive
100%

SECTOR FOCUS

0 Crops
0 Livestock
0 Forestry
40 Fisheries/wildlife
60 Natural Resources
0 Policy and management
100%

RESEARCH SUBJECTS

30 GROUNDNUTS
10 FISH
20 WATER
10 SOIL
30 Support/services
100%

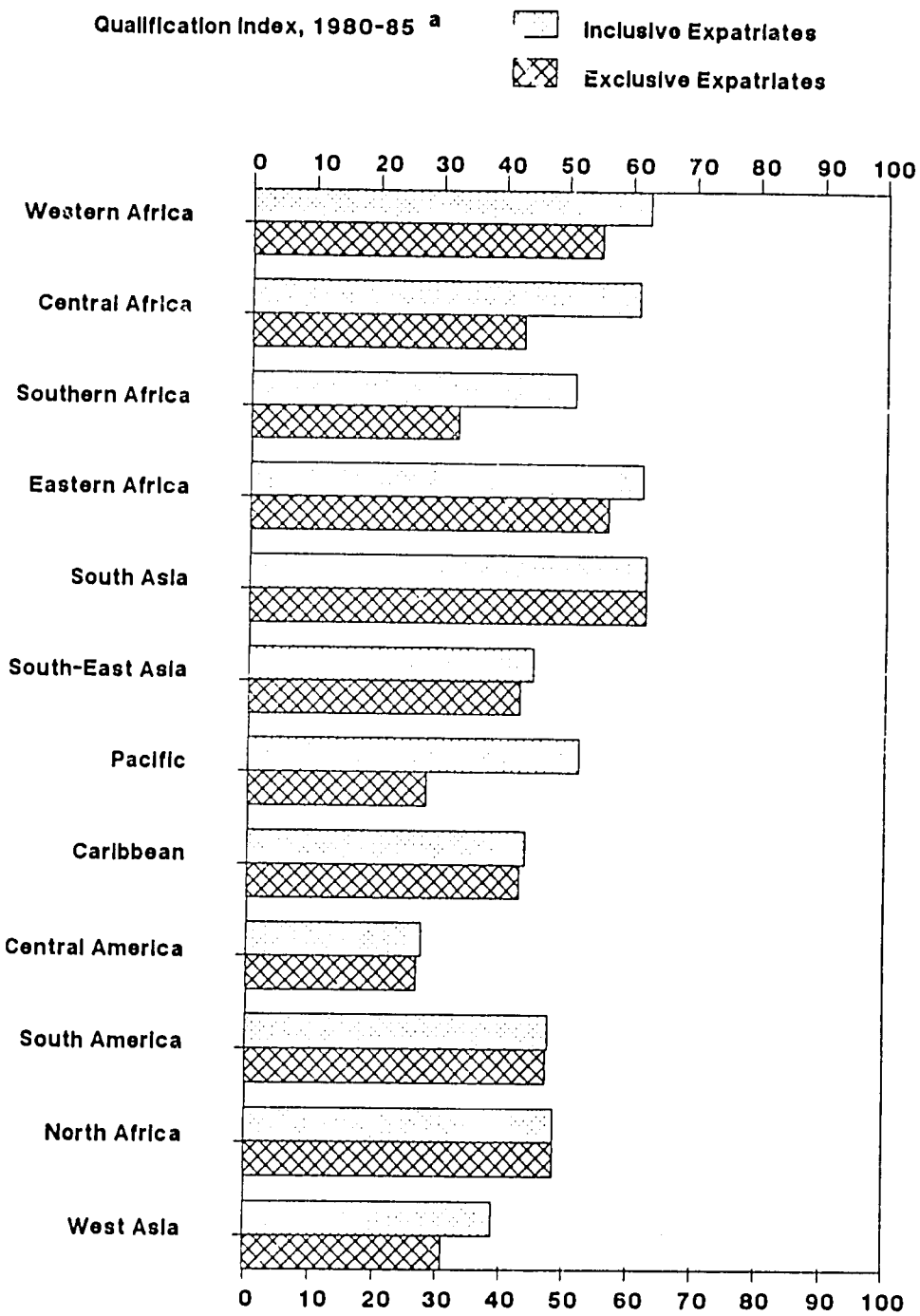
4. RESEARCH DOCUMENTATION

Domestic	Foreign	
0	0	Books + book chapters
1	0	Journal articles
1	0	Research reports
0	0	Research abstracts
0	0	Extension publications
0	0	Conference reports/papers
0	0	Radio, TV, video tapes/programs
0	0	News articles
0	0	Position papers
0	0	Other:

5. STAFF SUPERVISION

1.00 Other Researchers
Field Technicians
4.00 Laboratory Technicians
2.00 Laborers
Clerical

ARIS APPENDIX 3



a) Qualification index = (PhD+MSc)/(PhD+MSc+BSc).
Expatriates are assumed to hold a PhD or an MSc degree.

ARIS APPENDIX 4

Indentification of ARIS Terms with Codes of CARIS* Index by Fields of Science and Techniques

Plant Production	2300 and 3300 (except 3320)
Plant Breeding	3320
Plant Protection	3700
Animal Production	2200 and 3400
Animal Health	3800
Basic and Support Sciences	1100, 1200, 1300, 2100, 2500, 2600, 2700, 3100, 9100
Soil Science	1470
Natural Resource Management	1400 (except 1470), 2400, 3500, and 3600
Socioeconomics	6000 and 7000
Agricultural Engineering	3200
Food and Nutrition	4000 and 5000
Management/Administration	

* *CARIS (Current Agricultural Research Information System). 1978. Agricultural Research in Developing Countries: Vol. 2–Research Workers. Rome: FAO.*

SESSION 3

STAFFING

RECRUITMENT PLANNING

Byron Mook

Introduction

How do research managers go about estimating the future manpower needs of their organizations?

How many scientists and managers will be needed (QUANTITY) and what kinds of people should they be (QUALITY)? These two questions are clearly interrelated.

The focus of this paper is primarily on QUANTITY considerations. The objective is to present a practical and powerful method for recruitment planning. Potential users of the method include senior officials of national agricultural research systems (NARS), including those specifically charged with the management of scientific personnel.

Research managers have two broad options for dealing with recruitment planning. These two options are politically and even to some extent philosophically different. Both are described below.

Approach No. 1–"Wish Lists"

The basis of this first approach is a request to heads of research institutes, stations, and/or programs to state their manpower "requirements" over the next *x* number of years.

How many people do you need?
Of what type?
What kinds of qualifications should they have?
In which scientific fields?

The main problem with beginning to estimate future manpower needs on the basis of such questions is that managers almost always state their "needs" too high. There are at least four reasons for such overestimation.

(1) *Budgetary strategy.* A research manager often feels that his/her request will be cut anyway, so that (s)he must overestimate if (s)he is to finish with the resources which (s)he thinks are really needed.

The critical decision which (s)he must make, of course, concerns the degree to which (s)he overestimates. If (s)he goes in to the Ministry of Finance too high, (s)he runs the danger of giving the strategy away–and therefore of getting his/her request cut even more than (s)he expected. But if (s)he goes in too low, and the MOF cuts everyone by a more-or-less standard percent, (s)he runs the risk of finishing with too little.

(2) *Agricultural research in national development.* Most agricultural research managers believe that the scientists in their organizations have a unique potential for making contributions to the nation. Their argument is that the economy depends on agriculture, and that agriculture depends on agricultural research.

The problem with such reasoning is that most health managers, and education managers, and industrial managers also believe that the sectors which they represent are most important for economic growth. And if all such managers make the same case, each individual case is obviously weaker.

(3) *Professional status.* Research managers often feel that they represent an elite group. Agricultural scientists are better educated than the majority of

the national population, most widely travelled, and better paid. In order to maintain such status-so the (usually unstated) argument goes-research leaders must continually strengthen their ranks with better people. Such an argument addresses primarily quality issues rather than quantity ones.

(4) *Empire building.* Some research managers equate numbers of subordinates with bureaucratic power. The more employees, the bigger the budget, the greater the influence. Mainly a quantity argument.

All four of these arguments are valid. The problem is that managers who make them may actually do harm to the agricultural research organizations which they serve. If NARS recruit either too many people, and/or people who are too highly qualified, two interrelated types of management problems are likely to appear.

(a) *Lack of resources.* Most NARS put at least 60% of the public funds they receive into personnel. Many actually put more; figures of 80%-95% are not uncommon in sub-Saharan Africa particularly. The main management challenge in such situations is NOT to emphasize the building of the personnel resources of the organization, but rather to find the operating funds required to keep a gradually growing organization functioning.

(b) *Lack of motivation.* Without operating resources, scientists will not be able to do the work for which they have been trained. They are therefore likely to become frustrated-and either to become inactive or to begin to look for alternative employment elsewhere.

Furthermore, if a research organization recruits too many highly qualified scientists, it may develop what is sometimes called an "inversion of the skill hierarchy." In plain terms, the organization becomes top-heavy, with too many self-perceived leaders and not enough followers. The only way in which management can avoid inversion of this kind is to set narrow gates along career paths which only a few people can get through. But the problem with such a "solution", is that it usually leads to the stagnation (and frustration) of highly qualified people at lower grades.

Approach No. 2–"What We Can Afford"

A second, alternative approach to estimating future personnel possibilities is more sound from both management and economic points of view. But it does require restraint. It asks not "how much is needed?" but rather "how much can we afford?"

Five variables are critical to analysis based on this method:

(1) *AGDP* (Agricultural gross domestic product). For the current year and with estimates of growth in the period for which recruitment is being planned.

(2) *Percent of AGDP being spent on agricultural research.* For the current year and-again-with estimates of growth (or decline) in the period for which recruitment is being planned. Most NARS now receive about 1% per year; some international agencies have set targets of 1.5%-2% per year.

(3) *Bill for research salaries/benefits.* Expressed as a percentage of total research expenditure. This figure in most NARS-as noted above-is at least 60% and is often closer to 80%.

(4) *Bill for salaries/benefits of graduate scientific staff.* A derivative of no. 3, also expressed as a percentage of total research expenditure. This figure (particularly when coupled with an analysis of the spread between salaries paid to different categories of personnel) gives an indication of the shape of the personnel pyramid.

(5) *Movement of graduate scientific staff into higher salary grades over the period for which recruitment is being planned* ("Grade creep"). Even if a research organization does no recruitment at all in a given year, its salary and benefits bill will go up simply because of increments and promotions.

To illustrate an approach to recruitment planning using these five variables, a "real-life" example is appropriate. The data presented below were gathered by ISNAR in 1982 as part of its collaboration with one NARS.

The starting point of the analysis is collection of information on each of the five variables.

(1) *AGDP.* In 1981, the AGDP of the country was the equivalent of US$730,080 000.

The government was optimistic that AGDP was going to grow at an annual rate of 4% over the next decade. Some nongovernment economists were

Table 1

ASSUMPTIONS

4%	AGDP Growth
1.06%	Percent of AGDP for Research
70%	Total Salaries/Benefits
19%	Graduate Salaries/Benefits
3%	Grade Creep

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Total
AGDP based on 4% annual growth	730800	760032	790433	822051	854933	889130	924695	961683	1000150	1040156	1081763	
Total NARS oper.budget based on 1.06% of AGDP for research	7746	8056	8379	8714	9062	9425	9802	10194	10602	11026	11467	
Total staff sals/benefits based on 70% of oper.budget	5423	5639	5865	6100	6344	6597	6861	7136	7421	7718	8027	
Graduate sals/benefits based on 19% of oper.budget	1472	1531	1592	1656	1722	1791	1862	1937	2014	2095	2179	
Reduction in REAL graduate sals/benefits based on 3% annual grade creep		1486	1546	1607	1672	1739	1808	1880	1956	2034	2115	
Number of graduates at 2500 (constant)		594	618	643	669	695	723	752	782	814	846	
Net increase in graduates/year			24	25	26	27	28	29	30	31	33	253

unconvinced, however; they believed that such an estimate was very optimistic and argued that a more realistic AGDP growth rate was closer to 2%.

(2) *Percent of AGDP being spent on agricultural research.* In 1981, this figure was 1.06%.

Research planners hoped that the figure would rise closer to 1.5% within three to five years. But Ministry of Finance officials were publicly noncommittal and privately pessimistic about such a rise. Some even wondered whether the 1.06% level could be maintained in the face of increasing debt service, military, and social welfare pressures.

(3) *Total bill for research salaries/benefits.* In 1981, this figure was the equivalent of US$5,423,000. Such a figure represented 70% of the operating (recurrent) expenditure budget.

(4) *Total bill for salaries/benefits of graduate scientific staff.* In 1981, this figure was the equivalent of US$1,472,000–or 19% of the operating expenditure budget. There were about 550 BAs, MSes, and PhDs in the NARS.

(5) *Movement of graduate scientific staff into higher salary grades.* In 1981, planners estimated that the annual increased financial cost of "grade creep" was 3%.

In order to look at the implications of such numbers, ISNAR and government planners put together different scenarios using different values for each of the five variables. Table 1 shows a 10-year projection based on the following assumptions:

(1) *AGDP.* **4%** annual growth.

(2) *Percent of AGDP being spent on agricultural research.* Maintenance of the current **1.06%** figure.

(3) *Total bill for research salaries/benefits.* Maintenance of the current **70%** figure.

(4) *Total bill for salaries/benefits of graduate scientific staff.* Maintenance of the current **19%** figure.

(5) *Movement of graduate scientific staff into higher salary grades.* **3%** per annum.

In this scenario, the total number of graduates which could be added to the research organization was 252–an increase of 25 to 30 (or circa 4%) per year. The figures in the bottom row of the table are NET: that is, they represent the total of both recruits and retirements/ resignations. But since most scientific staff in this particular NARS were young, planners in 1981 could not expect many retirements in the years before 1991.

Such figures were disappointing to the managers of the NARS. When they had earlier asked institute and station heads for "wish lists" (i.e., lists of perceived manpower needs), the aggregate annual growth figures had been in the range of 50 to 70 (or circa 10%) per year!

How could such a level of growth be paid for? Table 2 shows a 10-year projection based on the following assumptions:

(1) *AGDP.* **4%** annual growth.

(2) *Percent of AGDP being spent on agricultural research.* Growth in the current **1.06%** figure to **1.46%** by 1991 (in annual intervals of 0.04%).

(3) *Total bill for research salaries/benefits.* Maintenance of the current **70%** figure.

(4) *Total bill for salaries/benefits of graduate scientific staff.* Maintenance of the current **19%** figure.

(5) *Movement of graduate scientific staff into higher salary grades.* **3%** per annum.

In this scenario, the total number of graduates that could be added to the research organization was 548, a much more desirable result. But the assumption that made this figure possible, a substantial growth in the percent of AGDP being spent for research–was VERY optimistic.

At this point, ISNAR and government planners rearranged the tables. Suppose the dependent variable was changed from number of scientists who could be recruited to percent of budget being spent on salaries/ benefits?

Table 3 shows a 10-year projection based on the following assumptions:

(1) *AGDP.* **4%** annual growth.

Table 2

ASSUMPTIONS

4%	AGDP Growth
1.06% – 1.46%	Percent of AGDP for Research (0.04% annual growth)
70%	Total Salaries/Benefits
19%	Graduate Salaries/Benefits
3%	Grade Creep

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Total
AGDP based on 4% annual growth	730800	760032	790433	822051	854933	889130	924695	961683	1000150	1040156	1081763	
Total NARS oper.budget based on 1.06% of AGDP for research in 1981, rising by 0.04% annually to 1.46% in 1991	7746	8360	9011	9700	10430	11203	12021	12887	13802	14770	15794	
Total staff sals/benefits based on 70% of oper.budget	5423	5852	6308	6790	7301	7842	8415	9021	9661	10339	11056	
Graduate sals/benefits based on 19% of oper.budget	1472	1588	1712	1843	1982	2129	2284	2448	2622	2806	3001	
Reduction in REAL graduate sals/benefits based on 3% annual grade creep		1542	1662	1789	1924	2067	2217	2377	2546	2725	2913	
Number of graduates at 2500 (constant)		617	665	716	770	827	887	951	1018	1090	1165	
Net increase in graduates/year			48	51	54	57	60	64	68	71	76	549

Table 3

ASSUMPTIONS

4%	AGDP Growth
1.06%	Percent of AGDP for Research
6%	Average Annual Growth–Cost/Scientist
5%	Average Annual Growth–Numbers of Scientists

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGDP based on 4% annual growth	730800	760032	790433	822051	854933	889130	924695	961683	1000150	1040156	1081763
Total NARS oper.budget based on 1.06% of AGDP for research	7746	8056	8379	8714	9062	9425	9802	10194	10602	11026	11467
Average cost per scientist (6% annual growth)		7.686	8.147	8.636	9.154	9.703	10.286	10.903	11.557	12.250	12.985
Number of scientists (5% annual growth)		566	594	624	655	688	722	758	796	836	878
Total salary bill		4350	4842	5389	5998	6676	7430	8270	9204	10244	11402
Percent of budget being spent on personnel		54%	58%	62%	66%	71%	76%	81%	87%	93%	99%

(2) *Percent of AGDP being spent on agricultural research.* Maintenance of the current **1.06%** figure.

(3) *Average cost per scientist.* **6%** annual growth. This figure takes account of both grade creep (3%) and upward revision of civil service salary scales (3%).

(4) *Number of scientists.* **5%** annual growth.

In this scenario, the percent of the budget being spent on salaries/benefits by 1991 was 99%. In order to avoid such a disaster, one of the above four variables had to be shown to be wrong. Either AGDP had to grow more, or more had to be spent on agricultural research, or the average cost per scientist had to grow less, or the number of scientists had to grow less.

It was difficult to agree as to where the most room for maneuver lay.

Conclusion

The approach to recruitment planning presented in this paper has one important feature which recommends it over all others, i.e., it forces the research manager to take account of financial constraints. A recruitment plan for agricultural research can be (and almost certainly should be) a political document. Policymakers are more likely to provide increased resources for research when they can base their decisions on a well-documented, well-researched, and well-argued case. "Wish lists" are not likely to be sufficient.

The three tables above were put together using a basic spreadsheet program on a small microcomputer.

The advantage of a spreadsheet for recruitment planning using the "what-we-can-afford method" is clear. By changing any one cell in the matrix (i.e., by changing any one assumption), all the other cells in the matrix change automatically and immediately. It is therefore possible for the planner to ask "what if. . ." questions and to see the implications of unexpected developments. Tables 1 and 2 have the same structure, but are based on different assumptions.

But the method does not depend on a microcomputer. Tables such as the ones presented here can easily be prepared using a simple hand calculator.

HUMAN RESOURCE PLANNING FOR NATIONAL AGRICULTURAL RESEARCH: A MANAGEMENT EXERCISE BASED ON DATA FROM THAILAND

Byron T. Mook

Introduction to the Thai Case

This paper is in the form of a case. Similar cases are used in management training schools throughout the world.

The case describes some of the issues involved in human resources planning in a NARS. It is set in Thailand. The organizations described and the data presented are real. The case presents a problem which has to be solved.

There is no "correct" answer. Each participant in the workshop was challenged to struggle with the data and to arrive at his/her own individual "solution".

Participants were first given 45 minutes to read the case, keeping the following four questions in mind:

1) What exactly is the Director being asked to write?

2) What are the main issues with which the Director has to deal?

3) Which data will the Director find most useful?

4) What are the three or four most important points which the Director will want to make in what he writes?

Following the reading time, participants spent 45 minutes in small groups discussing the case and sharpening their answers to the above questions. Hand calculators were available for manipulation of the data provided in the annexes to the case.

The exercise concluded with a 45-minute plenary discussion under the leadership of Dr. Mook. Participants presented their assessments of the issues raised and examined alternative "solutions".

Readers are similarly invited to come up with their own "solutions".

* * *

The Director of Personnel, Department of Agriculture, Royal Thai Government, sat in his office trying to decide what he should write to the Civil Service Commission (CSC).

Just before office closing time yesterday, a request had arrived from the CSC for a two-page summary of the likely graduate manpower situation in the Department in the year 1990. The CSC said that it wanted this summary in three days.

Why was the CSC making this request? The Director thought that he knew of at least two reasons.

- The government needed to reduce expenditures. Its budget deficit was growing. The number of new civil servants being hired had to be reduced.

- The government was also concerned that many public organizations were becoming top-heavy. Development-oriented departments like the DOA had grown fast in the late 1960s, 1970s, and early 1980s. But now all those scientists who had been hired five to 20 years ago had risen to middle- and senior-level positions. Not only did more such officials mean higher salary bills, but the government was also worried that too high a proportion of people

at the middle and top ranks might decrease organizational efficiency.

The Director realized that the manpower projections which the CSC wanted would be difficult to make. How many graduates were there likely to be in the department six years from now? How would these personnel be distributed among different salary grades? The CSC said that it regarded such a planning exercise as important for all government departments. Its request had been explicit: a good manpower plan could strengthen the DOA case for further funding and for reform of salaries and careers.

The Director thought of the many considerations that he would have to take into account. How many graduates did he now have on the payroll? In what salary grades were they? How many would have retired by 1990? How many new graduates would have been recruited?

His most immediate problem–which he recognized right away–was information. Where would he be able to get such data in the limited time available?

Personnel Records in the Department

The Director was justifiably proud of the personnel records in the department. For each graduate employee, the records section of his (personnel) division kept a bound book containing all relevant information on the family background, education, in-career training, postings, salary changes, leaves, awards, disciplinary actions, and even military service of each employee.

The problem – as the Director well knew – was that he had no efficient means of aggregating these data. If he wanted to know something about a particular individual, the information was almost certainly in his/her file. He could ask the head of the records section to bring that file to him. But if he wanted to know something about a particular class of persons – such as all those with PhDs, or those in Grade Post Classification 7 (PC7) – then the only way was to have the staff of the records section go through each and every file, one by one.

"The department recruits individuals," he thought, "but we are often called on to supply information on groups of people."

The Director had first become aware last year of this need to manage his information more efficiently. At that time, the World Bank had asked him for data very similar to those which the CSC was requesting now. He remembered – not happily – how he had had to go to the Director General to ask him to send an express message to each division and institute requesting the needed information. The DG had asked then why the personnel division didn't keep all such information on a more systematic basis.

After that incident, the Director had taken what he thought was the first step: he had organized an inventory of all graduate personnel in the department. He himself had designed a data sheet on which the basic educational and career information for each graduate could be tabulated (see annex 1). Then clerical personnel from the records section had gone through each personal file by hand. The resulting data had been aggregated and computerized.

But–the Director knew–there had not been enough follow-up. The result was that the information that had been collected was already out of date. Still, it was the best he had. He did not have time now to gather new data on which to base his report for the CSC. Furthermore, he himself did not have easy access to the computer on which the data had been entered.

Structure of the Department

The Department of Agriculture was divided into 12 discipline-based divisions and six commodity-based institutes. The 18 division and institute directors reported to three deputy directors general, who in turn reported to the Director General.

In late 1984, the total graduate staff strength of the department was 1419 persons (see annex 2).

A BSc or MSc entering the department joined at grade PC3 (see annex 3). A PhD joined at PC4. Promotion to PC5 occurred almost automatically for all graduates. A BSc could expect to reach PC5 within about 10 years, a MSc within about five years, and a PhD within three years. Promotion to PC6 required passing a test. Division and institute directors were PC8s.

In late 1984, 80% of the graduate staff members of the DOA were in PC4, PC5, or PC6 (see annex 4).

Characteristics of Graduate Staff

As the Director looked at the data on which he would

have to base his projections, he was struck by the high percentage of women–38%–among the graduate staff. He did not know of any other country which had such a high percentage of female agricultural research scientists and managers. Maybe the Philippines. Furthermore, many of these women were young–50% were under 34 years of age, compared with only 30% of the male graduates. Even in absolute terms, there were more women in the department under 34 than men–269 vs. 259. Fifty-one percent of the graduate recruits over the past nine years had been women.

"Some people feel that agricultural research is a job for men," he thought. "But what are we to do when most of the best young men in Thailand choose to study engineering or medicine or business–and the top graduates in the universities in agriculture-related fields are women?"

The Director wondered what the implications of his figures might be for the future management of the department. He had used the data that the records section had collected to calculate that 34% of the male graduates worked in research facilities outside of Bangkok, compared to only 20% of the female graduates. He also had discovered that women graduates were overrepresented in most of the divisions (i.e., more than 38%) and underrepresented in all of the institutes.

A second characteristic of the graduate staff that caught the Director's attention as he looked at the data was their age distribution (see annex 5). The retirement age in the Department was 60. Again, he wondered what the future management implications of the current distribution might be, particularly when he considered the close positive relationship he saw between age and PC grade. For example:

- Fewer than 3% of the graduate staff under 29 were in PC5.
- Fewer than 1% of the graduate staff under 35 were above PC5.
- Fewer than 1% of the graduate staff under 40 were in PC7.
- Only 2% of the graduate staff under 45 were in PC7 or PC8.
- More than 86% of the graduate staff in PC7 and up were over 45.

The Director remembered that a young scientist had come to his office just last month to inquire about the speed at which he was being promoted. "Do we really have merit promotions when so few young people have risen to PC6 and PC7?" the man had asked. "Are so few young people really qualified to assume positions of scientific leadership?"

The Director had understood the man's point. At the same time, however, he had asked himself whether more rapid promotions of deserving younger scientists might not simply mean even more people in the middle and upper PC grades. If that happened, he feared, the graduate staff pyramid in the department might begin to look like an upside-down pyramid.

Careers

One of the points the young scientist had made had been that promotions in the department seemed to be "almost automatic." The Director did not believe that such a statement was true. The official policy of the government was that decisions about promotions were based primarily on a combination of merit and experience.

Nevertheless, he had asked the records section to collect salary and position data on a sample of 1039 graduate staff so that he would have some evidence on this issue. He wanted an answer to the following questions:

- When an individual on one salary scale, e.g., PC3, reaches the point at which his/her salary is the same as that of an individual at the bottom of the next salary grade, e.g., PC 4, how often does he/she move up?
- If such moves are common, then is there a case that promotions are in fact "automatic"?

The Director thought of the example the young man had given him: if someone joined the department at the bottom salary point in PC3, Baht 2765, and got one salary increment each year for the next five years, then he or she would be at the sixth salary point in PC3, which is Baht 3745 (see annex 6). This amount–Baht 3745–was also the bottom salary in PC4. Would he be promoted automatically?

The Director had sometimes heard this crossover point referred to as a "stagnation point." In fact, he remembered that a senior scientist had once said to

him, "If I remain on a particular salary scale after I pass the crossover point, then I feel that I have missed my promotion." (See Annex 7.)

Job Titles

As the Director continued to look at the data, he noticed the large number of persons who had the same job title. For example, 55% of the graduate staff were designated as agricultural technologists and another 12% were designated as scientists. The formal job descriptions that accompanied these designations were general.

He wondered what the relationship might be between job titles and careers. How important was it if people in different PC grades had the same job titles? How specific should job descriptions in agricultural research be?

Estimating Future Manpower Growth

As the Director thought of the task before him, he wished that he had more complete and current data. But since he had to begin somewhere, he decided on two variables that he thought would certainly be important for estimating the numbers and characteristics of future graduate personnel in the department.

- The annual net percentage increase in graduate personnel that the CSC was prepared to allow. He did not know if this figure was likely to be 2%, or 1%, or even 0%. The official position this year was 2%, but he had heard rumors of lower figures in the future because of government pressures for budget reductions.

- The additional number of graduate staff that the department was going to be allowed to have–on top of the annual net percentage increase mentioned above–as a result of a special World Bank-funded National Agricultural Research Project (NARP).

  The project had a large training component. Substantial numbers of young Thai scientists were now abroad for postgraduate studies and would have to be employed by the department when they returned. The target figure for additions of graduates to the department for the NARP was 562 by 1990. The Director believed that the figure might be lower, perhaps 450 or even 350. Placements of trainees abroad had been running somewhat behind what had been planned, and nominations of technicians to study for local BSes under the NARP were running considerably behind.

Conclusion

As the Director thought about all these numbers, he wondered how he should start. What issues should he include in his short paper for the CSC? Which data should he use?

The issues were clearly important ones. The fact that the CSC wanted the paper in three days showed a sense of urgency. The Director suspected that whatever he wrote could become the basis for discussion and finally decision on

- the number of people whom the department would be allowed to recruit in the next five years;

- the qualifications of those recruits;

- the reform of promotion policies in the department;

- the development of job descriptions for department scientists and managers.

He wanted to have a first draft of the two-page report by afternoon.

What should he write?

ANNEX 1

This is a reproduction of the data sheet used by the Department of Agriculture in Thailand to collect information on its scientific staff.

01 - Personal File Number

___ ___ ___ ___

02 - Name / Last Name

Name _____

Last Name _____

03 - Birth Year

___ ___ ___ ___Don't Know

04 - Sex

___ Male

___Female

05 - Year of Joining Government Service

___ ___ ___ ___Don't Know

First Degree

06 - Institution

___ 1- Institute/College

___ 2 - Thai University ___ 9 - Other

___ 3 - Foreign University ___ 0 - Don't Know

07 - Year of Graduation

___ ___ _____ ___ 0 - Don't Know

08 - Subject

___ 11 - Agriculture/Crops

___ 12 - A gronomy

___ 13 - Botany/Plants

___ 14 - Horticulture

___ 21 - Breeding/Genetics

___ 22 - Physiology

___ 23 - Seeds

___ 31 - Pathology

___ 32 - Entomology

___ 33 - Nematology

___ 34 - Zoology

___ 35 - Weed Science

___ 41 - Chemistry

___ 42 - Soils

___ 43 - Water Management

___ 51 - Enginee ing/Architecture

___ 52 - Food Science

___ 61 - Administration/Management/Accounting/Banking

___ 71 - Social Science/Economics/Statistics/Mathematics/Law Education/Psychology/Mass Communication/Arts/ Language/ Library Science

___ 99 - Other _____

___ 00 - Don't Know

Highest Degree (if different from first degree)

09 - Name of Degree

___ 1 - Masters ___ 9 -Other

___ 6 - Ph.D. ___ 0 - Don't Know

10 - Institution

___ 1 - Institute/College ___ 9 -Other

___ 2 - University ___ 0 - Don't Know

11 - Year of Graduation

___ ___ _____ ___ 0 - Don't Know

12 - Subject

___ 11 - Agriculture

___ 12 - Agronomy

___ 13 - Botany/Plants

___ 14 - Horticulture

___ 21 - Breeding/Genetics

___ 22 - Physiology

___ 23 - Seeds

___ 31 - Pathology

___ 32 - Entomology

___ 33 - Nematology

___ 34 - Zoology

___ 35 - Weed Science

___ 41 - Chemistry

___ 42 - Soil Science

___ 43 - Water Management

___ 51 - Engineering/Architecture

___ 52 - Food Science

___ 61 - Administration/Management/ Accounting/Banking

___ 71 - Social Science/Economics/Statistics/Mathematics/Law/ Education/Psychology/Mass Communication/Arts/Language/ Library Science

99 - Other _____ _____ _____

___ 00 - Don't Know

Entry Post

13 - Year of joining Agriculture Dept, Rice Dept, or DOA

___ ___ _____ ___ 0 - Don't Know

14 - Grade Then

___ 03 - PC-3
___ 04 - PC-4
___ 05 - PC-5
___ 06 - PC-6
___ 07 - PC-7
___ 08 - PC-8
___ 09 - PC-9
___ 10 - Grade 3
___ 11 - Grade 2
___ 12 - Grade 1
___ 13 - Special
___ 01 - Lower than grade 3
___ 00 - Don't Know

15 - Division Then (if any)

___ 31 - Botany and Weed Science
___ 32 - Agricultural Chemistry
___ 33 - Agricultural Engineering
___ 34 - Agricultural Toxicology
___ 35 - Plant Pathology and Microbiology
___ 36 - Entomology and Zoology
___ 37 - Soil Science
___ 38 - Breeding and Genetics
___ 39 - Technology
___ 40 - Plant Industry
___ 41 - Research and Experiments
___ 42 - Rubber
___ 43 - Sericulture
___ 44 - Field Crops
___ 45 - Rice
___ 51 - Finance
___ 52 - Programme Planning
___ 53 - Personnel
___ 54 - Office of the Secretary
___ 71 - Agricultural Regulatory
___ 72 - Extension and Dissemination
___ 99 - Other
___ 00 - Don't Know

16 - Institute Then (if any)

___ 1 - Field Crops
___ 2 - Rice
___ 3 - Horticulture
___ 4 - Rubber
___ 5 - Sericulture
___ 6 - Farming Systems
___ 9 - Other
___ 0 - Don't Know

17 - Position Then

___ 11 - Executive
___ 12 - Agronomist
___ 21 - Agricultural Technologist
___ 22 - Scientist
___ 23 - Plant Pathologist
___ 24 - Entomologist
___ 25 - Zoologist
___ 41 - Agricultural Engineer
___ 42 - Mechanical, Civil, Survey Engineer or Architect
___ 51 - Statistician
___ 52 - Economist
___ 53 - Planning and Policy Analyst
___ 54 - Librarian
___ 55 - Dissemination Technical Officer, Dissemination Clerk
___ 56 - Training Officer
___ 71 - Personnel Officer
___ 72 - General Administrative Officer
___ 73 - Legal Officer
___ 74 - Financial Officer, Internal Auditor, Finance Accounting Management Officer
___ 81 - Agricultural Management Officer
___ 99 - Other
___ 00 - Don't Know

18 - Place of Work

___ Amphur

___ Jungwat

Present Post

19 - Year of this Appointment

___ ___ _____ ___ 0- Don't Know

20 - Grade Now

___ 03 - PC-3
___ 04 - PC-4
___ 05 - PC-5
___ 06 - PC-6
___ 07 - PC-7
___ 08 - PC-8
___ 09 - PC-9
___ 00 - Don't Know

21 - Division Now

___ 31 - Botany and Weed Science
___ 32 - Agricultural Chemistry
___ 33 - Agricultural Engineering
___ 34 - Agricultural Toxicology
___ 35 - Plant Pathology and Microbiology
___ 36 - Entomology and Zoology
___ 37 - Soil Science
___ 51 - Finance
___ 52 - Programme Planning
___ 53 - Personnel
___ 54 - Office of the Secretary
___ 71 - Agricultural Regulatory
___ 99 - Other
___ 00 - Don't Know

22 - Institute Now

___ 1 - Field Crops
___ 2 - Rice
___ 3 - Horticulture
___ 4 - Rubber
___ 5 - Sericulture
___ 6 - Farming Syste
___ 9 - Other
___ 0 - Don't Know

23 - Job Name Now

___ 11 - Executive
___ 21 - Agricultural Technologist
___ 22 - Scientist
___ 23 - Plant Pathologist
___ 24 - Entomologist
___ 25 - Zoologist
___ 41 - Agricultural Engineer
___ 42 - Mechanical, Civil, Survey Engineer or Architect
___ 51 - Statistician
___ 52 - Economist
___ 53 - Planning and Policy Analyst
___ 54 - Librarian
___ 55 - Dissemination Technical Officer, Dissemination Clerk
___ 71 - Personnel Officer
___ 72 - General Administrative Officer
___ 73 - Legal Officer

__ 74 - Financial Officer, Internal Auditor, Finance Systems Analyst or Finance Management Officer
__ 81 - Agricultural Management Officer
__ 99 - Other
__ 00 - Don't Know

18 - Place of Work

__ Amphur
__ Jungwat

ANNEX 2: DISTRIBUTION OF GRADUATE PERSONNEL BY DIVISION AND INSTITUTE

Botany and Weed Science Division	64	Field Crops Institute	213
Agricultural Chemistry Division	109	Rice Institute	243
Agricultural Engineering Division	37	Horticulture Institute	107
Plant Pathology and Microbiology Division	33	Rubber Institute	109
Entomology and Zoology Division	129	Sericulture Institute	45
Soil Science Division	53	Farming Systems Institute	35
Finance Division	5		
Programme Planning Division	32	Subtotal	752
Personnel Division	13		
Agricultural Regulatory Division	70	Unclear from Personal Files	119
Office of the Secretary	3		
Subotal	548	TOTAL	1419

ANNEX 3. SALARY SCALES

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
20	3535										
19	3325										
18	3115										
17	2905										
16	2765										
15	2625										
14	2485	4685	5745	7285	9385						
13	2345	4425	5465	6935	8895	12535					
12	2205	4165	5205	6585	8475	11975					
11	2065	3955	4945	6305	8055	11415					
10	1950	3745	4685	6025	7635	10855	13095	14295	15575	16975	
9	1865	3535	4425	5745	7285	10365	12535	13695	14935	16275	17745
8	1780	3325	4165	5465	6935	9875	11975	13095	14295	15575	16975
7	1695	3115	3955	5205	6585	9385	11415	12535	13695	14935	16275
6	1620	2905	3745	4945	6305	8895	10855	11975	13095	14295	15575
5	1545	2765	3535	4685	6025	8475	10365	11415	12535	13695	14935
4	1470	2625	3325	4425	5745	8055	9875	10855	11975	13095	14295
3	1395	2485	3115	4165	5465	7635	9385	10365	11415	12535	13695
2	1325	2345	2905	3955	5205	7285	8895	9875	10855	11975	13095
1	1255	2205	2765	3745	4945	6935	8475	9385	10365	11415	12535

ANNEX 4. DISTRIBUTION OF GRADUATE PERSONNEL BY GRADE

Grade	Number	Grade	Number
PC3	97	PC8	20
PC4	345	PC9	4
PC5	391	PC10	1
PC6	393	unknown	1
PC7	167	TOTAL	1419

ANNEX 5. DISTRIBUTION OF GRADUATE PERSONNEL BY AGE

Grade	Number	Grade	Number
60 and over	8	30-34	342
55-59	29	24-29	175
50-54	100	under 25	11
45-49	132	TOTAL	1419
40-44	237		
35-39	385		

ANNEX 6. SALARY POINTS

Figure in parentheses = number of people at that salary point.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
20	3535										
19	3325										
18	3115										
17	2905										
16	2765										
15	2625										
14	2485	4685	5745	7285	9385 (1)						
13	2345	4425	5465	6935	8895	12535					
12	2205	4165	5205	6585	8475	11975 (1)					
11	2065	3955	4945	6305 (1)	8055 (1)	11415 (4)					
10	1950	3745	4685	6025	7635 (1)	10855 (3)	13095 (18)	14295 (3)	15575	16975	
9	1865	3535	4425	5745	7285 (4)	10365 (5)	12535 (18)	13695 (4)	14935	16275	17745
8	1780	3325	4165	5465 (3)	6935 (32)	9875 (9)	11975 (26)	13095 (1)	14295	15575	16975
7	1695	3115	3955 (3)	5205 (15)	6585 (72)	9385 (16)	11415 (21)	12535 (2)	13695	14935	16275
6	1620	2905	3745	4945 (53)	6305 (45)	8895 (34)	10855 (21)	11975 (2)	13095	14295	15575
5	1545	2765	3535	4685 (48)	6025 (21)	8475 (75)	10365 (10)	11415	12535	13695	14935
4	1470	2625	3325 (12)	4425 (46)	5745 (28)	8055 (96)	9875 (9)	10855	11975	13095	14295
3	1395	2485	3115 (26)	4165 (48)	5465 (44)	7635 (40)	9385 (6)	10365	11415	12535	13695
2	1325	2345	2905 (20)	3955 (24)	5205 (36)	7285 (20)	8895 (6)	9875 (1)	10855	11975	13095
1	1255	2205	2765 (2)	3745	4945	6935 (1)	8475	9385	10365	11415	12535

ANNEX 7. PC GRADES AT THE STAGNATION POINT

When the Director looked at the numbers of people in each PC grade above what might be called the "stagnation point" (i.e., the point at which an individual's current salary level was equal to the lowest salary level in the next PC grade), he found the following:

Grade	Percent above Stagnation Point
PC3	6
PC4	8
PC5	2
PC6	24
PC7	91

Even more striking, when he computed the numbers of people at this "stagnation point" + 1 (that is, one more salary level), the figures became:

Grade	Percent above Stagnation Point +1
PC3	2
PC4	2
PC5	1
PC6	13
PC7	84

SESSION 4

CONSIDERATIONS FOR TRAINING IN NARS

SOME ASPECTS OF TRAINING IN NATIONAL AGRICULTURAL RESEARCH SYSTEMS (NARS)*

Luka O. Abe

Introduction

In our context, training may be described as a process that enables individuals to acquire knowledge, skills, and abilities that will enable them to fulfill the requirements of their job.

Training plays an extremely vital role in the acquisition and utilization of an organization's human capital. It is for this reason that an organization will incorporate training in its manpower planning. It is often said that in times of uncertainty, training becomes one of the most critical functions, and for most of the developing country national agricultural research systems (NARS), training remains crucial in their strategy toward achieving food self-sufficiency.

The NARS of many developing countries have the challenge of simultaneously developing a large cadre of highly trained personnel, while attempting an ambitious research agenda for the provision of production technologies to the small-scale farmer. This, in many cases, has met with a great deal of frustration. NARS policymakers have grown impatient and express a lack of confidence in the NARS, and this has sometimes resulted from a lack of understanding of the rigors of research and the intricacy of institutional capacity building for research. Institutional capacity-building efforts such as the establishment or strengthening of national institutions to meet the needs of agriculture and research need careful preparation and substantial local commitment and input.[1]

For its viability and effectiveness in fulfilling its mandate, a NARS must build its human capital from an indigenous source, and in many cases, particularly in sub-Saharan Africa, the base has been narrow and weak because of constraints in its sources such as the institutions (universities and colleges). One may ask why this indigenous capacity is so vital to national agricultural research. A strong capacity will influence a number of factors related to agriculture and agricultural research, such as an increased capacity to demand support for agricultural research and influence in policy articulation, an enhanced ability to tap information worldwide such as from international agricultural research centers (IARCs), an ability to generate and transfer technology to the NARS, and the formulation of a vision for the NARS and the efficient and effective management of its resources.

Types of Training in NARS

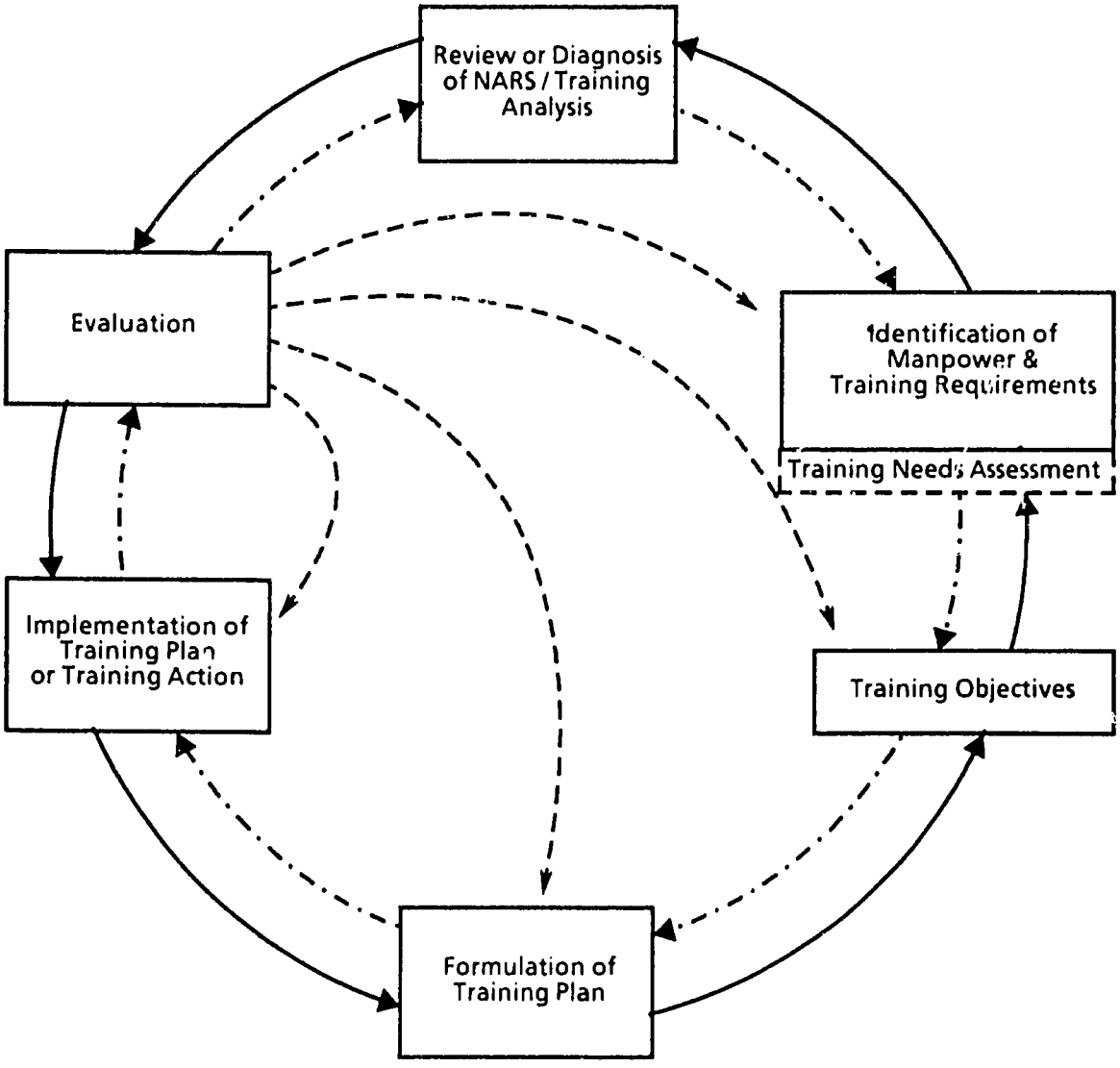
When discussing national agricultural research systems in the context of its manpower requirements and development, it is important to look at the availability of trained personnel in the country *in toto*. This gives some idea of the size and strength of the base and sources from which a NARS can acquire and develop its human capital. Typically, there are four categories of personnel engaged in a country's agricultural development.[2] These are the professional personnel (with at least a first degree (BSc) of scientific or technical agricultural education), the senior technical personnel (usually with postsecondary technical training or relevant experience equivalent to diploma level), junior technical personnel (usually with one or two years of agricultural training), and vocational or artisan personnel (who have had six months to two years of practical vocational education or on-the-job training leading to recognition of competence).

**Orginally entitled "Human Resource Development in National Agricultural Research Systems (NARS)."*

Table 1.
Typology of Training in NARS

TYPE OF TRAINING	OBJECTIVE	DURATION	TARGET	LOCATION	EXPECTED RESULT
1. Induction.	- To enable staff to become acquainted with organizational mandate, goals, rules, and regulations. - To meet others and become more acquainted with the programs and activities within a short time. - To facilitate socialization.	Few days to one month	All new staff	In the organization	Faster integration and assimilation of staff into the organization.
2. On-the-job.	- To enable researchers to learn research techniques and methods. - To coach young researchers on the scientific and research process.	Continuous	All but emphasis on young researchers	Other institutions or at own institutes	Improved research productivity, job satisfaction, reduction in downtime of equipment, motivation and leadership role, etc.
3. Short-term. (e.g. short-term travel grants)	- To enable staff to acquire new skills, knowledge, and attitudes.	Few days to six months	*All*, depending on topic		improved research productivity.
4. Postgraduate. or Professional	- To increase knowledge and upgrade skills and research capability in general. - To enable staff to achieve academic advancement.	One year to 3 to 5 years	BSc or MSc degree holders institutions	At local or overseas universities or leadership improved.	Enhanced research skills and knowledge. Research Better career prospects.
5. Postdoctoral. or long-term fellowships.	- To improve knowledge, skills, and professional contacts. - To upgrade skills of researchers.	Up to one year	MSc or PhD degree holders	At IARCs, other universities or institutions	Improved leadership, technical skills, and knowledge.
6. Agricultural. research management	- To improve capacity for management of resources, develop skills in agricultural research planning and budgeting, monitoring and evaluation, and improve supervisory and management leadership, etc.	Few days to one month	Mid- to senior-level research managers	National training, international or regional seminars, conferences, and symposias	Improved managerial skills–leadership and motivational. Improved resource management kills.
7. Technical.	- To upgrade expertise of technical personnel.	A few months	Technical staff	At polytechnics, international institutes, or other laboratories	Improved specialized techniques and methodology.

Figure 1. Training process for institution and for individual staff (Adapted from L.A. Stanley. 1987. Guide to Training Need Assessment. International Centre for Public Enterprises in Developing Countries.)



These constitute the potential pool for a NARS human resource. In most NARS, the professional and technical categories are the most vital. The difficulties often arise in the availability, the quality, and the level of training of the personnel in research vis-a-vis the agricultural research requirement of the NARS. Developing countries, particularly in Africa, have the following inherent constraints in their system-building efforts:

- The scientific manpower base is small, and the numbers of agricultural researchers show severe shortfalls. Hence NARS have to rely on a small pool of researchers, even very young and inexperienced ones, for leadership roles in research.

- This situation results from the lack of a strategy for developing agricultural research capacity, as in the integration of the continuum of research, experimentation, adaptation, and dissemination of technology in to a national context.

- Many NARS have a high turnover of staff (in 1984, 51% of researchers in the Kenya NARS had been on the job less than two years, and only 9% had more than ten years' experience).

- Training at advanced and intermediate levels and at educational institutions often fails to meet the needs of agriculture and research.

To meet the human resource requirements, NARS may include in their staff development programs the following programs: induction training, on-the-job training, postgraduate professional training, short-term training, research management training, and technical training. These are often used as a means of improving the performance and enhancing the capabilities of their staff. Table 1 summarizes each of these, their broad objectives, duration, target groups in NARS, where such training may be obtained, and the expected behavioral and technical outcomes.

The Training Process

It is through the activities involved in human resource planning that a NARS is able to identify its broad training plans. Human resource planning gives us the number of researchers available and their qualifications, activities, and experience. It also specifies their discipline and commodity research areas and the distribution within the network of institutions or research stations. The information is vital in assessing the human resource potential of the NARS, and it further assists in diagnosing weaknesses in the system that can be remedied through training. In figure 1 we depict the training process in a scheme showing at least six components: review or diagnosis of NARS, identification of management and training requirements and assessment of training needs, training objectives, formulation of training plan, implementation of plan, and evaluation.

NARS should not regard training as a panacea for improving low staff performance. Low performance may be due to various factors which must be investigated to determine the utilization of staff in the NARS to ensure that training is the right course of action to take. Among these factors could be inadequate job design; poor motivation (e.g., reward systems); lack of leadership and guidance, (or ineffective supervision) particularly for young researchers; poor work conditions or an environment not conducive to high productivity (e.g., poor research facilities, such as equipment, field facilities, etc.); unclear vision and priorities for the NARS; poor management support of the research operations (e.g., inadequate funding and supply of both technical administrative support personnel, an overloaded research officer, which may result in intolerable work pressures); intragroup conflict, dissatisfaction, or grievances, etc.

The list above is not exhaustive. However, experience shows that when certain changes are expected in the organization, training and retraining of personnel may be prescribed. Table 2 gives a summary of NARS training-need indicators that have direct implications for training. These serve as early-warning systems that may guide a NARS toward training.

These indicators tell us where gaps between the job requirements and abilities of individuals in an institutional context are likely to occur–thus the need for training. All too often researchers are whisked off for training only to return to face the same set of conditions in the institution. Unless a careful diagnosis of the constraints are done, the problem of staff opting for training will persist; eventually this may result in demotivation and frustration of staff and low institutional productivity. Furthermore, a caveat is

Table 2.
Training-Need Indicators

TRAINING-NEED INDICATORS	
1. Organizational Plans (Research Strategy, or Manpower Development and Training Plans).	**5. Morale Factors**
– Projected changes in mandate. (or objectives) and research priorities.	– Personnel friction – Conflicts – Poor leadership
– Changes in structure and organization.	**6. Job Knowledge**
2. Employee Records	– Technical aspects – Administrative aspects Supervisory aspects
– Staff turnover – Low performance ratings – Career paths and plans.	**7. Communication Facilities**
3. Research Operations	– Poor written and oral communications. – Poor flow of information, up and down.
– Acquisition of new research equipment, techniques, or methodologies. – Fluctuations in research output. – Performance appraisals.	**8. Supervision**
4. Staff Selection Policy	– Lack of clarity in work assignments. – Planning and scheduling – Improper resolution of conflict.
– Qualifications of staff at functional levels. – Experience and training background of staff.	

issued to NARS that training is not always the wisest or least costly course of action. This is especially so if people with the right kind of abilities are not being selected or if poor performance is a result of any one of the factors indicated above.

Determination of training needs is one of the steps in a training process. Suffice it to say that training analysis revolves around evaluation of the research priorities, activities, and available resources; the relationship between and among the elements; the physical, environmental, and social constraints; and the knowledge, skills, and capabilities necessary to undertake the various tasks to fulfill a NARS mandate.

In most cases, training-need assessments have to answer questions related to the job and tasks of an individual like the following:

- What is the purpose of the job?
- What basic training should the jobholder possess?
- Where does the jobholder fit in the organization?
- What tasks and duties does the jobholder have to carry out?
- What is the indication that the job is not being carried out properly?
- What are the communication links between jobholders and their colleagues in other activities and how will he or she be supervised?
- Where would such training be tenable?

The Need for an Institutional Training Plan

A short case study of the manpower and training plans of the Kenya NARS, formulated in 1982 in anticipation of a restructuring and reorganization of the NARS, can be used to underscore the need for a training plan.[3] The formulation of the Kenya NARS training plan recognized the need for the NARS's expansion. The following steps were undertaken in the planning: analysis of the constrained and unconstrained demands for additional research scientists and support personnel and specification of the remedies; the allocation of additional staff to priority research areas; an indication of the current and desired balance between basic, applied, and adaptive research; the linkages between research and extension; and the allocation of personnel to various commodity research areas–crops, forestry, animal production, and veterinary medicine. This plan went further and identified the training needs of the research personnel and the strategies for meeting them. Among the training needs were the following:

- As stated in the plan, for the young research officer, developing a positive attitude toward a career in agricultural research and an orientation toward the role of an agricultural researcher as one who develops solutions to farmer problems is probably the most difficult educational objective. In this belief, it was hoped that the NARS would be able to create an environment conducive to high productivity through appropriate motivation of staff.
- A second priority training area recommended in this plan was short courses at the international agricultural research centers (IARCs). Again following on the need for changing attitudes and the acquisition of skills and knowledge as behavioral outcomes, such training should stimulate the interest and enthusiasm of the young researchers as they are immersed in active research programs, working under highly experienced scientists. It is to be noted, however, that short-term production courses such as those in IARCs are also tenable at other national or regional research organizations.
- The plan recommends postgraduate training for research officers to increase their technical knowledge and skills in research methodology and techniques. The recommendation observes that MSc-level training should be the minimum qualification for all senior research officers, and PhD-level training would be a prerequisite for research leaders such as program coordinators, directors, etc.

All these need to be considered when formulating a NARS training plan, which should include the following features: an inventory of agricultural research scientists by discipline; a projection of both the unconstrained and constrained demand for agricultural research scientists in a country; a clear policy on selection and recruitment and on career paths for scientists as well as personnel costs; an overall training strategy–statement on the priority of training needs;

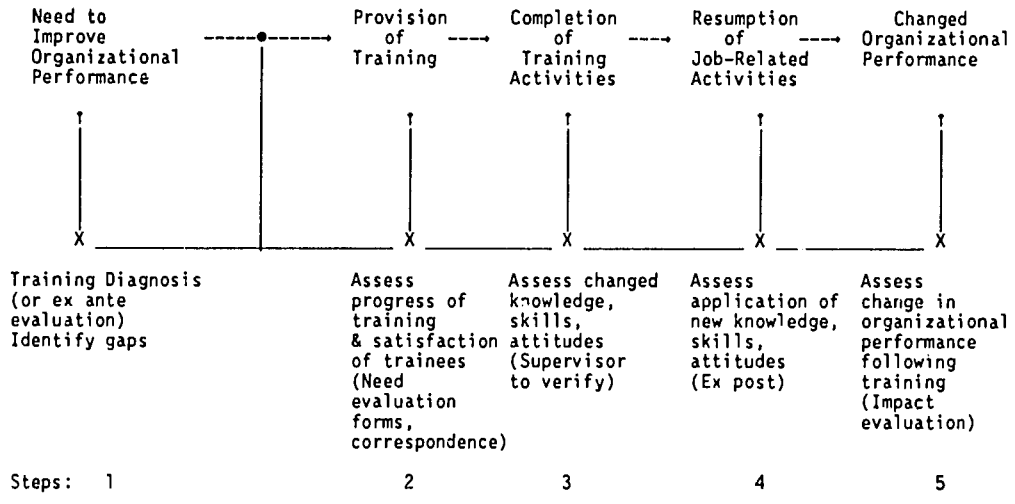


Figure 2. Evaluation of five levels of management training outcomes (Adapted from K. Brethower and G. Rummler. 1979. Evaluating Training. Training Development Journal, May 1979:17)

types of training–whether professional, short-term, study tours, or leadership training–and how these are to be implemented; a statement on how staff will be deployed once trained–which research commodity group, location, or discipline; and finally, it must state the availability of support staff for backstopping research where the trained researchers are expected to work. The plan would also state actual and desired ratios of scientists and technical staff, and if shortfalls occur, how this will be remedied.

Evaluation of Training

In a training context, evaluation is the assessment of the value of a training system, course, or program in special as well as financial terms. What evaluation fails to do in training, particularly in agricultural research, is validation, which is a measure of the overall benefit, in terms of cost, of a course or program. Evaluation can assess course objectives; however, validation is not possible, since the impact of training has long-range, and multifarious, implications that are difficult to quantify and measure. This often seriously limits efforts to generate support for training. The rationale for evaluation is reflected in the common thread that runs through the training process. Evaluation attempts to show whether the training has achieved its stated objectives and to what extent it was effective, to what extent it has contributed to the organization as a whole, and to what extent it has influenced future training and training-related decisions and actions. In other words, evaluation attempts to establish whether the right action was taken.

The relationship of evaluation to the other components in a training process is strong. Evaluation as part of the training process provides feedback information at each stage to enable planners and implementors to effectively execute training. A typical evaluation scenario for an individual undergoing a training event is shown in figure 2, where five outcomes may be evaluated. A NARS should develop its own scheme for all the training it delivers or supports.

In steps 2 and 3, an on-going evaluation is conducted. In step 2, it is important to assess not only the progress of technical or management training, but it is also important to understand how well satisfied trainees are with the progress on their training. In step 4, when trainees are back at their post, it is important to evaluate the knowledge, skills, and attitudinal benefits of training. This is an exercise that should be carefully carried out to establish baseline data to assess and discuss with trainees the changes they expect to bring into the workplace. Often trainees are left at this stage to wonder just how the organization is hoping and willing to allow them to propose and implement changes.

This problem is characteristically summed up in a statement by David F. Nygaard. "Too often newly trained men and women go home to unchallenging situations, to professional isolation, to no money for research, and to equipment that doesn't work. When that's the case, everyone loses."[4] This need not happen if we plan a follow-up scheme to keep trainees inspired and capture their enthusiasm and interest to ensure transfer of acquired skills or knowledge to their work. A follow-up scheme will validate whether the skills and knowledge gained was beneficial, practical and useful. Step 5 is concerned with this aspect, which deals with impact evaluation–the long-term impact of a training program on the system.

A scheme for follow-up of training is given in figure 3. The scheme identifies four areas–further personal development, liaison with former participants, help in the practical application of knowledge and skills acquired, and evaluation of the training–as vital to the process. The components used in a follow-up exercise to guarantee training impact are indicated. When selecting training institutions, NARS should opt for those that incorporate these in their follow-up of participants.

Some Key Considerations in the Management of Training in a NARS

Most NARS usually have an officer designated as a *training officer*. However, very often his/her task is not well defined; thus, the organization is unable to respond promptly and effectively to the training requirements of the system. Because the training officer is an important staff member in the NARS, it is vital to fully understand this role.

The training officer's primary function is basically to assist the research managers–directors of research, heads of stations, program coordinators, or team leaders–in their responsibility to train young scientists. In agricultural research where a lot of coaching is needed, training officers could inspire program coordinators to analyze the problems of young researchers, identify which ones constitute training problems, and to provide advice, information, help, and services, etc, to them to resolve them. While they may not have specialized knowledge and skills in the various research technologies and methodologies, training officers, with their own specialized knowledge and skills, could contribute in the area of manpower planning, training-need assessments, performance appraisals, instruction techniques, preparation of training materials and audio-visuals, evaluation and follow-up, etc. What has tended to happen in most NARS is that training officers are simply used in the implementation of training and rarely in the planning and design of training. This is unfortunate since they are usually expected to possess the analytical skills necessary for assessment of training needs.

Organizationally, training is an integral part of the personnel function; it is here that the process of job description begins. In effect, training officers should participate in this process as it presents an opportunity to identify gaps in knowledge of personnel and the training requirements of the staff they are requested to organize training for.

A word about funding of training. Professional development is a costly venture requiring careful planning and adequate funding for its systematic implementation if it is to achieve its unified system-building function. NARS should ensure that investment in training programs is commensurate to, in step with, and complementary to its other institution-building and research programs.

Disjointed and uncoordinated funding tends to disrupt rather than harmonize these vital components of a NARS. Donors sometimes unwittingly encourage this as they may support commodity research without providing funds for training of indigenous staff to assume future research leadership roles. Good research planning, manpower projection, and training-need identification will enable NARS to avoid this pitfall. A classic example of this can be gleaned from the Malawi NARS where the Overseas Development Administration (ODA) (UK) made a heavy investment in research on maize but little or no support was provided for research training; however, thanks to USAID, a vigorous training scheme was launched to correct this anomaly, and the continued productivity of the Malawi NARS maize research program was assured.

In terms of supplementary funding, most NARS are still not fully exploiting the potential sources that exist from various bilateral and multilateral assistance organizations, private institutions, etc. It is incumbent upon policymakers and directors of NARS to actively seek support from these agencies.[5] It is important, however, to point out that although it is widely

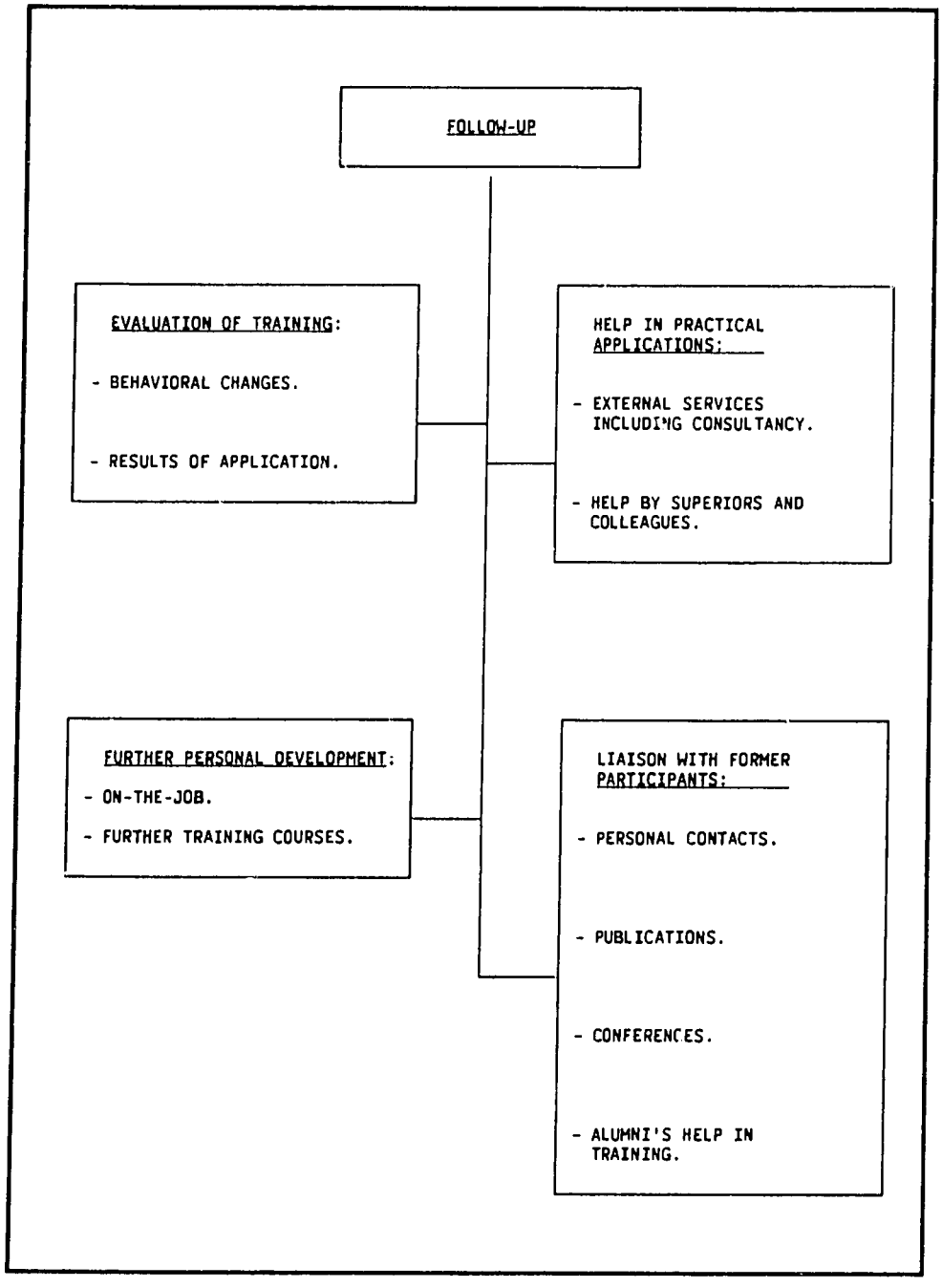


Figure 3. Follow-up scheme of participants (Adapted from M. Kubr. 1985. An Introductory Course in Teaching and Training Methods for Management Development. ILO, Geneva.)

accepted that research and its associated technological application are human-resource intensive, the investment in training has been lack luster and donors have not placed a high premium on it.

The international agricultural research centers (IARCs) and other regional centers are also very fruitful sources of support. For instance, the Southern African Center for Cooperation in Agricultural Research (SACCAR) is an important source of support for training researchers in the SADCC member states. SACCAR has a mandate to foster cooperation in agricultural research and to improve the capacity of individual countries to undertake carefully prioritized agricultural research projects.

For many NARS, the promotion of organizational changes will have to focus on professional training of their staff to advanced degree levels. Since local universities are weak and lack the resources, greater reliance will be placed on overseas training. But where possible, governments are responding by attempting to overhaul or reorganize national higher educational programs. As an example, the SADCC member states are establishing regional centers of excellence in the various faculties of national universities. This move aims, *inter alia*, to strengthen postgraduate training for NARS staff in selected disciplines. Through SACCAR, short-term travel grants and long-term fellowships to upgrade the formal skills of NARS staff are also utilized to achieve the aims of institution-building and strengthening.

Notes

1. Uma Lele et al. 1987. The Development of National Agricultural Research Capacity: India's Experiencewith the Rockefeller Foundation and Its Significancefor Africa.

2. FAO. 1983. Trained Agricultural Manpower Assessment in Africa.

3. NCST/ISNAR. 1982. A Manpower and Training Plan for the Agricultural Research System in Kenya, 1983-87.

4. David F. Nygaard (Director, Human Capital Development, (Winrock International). 1970. We Foster leadership. In 87 winrock International Annual report.

5. Two publications are useful as a guide:
   (a) Agricultural Assistance Sources. 1982. Published by International Agricultural Development Service. 1611 North Kent Street, Arlington, VA 22209, USA. IADS is now called Winrock-International Institute for Agricultural Development. Address in Virginia remains the same. (b) The International Foundation Directory (Edited by H.V. Hodson), published by Europa Publications Ltd., 18 Bedford Square, London, WC1B 3JN. NARS should request these.

THE MANAGEMENT OF A REGIONAL TRAINING PROJECT: THE SACCAR/ISNAR SOUTHERN AFRICAN AGRICULTURAL RESEARCH MANAGEMENT TRAINING PROJECT

Luka O. Abe

Introduction

The Southern African Development Coordination Conference, SADCC, launched in April 1980, is comprised of the countries of Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe. Though formed out of a practical desire to develop collective economic self-reliance among member states, it soon channeled its interest into agricultural research cooperation. This interest was precipitated by the persistent drought of the 1970s and '80s which drastically reduced agricultural production in many of the countries. The population of the region is currently estimated at 70 million and projected to rise to 100 million by the year 2000. Up to 80 percent of the population and the labor force in the member states is dependent on agriculture for employment and income; agriculture, therefore, plays a central role in the economy of these nations.

The Southern African Centre for Cooperation in Agricultural Research, SACCAR, the brainchild of the Government of the Republic of Botswana, was formed in 1984 with a mandate to undertake agricultural research coordination in the SADCC region.

The overall objectives of SACCAR are

- to promote and disseminate information on available technology among the NARS of SADCC member states;
- to promote and implement studies of problems common to all or several SADCC member states and to initiate cooperative research to overcome these problems;
- to generate new technologies needed by farmers, to raise the productivity of food and nonfood crops, livestock, fisheries, and forestry through rational collaborative projects and intercountry liaison;
- to strengthen national agricultural research systems and capabilities through human research development.

SACCAR currently operates 11 collaborative research networks which include

- the Sorghum and Millet Improvement Program–with ICRISAT;
- the Sorghum and Millet Utilization Project–with Zimbabwe;
- the Grain Legume Improvement Program–with CIAT and ICRISAT;
- Land and Water Management Project–in Botswana;
- Agroforestry–with ICRAF;
- Maize and Wheat Improvement Network–with CIMMYT;
- Gene Bank Project with the Nordic countries;
- a Network of Farm Power and Equipment for Smallholder and Large-scale Farms;
- Livestock Improvement Program (LIP);
- the Regional Vegetable Research Program;

Table 1.

SADCC NARS Institutional Development and Management Capacities

Country	Size (No. of Scientists)	Inst. Dev.	Management
Tanzania	Large (> 320 researchers)	Low	Low efficiency* Low effectiveness**
Zimbabwe & Malawi	Medium (> 120)	Medium	Low efficiency Moderate effectiveness
Zambia	Medium (> 100)	Low	Low efficiency Low effectiveness
Botswana, Lesotho, Swaziland	Small (< 20)	Low	Low efficiency Moderate effectiveness
Angola, Mozambique	Small (> 10 < 60)	Low	Low efficiency Low effectiveness

* Efficiency = capacity of a NARS to provide relevant technology.
** Effectiveness = capacity of a NARS to maximize output from resources available to it.

Figure 1.
Project workplan, 1986-1990

Activities	1986	1987	1988	1989	1990
1. Project Start-up	Sept.				
2. Planning Visits & Consultations (Training-Need Assessment)	——	——	——	——	——
3. Information Dissemination	——	——	——	——	——
4. Curriculum and training materials development	——	——	——	——	——
5. Training					
– National Management Improvement Program (Malawi, Tanzania, Zambia, Zimbabwe)		w w w	w w w w	w w w w w	w w w w w
– Workshops					
Botswana, Lesotho, Swaziland				w w	
Angola/Mozambique Seminar for Policymakers				w	
6. CDA Program Exchange					
7. Monitoring & Evaluation		r r r r	r r r r	r r r r	r r r r

Key:
—— denotes continuous process
w denotes workshop
r denotes quarterly report

- Agricultural Research Management Training Project–with ISNAR as the executing agency.

These research networks show the scope and opportunities for working with various organizations, apart from the NARS, for the enrichment of the knowledge base in agricultural research management in the region. We shall explore this aspect later in our discussion.

Description of the Project

The project objectives are stated as follows:

- to foster human resource development in agricultural research management;
- to strengthen the capacity of national research leaders to plan, program, budget, execute, and monitor research programs of relevance to national development goals;
- to build the skills of middle-level research administrators in the management of agricultural research activities;
- to work towards building a base for the sustained management training capacity for agricultural research within the region;
- to reinforce the exchange of information among SADCC scientists and administrators on issues related to the management of regional and national agricultural research programs.

Profile of the NARS in the Region

As stated earlier, the region has a population estimated at 70 million for all nine countries. In total the region has just a few more than 830 agricultural researchers (see table 5 for details). A closer look at the NARS shows that they are vastly different in their research requirements, and they are at varying stages of development. Table 1 summarizes categories of NARS in the region–their levels of institutional development and management capacities. These characteristics have implications for our strategy for training in each of the categories.

ISNAR's Role in the Project

As the executing agency for the project, ISNAR's responsibilities include technical and logistical coordination of training events; identification of resource persons; maintenance of an information dissemination system, which initially involves the creation of a library of pedagogic materials, case studies, exercises, and relevant literature, both at ISNAR and at the SACCAR Secretariat; preparation and submission of periodic reports to donors, SACCAR Secretariat, and other interested parties; and follow-up of training with NARS. SACCAR is responsible for some aspects of the technical coordination of events.

Project Activities

The workplan for the project is shown in figure 1. The project started in September 1986 and will run until 1990. The basic activities include planning visits used to assess training needs and planning for logistics for workshops and curriculum development, which is a continuous process. A total of 19 training events have been planned for the project–the larger NARS of Malawi, Tanzania, Zambia, and Zimbabwe will each have four training events, while the smaller NARS of Botswana, Lesotho, and Swaziland will be grouped together for one regional course. Mozambique and Angola will also have only one event in the four-year period. In the third year (1989) of the project, a regional seminar for policymakers from the four NARS will be held. It is also planned that a SACCAR representative, possibly the manpower and training officer, will travel to Francophone West Africa to visit the AGIR project and to exchange experiences on the two projects.

Training-Need Assessment

ISNAR's involvement with NARS in the African region spans a number of years of advisory service, research, and training activities with the NARS. Since 1982, under the donor association, Cooperation for Development in Africa (CDA), ISNAR undertook a program on strengthening the management of agricultural research in Africa, which focused on staff development for the African NARS. Under this project, ISNAR conducted a field study to determine

Table 2.

TRAINING-NEED INDICATORS

1. **Organizational Plans** (Research Strategy, or Manpower Development and Training Plans).

- Projected changes in mandate. (or objectives) and research priorities.
- Changes in structure and organization.

2. **Employee Records.**

- Staff turnover
- Low performance ratings
- Career paths and plans.

3. **Research Operations.**

- Acquisition of new research equipment, techniques, or methodologies.
- Fluctuations in research output.
- Performance appraisals.

4. **Staff Selection Policy.**
- Qualifications of staff at functional levels.
- Experience and training background of staff.

5. **Morale Factors**

- Personnel friction
- Conflicts
- Poor leadership

6. **Job Knowledge**

- Technical aspects
- Administrative aspects
  Supervisory aspects

7. **Communication Facilities**

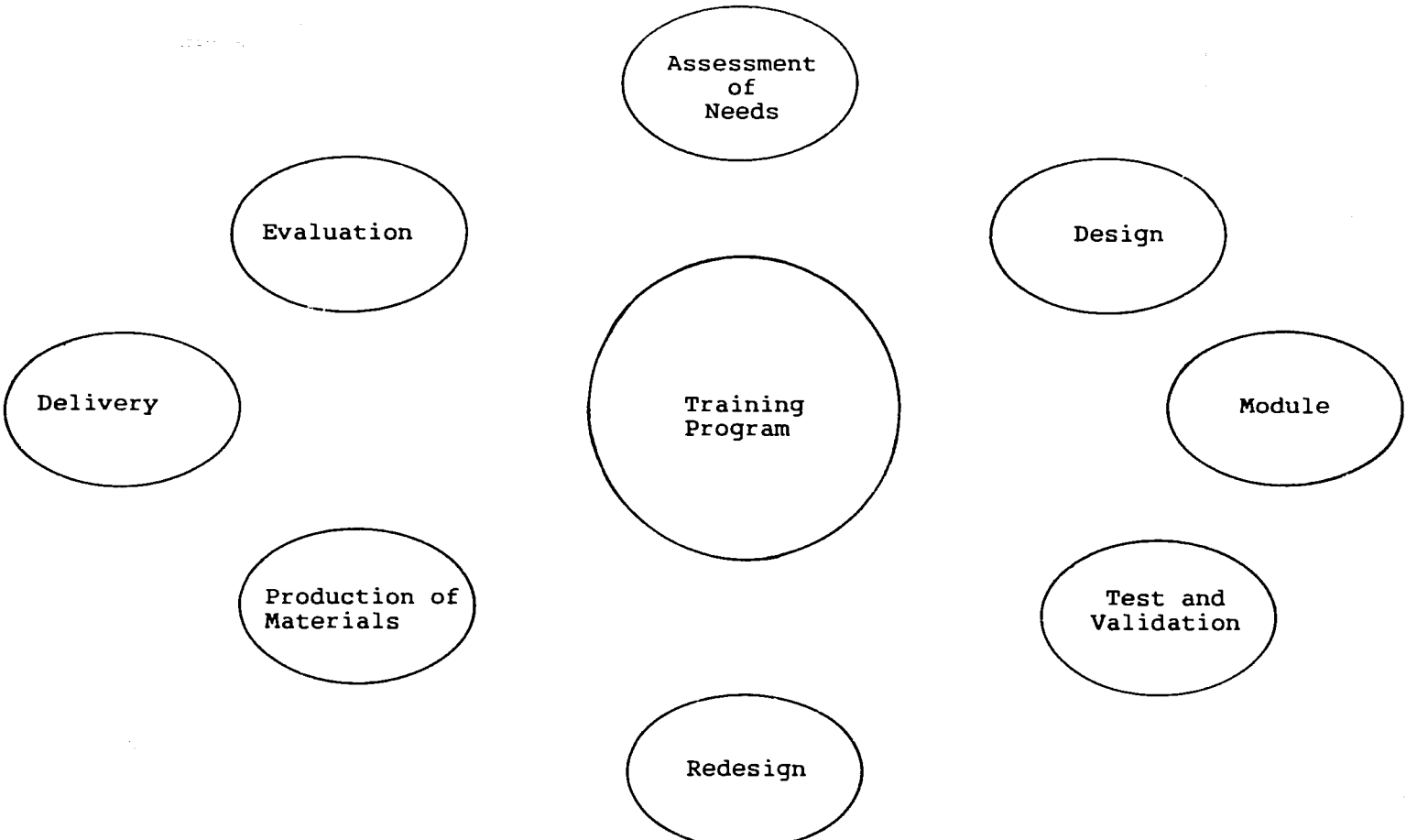
- Poor written and oral communications.
- Poor flow of information, up and down.

8. **Supervision**

- Lack of clarity in work assignments.
- Planning and scheduling
- Improper resolution of conflict.

Figure 2

Training Cycle for Design and Delivery of an Event



specific management development needs in African agricultural research, undertook the preparation and testing of training materials in agricultural research management, and also conducted a series of management training workshops.

From the experience in the first phase, it was established that there was a strong and urgent need for agricultural research management as a building strategy for NARS training institutions; but as it was not feasible to cover all of sub-Saharan Africa, attention was focused on the subregion under SADCC described earlier.

Training-Need Identification

In this project, training needs are first determined using the training-need indicator shown in table 2. This is a joint activity of SACCAR, ISNAR, and most important of all, the NARS. To cite an example, recently Tanzania requested that in their second national workshop, emphasis should be placed on strategic and research master planning, as the system is to undergo a major restructuring and reorganization. In responding to the request, we designed a training module that spanned topics on research planning, programming, priority setting, human resource management, management and supervisory leadership, teamwork, etc., in agricultural research. As most of the senior and middle-level research managers had little or no experience in research planning, the workshop afforded an excellent opportunity, through simulation exercises, interaction, and the use of case studies in working group sessions, to prime them for this task. We are informed that many who have been selected to serve on the national task force for the master planning experience attended our workshop.

Another training indicator has been identified in the area of communications in the Zambia NARS, and the project is responding by convening a regional workshop on training of trainers in techniques in communications to focus on scientific and technical report writing. It seems the need is pervasive in the region and each NARS will need to build its own capacity to train its staff in this area. The Zimbabwe NARS is in the process of consolidating its research at the program level and therefore wishes to adopt a nationally coordinated research program approach. It is hoped this project will respond to this proposed change by organizing a workshop or seminar on the management of nationally coordinated research programs. Such a workshop could necessarily use the experience of Malawi NARS in this area through a case study presentation.

It is important to note that the assessment of training needs is a continuous and vital process, and by using the indicators as early warning systems, NARS should respond in a timely and appropriate way. A significant function of the project coordinator is to monitor these requirements. This is sometimes done through planning visits, as indicated in the work plan.

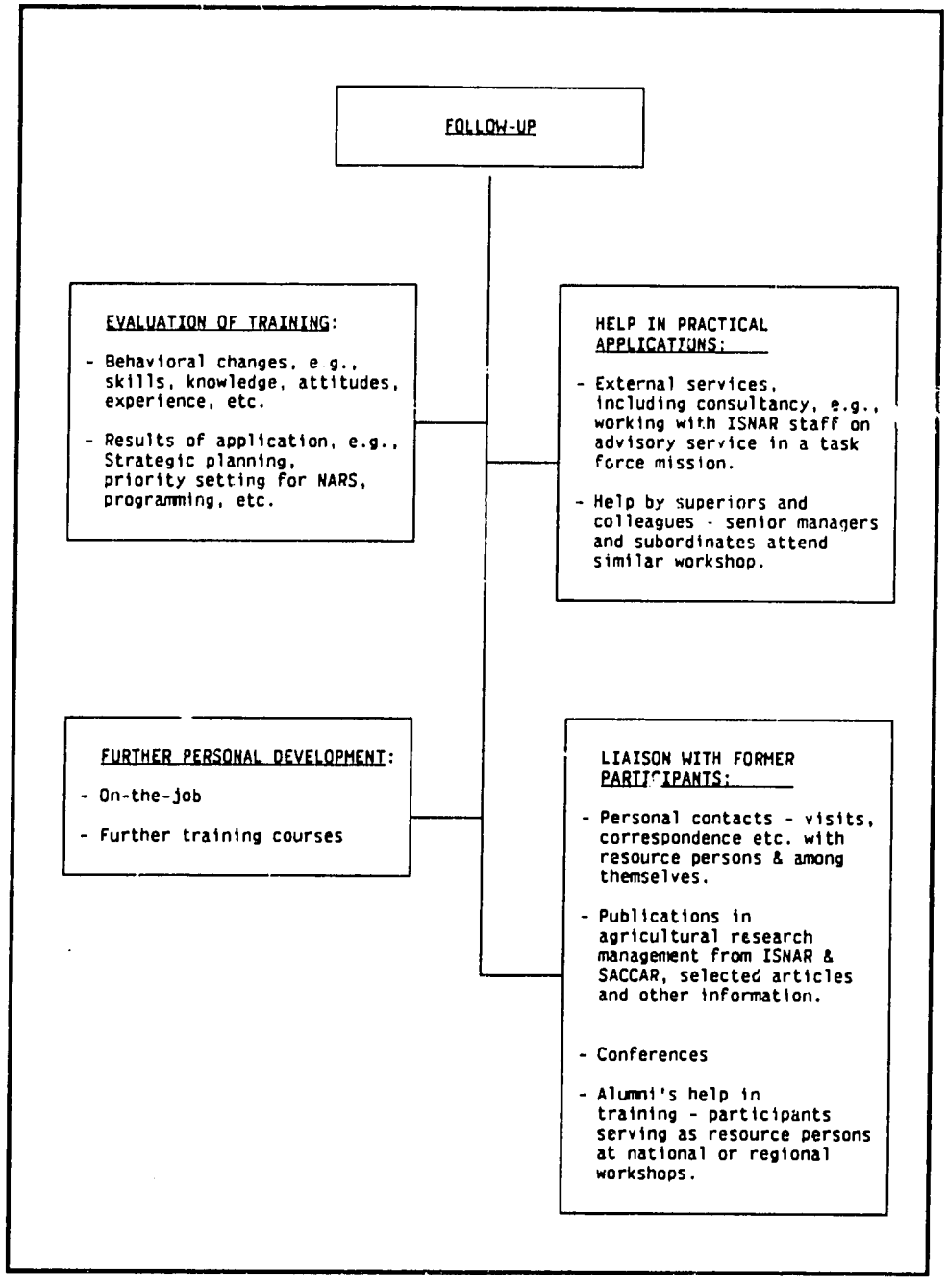
Training Areas

After training needs have been assessed, the problem of what type of training to deliver arises. As a rule, the training areas selected link directly to the goals and objectives of the research managers and of the NARS as an organization. The approach is intended to give results in the most cost-effective and productive way to the NARS, ISNAR, and SACCAR.

Figure 2 depicts the training process used in planning and delivery of the events.

All the training areas and the modules designed to achieve the training emphasize the following: reinforcement of fundamental agricultural research management skills; the enhancement of individual excellence, that is, how individuals can work better and be assured greater responsibility, thereby ameliorating their opportunity to achieve individual excellence; how to improve program productivity by using state-of-the-art concepts on which a sound foundation in agricultural research management can be built; and finally, using innovative training techniques, such as the integration of action-oriented methodologies–simulation, case study approaches, problem solving, etc.–that bring excitement and involve everyone.

Figure 3. Follow-up



Follow-up scheme of participants at SACCAR/ISNAR agricultural research management training project for NARS in SADCC countries. Adapted from M. Kubr. 1985. An Introductory Course in Teaching and Training Methods for Management Development. ILO, Geneva.

Table 3.
Areas of Focus for Training of Research Managers in NARS

TRAINING AREAS	MANAGERIAL LEVELS[1]		
	Policymakers	Senior Research Managers	Middle-Level Research Managers
• Development Policy	XXX	XX	X
• Planning and Priority Setting	XXX	XX	X
• Organization and Structure of NARS	XXX	XX	XX
• Linkages to Extension and Farmers	X	XXX	XXX
• Linkages to Knowledge Sources		XXX	XX
• Program Formulation and Budgeting	X	XXX	XXX
• Monitoring and Evaluation	X	XXX	XXX
• Management Information Systems	X	XXX	XXX
• Human Resource Management	X	XXX	XXX
• Financial Resource Management	X	XXX	X
• Physical Resource Management	X	XX	XXX
• Management and Supervisory Leadership	XX	XXX	XXX

Key:
XXX = Must Know (Priority 1)
XX = Should Know (Priority 2)
X = Nice to Know (Priority 3)

1. Policymakers – Board of Governors, Agricultural Research Council members, planners, executive officers in the NARS–permanent or principal secretaries, etc., responsible for policy and establishing long-range objectives of NARS.

Senior Research Managers – Senior managers and executives of the system, e.g., directors general/directors, their department and assistants–those responsible for overseeing implementation of policies.

Mid-level Research Managers – Research coordinators, station heads–those responsible for supervising research operations at research stations, laboratories, institutes, etc.

Table 4.
Degree of Success

Activity (Outcome)	Accomplishment	Clear, Specific	Verifiable	Realistic	Substantive Impact	Values	Time Frame
1. Promotion (publicizing, informing NARS of availability of training)							
2. Response to NARS request							
3. Needs assessment							
4. Negotiation with NARS (e.g., on funding, context, division of labor)							
5. Prospectus							
6. Coordination of development of materials							
7. Coordination of training teams							
8. Adoption of agenda							
9. Logistics (tickets, per diem, accommodation, recreation)							
10. Presentation of training materials (pedagogy, context, document)							
11. Evaluation							
12. Certificates							
13. Follow-up plans & implementation, etc.							

NOTE: Training outcomes and determination of the capacity with which the outcomes may be achieved. A scoring system is used. Low scores will give an indication of the need for further action.
The outcomes represent key considerations in planning and implementation to ensure client acceptance and satisfaction.

In table 3, we present some priority training areas and their levels of importance in designing training modules for the different levels of management in NARS. Most of the topics are drawn from the ISNAR critical factors.

Once needs are identified, a prospectus is prepared and circulated to prospective participants selected by the NARS. A sample prospectus is shown as annex I.

Evaluation

Evaluation of the project is done at several levels. First, it starts at the level of training-need assessment (called *ex ante evaluation*), the process stated above, to enable us to target the training. In this project, the training module has utilized a workshop mode. The second level of evaluation is at the delivery of the workshop. Workshop participants and resource persons assist the project coordinator in evaluating the workshop, emphasizing the extent to which the learning and behavioral objectives of the workshop have been achieved, the relevance and usefulness of the topics covered to participants of the workshop, etc. See annex III for a sample evaluation questionnaire and analysis.

This information is made available to resource persons and also used in planning and designing subsequent training events. The third level is a follow-up evaluation, shown in figure 3. In order to ensure a lasting impact in the NARS, the transfer of managerial and practical skills and knowledge must be completed. This is usually done through repeated reinforcement of the skills. In the scheme shown, further personal contact, liaison with former participants, and help in the practical application of these skills guarantee this transfer. For instance in Zimbabwe, ISNAR's involvement in advisory service to the NARS (where a local task force of research managers work hand in hand in a diagnostic review or on planning, etc.) will facilitate this process.

A second example is Tanzania, where it is expected that ISNAR staff will join a task force of local and international consultants for research master planning. The use of local resource persons drawn from former participants at similar workshops in the NARS ensures continued interest and development of personal capacity. The follow-up scheme therefore assists in consolidating knowledge and skills.

At the project level this is done through submission of quarterly reports to donors and to SACCAR and ISNAR management, along with mid-term and end-of-project evaluations.

Assessment of Outcome of an Event

Often, when we organize training, we get more immersed in the process and may neglect assessment of outcomes at each of the steps that assure the quality of the training and client satisfaction. It is therefore vital that for any event, outcomes be clearly identified and tested to ensure that they meet the following criteria: the extent to which we hope the task can be accomplished, clarity and specificity, verifiability–the quality of training materials, probability of success and input, how realistic the outcome is in relation to our resources or target group, how realistic the time frame for the outcome is. In doing this, we ensure the success of the training. Table 4 gives a checklist of activities which constitute key elements or outcomes of a training event that can be used in planning or implementing training.

Achievements

To date, training has been offered to 243 research managers in seven of the nine SADCC countries. Table 5 gives output showing the breakdown of participants by country.

The eight training events in the region have generated a large amount of training materials: country-specific case materials developed by indigenous resource persons, videotapes of lectures on monitoring and evaluation, problem solving, research station management, strategic planning in Malawi, and others on aspects of organizational behavior, e.g., delegation, motivation, leadership styles, etc. A list of materials and topics on videotape are presented in annex II.

Resource persons for the training events have been drawn from ISNAR, the NARS in the region (including the universities), and national or regional management training institutions. The project is building a pool of trainers which will ultimately form a core of trainers for the region. This can be viewed as a step towards institutionalization of agricultural research management training in the region.

Table 5.

Training Output, 1978-88

Country	Population (1985) in '000s	Approximate size of NARS (total no. of scientists)*	Number of Participants 1987	1988	Total
Angola	8,756	28			
Botswana	1,034	61		4	4
Lesotho	1,515	18		11	11
Malawi	7,044	120	34	34	68
Mozambique	13,791	15			
Swaziland	758	15		6	6
Tanzania	22,242	320	18	42	60
Zambia	6,640	110	33	29	62
Zimbabwe	8,406	150		32	32
Total	70,186	837	85	158	243

SOURCE: ISNAR Database (*in press*) and the World Bank Atlas (1987).
* Total is for professional staff with BSc degree or above.

The workshops have brought national universities (especially faculties of agriculture and veterinary medicine) closer to the national agricultural research institutes by providing a forum for looking at each other from various perspectives and fostering opportunities for better cooperation on managing research resources. These interests were powerfully manifested in the workshops in Tanzania, Malawi, Zambia, and the BLS countries (especially Swaziland).

Lessons Learned

We need to develop suitable training materials. At ISNAR efforts are being made to convert research and other types of materials into suitable pedagogical materials. Development of materials will involve an integrated process of literature search, state-of-the-art review, writing, rewriting, and synthesis of a variety of activities which validate the materials to ensure that prospective users will have a good understanding of the application of the concepts to their own situations. We recognize that development of good training materials is both a time-consuming and labor-intensive process.

In particular, participant evaluation of the workshops has clearly shown that materials based on case study approaches, role playing, simulation, and fieldwork, all of which emphasize concept application, are most preferred. This further underscores the need to relate the content of materials to the professional responsibilities of the research managers.

Furthermore, we have realized that in order to rapidly multiply training materials, the project should consider training persons to write cases. The need for case materials suited to the region has become even more apparent in the workshops already completed. Selected persons, representing NARS in the region, could be trained in case study methodology and assigned topics to research and prepare cases before testing them in the various workshops in the region.

Video technology has also been used to supplement and complement training materials, and participants have greatly appreciated this as it provides both relaxation and easy learning. The use of both commercially produced videotapes and materials taped at workshops will be promoted for blending with other materials to form an integrated system.

Even as we contemplate an intensive drive to develop materials at ISNAR, one quickly realizes the paucity of talent to undertake this task. Development of materials will undoubtedly require people with an interest in and understanding of the skills required for designing, writing, editing, typing, and reproducing the materials. Present staff at ISNAR are already overstretched.

We have further confirmed that these countries have specific training needs. Therefore, we have to tailor, modify, and adapt materials to suit the dynamic character of their NARS management. We need to further refine our needs assessment, making it more sensitive to the specific needs of the NARS.

We have also learned that there is the danger of losing our competitive edge in the region unless we continuously review our client needs and redesign and develop suitable materials to meet their needs in a timely way. There are other agencies (e.g., Winrock International, USDA/OICD, FAMESA, and ESAMI, etc.) which are operating in the region and would quickly step in to fill any gaps. However, where ISNAR has no comparative advantage, collaboration with other agencies is very much encouraged.

Our deliberate policy of involvement of indigenous persons to serve as facilitators at the workshops has helped us evaluate the potential capacity of the region to take charge of the project for a long-term sustained effort. The contributions from these people have been good and have not compromised the quality of the training; in fact, it has generated very positive support and accorded a high level of legitimacy to the project at the national levels.

According to training requirements identified through interaction with NARS managers, there is a need to teach general management principles and aspects of human and conceptual skills. This is because most of the mid- to senior-level research managers have not had any prior training in basic management principles, since they come from strictly biological science backgrounds. These subjects have been taught by the resource staff of national management training institutes and supported by ISNAR staff. The significance of this is the close collaborative arrangement forged between ISNAR and these institutes. Examples of this are the Institute of Development Management (IDM), which has a regional mandate for management training in Botswana, Lesotho, and Swaziland; the Zimbabwe Institute of Public Administration and Management (ZIPAM); and the Institute of Development Management in Tanzania, etc.

The management of linkage and collaborative

mechanisms of NARS with CGIAR institutes and other development agencies is a problem in many NARS. Though not directly within the purview of this project, it is necessary to address these issues since they sometimes gravely affect the running of a NARS, particularly where donor-supported projects are larger than national ones.

This project is being supported over a four-year period from 1986 to 1990. It is now at the midway point. It has already made tremendous gains in this initial phase to create better understanding of agricultural research management problems among some research managers in SADCC NARS. The training offered has mostly been of the overview type and will continue in this way for some of the NARS. It is hoped that in subsequent phases, with better understanding of the NARS and development of materials (e.g., case studies, etc.) the project will get into more problem-solving approaches.

Conclusion

Finally, NARS need to work continuously toward developing a strong culture in agricultural research management best suited to their environment. At present, the NARS are faced with the difficult task of managing culture changes, including consciousness-raising among NARS policymakers and managers for the need to increase productivity to generate appropriate technology for the farmer. This may mean adopting new work strategies, improving the scientific and research environment by challenging existing norms, improving the reward system for research, improving teamwork, and providing better research management tools and skills to the managers.

Managing culture change is imperative for the NARS if they are to meet the challenge posed by their countries for increased agricultural productivity. The process is viewed as continuous, requiring large investments in vital resources of time, money, and human capital. Through training interventions, this project is making an invaluable contribution to this process.

ANNEX I

PROSPECTUS

MALD/SACCAR/ISNAR WORKSHOP ON AGRICULTURAL RESEARCH MANAGEMENT

4 – 15 July 1988
Village 77 Hotel, Arusha, Tanzania

General Theme: Working towards an Improved Environment for Creativity and Productivity in Agricultural Research

A. INTRODUCTION

1. African countries have recognized that the traditional systems of agricultural production practiced by their farmers for hundreds of years can no longer support the ever-increasing demands of their spiralling populations. Furthermore, if these countries have to achieve any meaningful socioeconomic development, it is imperative that agriculture must provide the foundation and the base for industrial development. Many of the countries have responded to the challenge of reforming traditional agriculture by evolving new agricultural policies. This reform integrates an increase in investments in rural infrastructure, creating new and vigorous research and extension services and agricultural support services, such as credit, input distribution and marketing infrastructure. Nonetheless, food production in sub-Saharan Africa has declined in the last decade. Food production grew at only half the rate of population growth from 1970-84, creating serious shortfalls in some countries. Agricultural research can play a significant role by harnessing technology for food production, and the creation of a resource base for long-term strategy in food production. It is therefore important to ensure that African countries strive to strengthen their national agricultural research systems (NARS) for this task.

2. The International Service for National Agricultural Research (ISNAR), in close working relationship with the Ministry of Agriculture and Livestock Development (MALD) of Tanzania and others, has recognized organizational and management weaknesses which have constrained research. To be specific, some of these weaknesses revolve around the following issues: *policy aspects*–the relationship between national policy and agricultural research policy, priority-setting, resource allocation, etc.; *organizational issues*–structure and linkages within and between knowledge systems, with extension channels, policymakers, and external sources of knowledge; *internal management issues*–such as program formulation and budgeting, monitoring and evaluation, human resource development and management, communication and information management, and the development and management of physical resources. These issues must be addressed and steps must be taken to strengthen them if the NARS are to achieve their goal of delivering technological outputs to national agriculture.

3. Training of incumbent and future agricultural research managers in the MALD is viewed as a means of contributing to organizational change and ultimately the improvement of systems performance. Among the expected changess is a better environment for creativity of staff, improved performance, and an increased adaptability to a dynamic world. A strategy to effect such change is the provision of tools and techniques in management, specifically in research management.

4. The Southern African Center for Cooperation in Agricultural Research (SACCAR) and ISNAR have teamed up in a venture to assist NARS in the SADCC member countries, to strengthen their capacity for agricultural research management. Under this project, training courses are organized at the national level to respond directly to specific management needs of the individual systems. The

first workshop for 18 middle- to senior-level research managers in MALD was held 13-17 July 1987 at IDM, Mzumbe-Morogoro.

5. ISNAR acts as the executing agency of this SACCAR project. Funding of the project is through the Canadian International Development Agency (CIDA), Overseas Development Administration (ODA) (UK), United States Agency for International Development (USAID), SACCAR, and ISNAR.

B. THE SECOND TANZANIA NATIONAL WORKSHOP

6. This workshop is offered under the auspices of the SACCAR/ISNAR Project for Strengthening Agricultural Research. The Ministry of Agriculture and Livestock Development (MALD) and its parastatal organizations (TARO, TALIRO, TPRI, and Uyole Agricultural Centre) and Sokoine University of Agriculture are joint sponsors of the workshop.

6.1. *Course objectives.* The course objectives are

- to promote awareness of participants about research management and to identify problematic issues in agricultural research management in the national agricultural research system in Tanzania;
- to use issues identified in (a) to devise plans for future MALD/SACCAR/ISNAR training activities;
- to provide an opportunity for interaction and exchange of experiences among NARS managers for them to learn from each other and improve or strengthen their working relationship.

6.2. *Learning objectives.* The learning objectives are

- to enable participants to acquire and be conversant with concepts in general management and research management;
- to enable participants to acquire tools and techniques in agricultural research management;
- to provide an opportunity for NARS managers to establish linkages with trainers and training institutions in research management so as to promote long-term cooperation in establishing individual knowledge in research management.

7. ***Workshop Topics and Schedule***

The topics are provided in the workshop schedule. These can be categorized under the following general areas:

7.1. *Policy aspects*

- priority-setting in NARS;
- strategic and research master planning.

7.2. *Organizational issues*

- organizational options of NARS;
- management of linkages within and between knowledge systems with extension channels, policymakers, and external sources of knowledge.

7.3. *NARS internal management issues*

- program formulation and program budgeting;
- monitoring and evaluation;
- human resource development and management;
- performance planning and performance appraisal;
- organizational behavior aspects–conflict and conflict management, leadership, motivation, delegation, and time management;
- management and development of physical resources.

8. ***Participants***

The participants of this workshop are middle- to senior-level research managers from the parastatal institutions: Tanzania Agricultural Research Organization (TARO), Tanzania Agricultural Livestock Research Organization (TALIRO), Tropical Pesticides Research Institute (TPRI), Uyole Agricultural Centre (UAC), Sokoine University of Agriculture (SUA), the Zanzibar Agricultural Research Council (Ministry of Agriculture, Livestock and Natural Resources of Zanzibar), the Directorate of Research and Training, and Directorate of Extension. The following is the provisional list of participants nominated by the institutions:

9. ***Pedagogical Methods***

The sessions will be interactive using lectures, case studies, simulation exercises and games, movies, group discussions and working group presentations.

Cases from the region will be emphasized in the workshops.

10. ***Resource Persons***

Taken from ISNAR and the ministries of agriculture in Tanzania.

11. ***Logistic Arrangements***

11.1. *Venue*–The workshop venue will be Village 77 Hotel, Arusha, Tanzania, which offers excellent facilities.

11.2. *Accommodations*–Participants will be accommodated at the Village 77 Hotel.

11.3. *Transportation*–Travel of participants to Arusha will be met by their respective organizations; the organizers will meet costs only in exceptional cases.

11.4. *Out-of-pocket expenses*–Full board accommodation is provided; in addition, a modest sum of money (in local currency) will be paid to participants to meet their out-of-pocket expenses.

12. ***Certificate***

Each participant will receive a certificate of satisfactory attendance and completion at the end of the workshop.

13. ***Date***

The workshop is scheduled to start on 4 July and to end 15 July. Participants should be in Arusha by 3 July and expect to leave by 15 or 16 July 1988.

14. ***Contact***

Enquiries should be directed to Mrs. V.F. Malima, Directorate of Research and Training, Ministry of Agriculture and Livestock Development, P.O. Box 9071, Dar-es-Salaam. Telephone: 27231.

MALD/SACCAR/ISNAR WORKSHOP ON AGRICULTURAL RESEARCH MANAGEMENT

4-15 July 1988

VILLAGE 77 HOTEL, ARUSHA, TANZANIA

Theme: "Working towards an Improved Environment for Creativity and Productivity in Agricultural Research"

WEEK 1

SESSION	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1.	Opening Introduction and Course Overview	Essentials of Management	Program Formulation Case: Program Formulation in TALIRO	Presentation of Working Groups on Organizational Change in Samaru, Nigeria	Monitoring and Evaluation
2.	Organization and Planning of Crop and Livestock Research in Tanzania	Strategic and Research Master Planning	Priority Setting Movie: Priority Setting	"	Working Group Session on Monitoring and Evaluation
3.	The Role of Sokoine University in Agricultural Research in Tanzania	Movie: Strategic and Research Master Planning in Malawi	Organizational Options in NARS	Use of Logframe in Research Planning	Presentation by Working Groups on Monitoring and Evaluation Movie: Impact Evaluation
4.	International Cooperation in Agricultural Research. Regional Cooperation in Agricultural Research	Working Group Sessions on Strategic Planning	Working Group Sessions: Read and Prepare case on Organizational Change in Samaru, Nigeria	Working Group Sessions on Strategic Planning continues	Inventory on Human Resource Management

WEEK 2

SESSION	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1.	Management of Linkage to User Systems: Research Extension	Future Manpower Requirements for Agricultural Research in Tanzania	Presentation by Working Groups on Strategic Planning	Delegating Movie: Delegating	Planning of Future MALD/SACCAR/ISNAR Activities in Tanzania
2.	Case: The Organization and Management of Research and Extension Linkage in Tanzania	Human Resource Management in Agricultural Research in Tanzania	Leading and Leadership Styles Movie: Leadership	Time Management	Workshop Evaluation
3.	The Management of Linkage to User Systems: Farming Systems Research in Tanzania	Considerations for Performance Planning and Appraisal Movie: Revelations	Development and Management of Physical Resources	(continued) Movie: Salvation	Presentation of Certificate and CLOSING
4.	The Management of Agricultural Technology Development & Transfer Systems in Tanzania	Conflict and Conflict Management	Motivating Movie: Motivation		

ANNEX II

LIST OF MANAGEMENT TRAINING WORKSHOP MATERIALS GENERATED IN REGION

(up to September 1988)

1. SACCAR:
   Regional Cooperation in Agricultural Research and Training: Objectives, Strategies, Issues and Prospects of the SADCC Initiative
   —D.M. Wanchinga

2. The SACCAR/ISNAR Southern African Agricultural Research Management Training Project
   —L.O. Abe

3. NARS
   The Role and Functions of Networks in NARS
   —L.O. Abe

4. Internal and External Communications at Research Stations
   —L.O. Abe

5. The Role of the University of Malawi in the National Agricultural Research System
   —S.S. Chiyenda

6. Organization of Agricultural Research in Botswana
   —L.P. Gakale

7. Aspects of Research Station Management: An Overview
   —G.Y. Mkamanga

8. Organization and Structure of NARS: Analytical Framework
   —P. Sachdeva

9. Organizational Design: Concepts
   —P. Sachdeva

10. The Functions of Management in an Organization
    —J.P. Msimuko

11. Functions of Management
    —P. Sachdeva

12. Managerial and Organizational Productivity
    —P. Sachdeva

13. Malawi National Agricultural Research Strategic Planning
    —D.R.B. Manda

14. Strategic and Master Planning
    —P. Sachdeva

15. Notes on the Preparation of a Strategic Agricultural Research Plan
    —T.A. Taylor

16. A Proposal for Strategic Planning Model for Agricultural Research in Lesotho
    —by course participants

17. Guidelines for Strategic and Master Planning
    —by course participants

18. Guidelines for Strategic Planning Model for Agricultural Research in Swaziland
    —by course participants

19. Botswana Livestock Research Policy and Strategies
    —L.L. Setshwaelo

20. Guidelines for Strategic Plan for Botswana NARS

21. Human Resource Management in Livestock Research in Tanzania: A Case Study
    —A.M. Macha

22. Appropriate Human Resources for Agricultural Research in Malawi
    —D.R.B. Manda

23. Management of Human Resources: Bureaucratic Wheels in Motion
--R.B.C. Moyo

24. Management of Linkage to Knowledge Systems
--L.O. Abe

25. The Search for the Elusive Link: ISNAR's Research-Technology Transfer Linkages Project
--R.V. Cuyno

26. The Management of Linkages to User Systems: The On-farm Adaptive Research Programme in Malawi
--R. Tinsley

27. Managment of Research and Extension Linkages: Concepts and Application in Zimbabwe
--E.E. Whingwiri

28. Issues in the Management of Physical Resources
--L.O. Abe

29. Issues in Management of Physical Resources in Agricultural Research Stations
--H.J. Ndala/L.O. Abe

30. Motivation
--J.E. Chipeta

31. Motivation
--Management Services Board

32. Behavior Traits
--Management Services Board

33. Motivation and Behavior

34. Leadership and Managership
--J.E. Chipeta

35. Leading and Leadership
--Q.O. Mahasa

36. Decision Making
--J. Msimuko

37. Leadership and Management Styles
--A. Zinyemba

38. Delegation
--J.E. Chipeta

39. Delegation: The Most Powerful Tool in Your Managerial Kit
--Q.O. Mahasa

40. Delegation
--J. Msimuko

41. The Practice of Delegation
--A Zinyemba

42. Time Management
--Q.O. Mahasa

43. Time Management: Planning and Organizing Work
--G. Mulenga

44. Time Management
--Training Management Bureau, Ministry of Public Service, Zimbabwe

45. Conflict and Conflict Resolution
--J.C.O. Kidiro

46. Conflict and Conflict Management
--Q.O. Mahasa

47. Research Management, Agricultural Knowledge Systems and Research Utilization
--R.V. Cuyno

48. The Research System and Research Utilization: How to Reach the End-users
--R.V. Cuyno

49. What Makes a Tanzanian Worker Tick?
--B. Ngwilulupi

50. Notes on Networking, Coordination and Teambuilding
--R.V. Cuyno

51. Duties of a Research Project Coordinator (and his assisting colleagues)
--D.R.B. Manda

52. Management of Agricultural Research
--D.R.B. Manda

53. Manpower Requirements for the Agricultural and Livestock Research in Tanzania
--J.J. Mende

54. Notes on the Management of Agricultural Technology Transfer Systems
—T.A. Taylor

55. Management of Agricultural Technology Development and Transfer Systems in Tanzania
—J.M. Teri

56. Swaziland: Profile of a Productive Manager

57. Job Descriptions

58. Botswana: Qualities of an Agricultural Research Manager

59. The Role of the University of Swaziland: Faculty of Agriculture in Agriculture and Research
—B.M. Dlamini and G.T. Masina

60. The Adaptive Research Programme in Malawi: Philosophy and Methodology
—W.T. Kawonga

61. A Review of Agricultural Research Planning in Zambia
—I. Kaliangile

62. Program Formulation in Agricultural Research in Zambia
—I. Kaliangile

63. Proposed Monitoring and Evaluation System for Zambian NARS
—I. Kaliangile

64. The Role of the School of Agricultural Sciences of the University of Zambia in National Agricultural Research
—W.N.M. Mwenya (MSB)

65. Agricultural Research in Zanzibar
—S.S. Nasser

66. Policy of Crops Production Development and Research in Lesotho
—N.T. Peshoane

67. The Process of Agricultural Planning, Budgeting and Programming in Lesotho
—T.J. Ramotsoari

68. Organizational and Planning Aspects of Crop and Livestock Research in Tanzania
—F.M. Shao

69. The Management of Commodity Research Programmes in the Department of Agricultural Research in Malawi
—P.K. Sibale

70. The Management of Adaptive Research Planning Team (ARPT) in Zambia's Research Organization
—L.P. Singogo

71. The Role of Sokoine University of Agriculture in Agricultural Research in Tanzania
—J.M. Teri

72. Case Study: The Minoria Civil Service

LIST OF TRAINING VIDEO CASSETTES

1. The Unorganised Manager: Damnation	46 3159/40
2. The Unorganised Manager: Salvation	46 3160/39
3. The Unorganised Manager: Revelations (subtitled)	46 3183/26
4. Delegating (subtitled)	46 3135/11
5. Styles of Leadership (subtitled)	46 3664/23
6. Motivation: The Classic Concepts	46 3188/11
7. Trees of Plenty	
8. Teams and Leaders	46 3181/12
9. Unfinished Miracle	
10. ISNAR	*
11. Ekona Research Station	
12. Managing Success in Scientific Research "Beyond Number People"	
13. An End to Pounding	

14. Problem Solving: Basic Principles 46 3874/14

15. Harnessing the Monsoons

16. Strategic Planning in Malawi DAR
D.r. Manda
(30/3/88)

17. Strategic Planning
(BLS workshop) A. Taylor
(May '88)

18. Priority Setting A. Bottomley
(0000)-4220

Logframe D. McLean
4220-13114

Monitoring and Evaluation D. McLean
13114-20109

Impact Evaluation A. Bottomley
20109

19. Problem Solving: Basic Principles 46 3874/14

VIDEO TAPES–90 MINUTES

1. Lecture on Physical Resources L.O. Abe

2. Research Administration in
Zambia: B.K. Patel
What Managers Do M. de Lattre

3. Human Resource Management
Performance
Planning & Appraisal P. Sachdeva

4. Aspects of Research Station H. Dhliwayo
Management

5. NARS: Who Is Involved? D.R.Manda/
R.Cuyno

6. Logframe/Monitoring
& Evaluation D. McLean

7. Budgeting in the Ministry
of Agriculture, EnessMabambo/
Zambia Jag Trana

8. a. Effectiveness (2784)
b. Personal (5040) GROUP A

9. Visual Aids–Eye Contact (2796) GROUP B

10. Malawi "DAR" Planning Process D.R. Manda

11. Functions of Management:
Levels & Roles R.Cuyno/P.Sachdeva

12. Zambia Workshop:
Oral Comm. Presentation Ekona visitors

13. Effective Presentation of Station
Program

14. Zimbabwe: Research-Extension
Linkage E. Whingwiri
Zimbabwe: On-farm Reseach B. Mombeshora

15. Problem Solving R. Cuyno

16. Methodology for Priority Setting A. Bottomley

17. Functions of Management R. Cuyno

18. Managing Coordinated Research
Programs P.K. Sibale

19. DAR Strategic Planning and
Management D.R. Manda

20. Research Impact Evaluation A. Bottomley

21. BLS Workshop
Strategic Planning for NARS:
Kenya NARS Case T.A. Taylor

22. Future Manpower Requirements
in Tanzania J.Mende(12/7/88)

23 Strategic Planning Group

24. Presentation of Strategy Plans, Groups I, II, III

25. Strategic Planning and Kenya Case Study: Part I
5/7/88

26. Strategic Planning and Kenya Case Study: Part II
5/7/88

27. Management of Research and
Extension Linkage T.A.Taylor (11/7/88)

28. Farming Systems Research in Tanzania 11/7/88

29. The Role of the Sokoine University in Agric. Research in Tanzania Dr.Semoka (6/7/88)

30. Program Formulation T.A.Taylor (6/7/88)

31. Programming and Budgeting in TALIRO A.Macha(6/7/88)

LIST OF VIDEOTAPES

1. The Unorganised Manager: Salvation 46 3160/39

2. The Unorganised Manager: Revelations 46 3183/26

3. Delegating 46 3135/11

4. Styles of Leadership

5. Motivation: The Classic Concepts 46 3188/11

6. Program Formulation, T.A Taylor (6/7/88)

7. Strategic Planning in Malawi 'DAR', Mr. Manda

8. Management of Research Extension Linkage T.A. Taylor
   Management of farming systems research

9. ISNAR

10. Harnessing the Monsoons

11. Logframe, Priority setting, Monitoring and Evaluation
    Impact evaluation

ANNEX III

MAWD/SACCAR/ISNAR WORKSHOP ON AGRICULTURAL RESEARCH MANAGEMENT

29 August to 9 September 1988

WORKSHOP EVALUATION

Your cooperation in completing this questionnaire will be highly appreciated as the information will be useful in planning future training events in Zambia and other countries.

Resource persons especially will also benefit by improving on their materials and presentation.

A. ***Evaluation***

1. In general, I would rate the workshop as:

   5. Excellent 4. Very Good 3. Good 2. Fair 1. Poor

2. List three strengths of the workshop:

   _____

   _____

   _____

3. List three weaknesses of the workshop:

   _____

   _____

   _____

   _____

B. ***Please evaluate the topics covered and their effectiveness:***

	Content	Usefulness to Work	Presentation	Time Allotment: Too Short	Just Right	Too Long
1. Functions of Management	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
2. Review of Research Planning in Zambia	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
3. Role of University of Zambia in National Agricultural Research	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
4. Programme Formulation	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
5. Programme Formulation in Zambia NARS	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
6. Priority Setting	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
7. Management of Research-Extension Linkage	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
8. Management of Adaptive Research	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
9. Performance Planning and Appraisal	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
10. Motivation	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
11. Leadership	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
12. Conflict and Conflict Management	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
13. Aspects of Research Station Management: Mt. Makulu Research Station	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
14. Time Management	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
15. Delegating	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
16. Decision-making	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
17. Case Study on the Minoria Civil Service	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–

	Content	Usefulness to Work	Presentation	Time Allotment Too Short	Just Right	Too Long
18. Communications	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–
19. Strategic Planning Exercise	5 4 3 2 1	5 4 3 2 1	5 4 3 2 1	–	–	–

C. ***Please rate the other features of the workshop:***

	Very Good	*Good*	*Fair*
1. Use of videotapes in instructions			
2. Accommodations and meals at Garden House Hotel			
3. Entertainment			
4. Organization and management of workshop			

D. Please give comments on any issues you have on the workshop:

SESSION 5

PERFORMANCE APPRAISAL

PERFORMANCE REVIEW AND DEVELOPMENT IN AGRICULTURAL RESEARCH ORGANIZATIONS*

Paul Bennell

Introduction

The main objective of the agricultural research manager's job is to manage the performance of his or her staff. Management specialists generally agree that the design and management of performance planning and appraisal schemes is of central importance in this performance management process. Many also believe that staff appraisal has a greater potential for improving performance than any other area of human resource management. Realizing this potential is a major challenge facing all managers.

The purpose of this paper is to examine the actual and potential role of annual performance appraisal schemes (APAS) for staff of agricultural research organizations working in the developing country context. What is perhaps most striking is that, despite the alleged centrality of APAS for effective human resource management, agricultural research managers typically spend so little of their time formally appraising the performance of their research scientists and technical and administrative support personnel. Indeed, in many agricultural research organizations (ARO), staff appraisal is regarded by research managers as a bureaucratic encumbrance that is complied with in a ritualistic, almost perfunctory manner. The necessary forms and procedures are completed as quickly as possible so that research managers and scientists can get on with the serious but exciting job of creating new knowledge and developing new agricultural technologies.

Why do agricultural research managers generally attach so little importance to APAS? One obvious reason is that appraising the performance of scientists, in common with other "knowledge workers", is not easy (or, many would say, even possible) given the complexity, uniqueness, and novelty of the tasks carried out by the ARO. To do this every four or five years when the staff member is seeking promotion is difficult enough, let alone on an annual basis. Another more pragmatic reason is that many AROs in developing countries do not have the necessary room for manoeuvre needed to introduce an effective APAS because they are tied to inappropriate civil service appraisal schemes. And, what is the point of having an APAS when no significant financial rewards are attached to the appraisal process?

These are important reasons which cannot be overlooked. However, it is equally true that many agricultural research managers have an insufficient understanding of the role of APAS. This is not a problem unique to agricultural research. It has been commonly observed among research managers in all areas of research throughout the world. Thus, in general, "technical leaders fail to understand the dynamics of the process wherein the manager and the employee talk meaningfully about performance improvement, about measurement, and about how the individual can grow in his or her capability and career" (Miller, 1986:15).

A typical response of research managers is that research personnel and, in particular, scientists don't want to be appraised directly by their managers since they are sufficiently well self-motivated and capable of managing their own work. Moreover, such a process is antithetical to the high level of collegiality among peers that is deemed necessary for effective research.

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* *This is an abridged version of a paper, Annual Performance Appraisal Schemes in Agricultural Research Organizations. Mimeo, ISNAR, October 1988. Copies are available on request.*

Appraisal involves measuring differences in performance between individuals–most research managers do not like doing this, especially when they have to work closely with their colleagues on a daily basis.

Such concerns are understandable. It is equally apparent however that agricultural research directors are increasingly concerned about the inadequacies of their staff appraisal schemes and many are therefore actively seeking to develop new schemes which are appropriate to their specific institutional needs. This concern has been consistently expressed at numerous workshops and seminars organized by ISNAR in recent years.

The following discussion will first review briefly what we have termed the traditional approach to APAS. We will then consider an alternative approach called performance review and development which has been widely recommended by management specialists as being a more appropriate and thus effective performance appraisal scheme.

1. Performance Appraisal in Perspective

The annual appraisal process consists of formal interactions between the appraiser and the appraisee over the course of a year. These interactions are formal in the sense that they take place at regular, predetermined times and seek to achieve clearly specified objectives according to certain procedures. Information about the performance of the appraisee is collected using various types of written documentation. It is important to stress that we are concerned here only with *annual* performance planning and appraisal of the individual ARO employee. In most AROs, performance is also appraised over longer periods of time, usually when an employee seeks promotion from one grade or job position to another. Although the two appraisal processes are normally interrelated in various ways, they are qualitatively different, both in terms of the actual process of evaluation and their roles in the overall management process. The need for comprehensive and systematic periodic promotion appraisals for agricultural research personnel is generally well accepted by both senior managers and research staff in AROs. As we shall see, there is usually much less acceptance of the need for comprehensive and systematic annual performance appraisals.

The annual appraisal of personnel performs all or some of the following functions in facilitating the management of an organization's human resources:

- *evaluation:* to enable the organization to evaluate staff in order to allocate organizational rewards in the form of annual salary increases (normally fixed increments) and major job promotions;
- *auditing:* to discover the work potential, both present and future, of individuals and departments;
- *motivating staff:* to reach organizational standards and objectives;
- *discovering training needs:* by exposing inadequacies and deficiencies that could be remedied by training;
- *developing individuals:* by advice, information and attempts at shaping their behavior by praise or punishment;
- *planning:* by developing work plans with the individual.

Some of these functions tend to conflict with each other, most notably the formal evaluation of individuals and the motivation and development functions.

1.1 The traditional appraisal approach

What can be called the traditional philosophy or approach to staff appraisal commonly prevails in AROs in developing countries. There are some AROs where this is not the case but they are exceptional. The traditional appraisal philosophy has a number of general characteristics. The most important of these are described below.

Evaluation. The evaluation of the employee is considered to be the primary objective of the appraisal process. This is a limited conception of the appraisal process because it excludes other major appraisal functions, most notably the explicit incorporation of performance planning and the motivational and developmental needs of the individual appraisee. The preoccupation with evaluation is usually most marked in ministry-based AROs that are required to follow general civil service appraisal policies and practices that typically have remained largely unchanged for many

years. Here, the appraisal is concerned to ensure the accountability of the ARO employee as a civil servant to government and the public at large. It is therefore backward rather than forward looking in the sense that the major concern is with evaluating the past performance of the individual rather than using the evaluation in a way that can assist in improving performance in the future.

Rewards and sanctions. Given that the traditional appraisal approach focuses on evaluation, the main concern of both managers and employees is with the effect the appraisal has on the allocation of financial rewards both in the short term and the long term. Unlike their counterparts in the private sector, managers of public-sector AROs usually have little or no scope for making variable annual salary awards on an individual basis. Typically, the main outcome of the appraisal is whether the staff member should be awarded a fixed salary increment. Not surprisingly, where these increments are relatively small and/or are awarded virtually automatically, little importance is attached to the appraisal either by management or employees. The extent to which annual performance ratings are taken into account in assessing the suitability of an employee for major promotions can, however, be an important factor.

Top-down, centralized, and secretive. The traditional appraisal approach tends by its very nature to be top-down and centralized since the appraisal is administered by more senior management with limited participation by the appraisee or even his/her immediate supervisor. Furthermore, the whole process is often shrouded in secrecy, with confidentiality of all reporting processes being the norm. Frequently the results of the appraisal are not even divulged to the appraisee. As noted above, the award of a salary increment *is* the result. In some situations, it is only when the appraisee is rated as being unsatisfactory that the individual is informed. Thus, in general, the traditional approach is an impersonal, bureaucratic process.

The appraisal instrument. The written appraisal form is of preeminent importance in the traditional appraisal approach. Where taken seriously, ARO managements often become excessively preoccupied with the design of this form and, in particular, the construction of rating schemes with which to assess the behaviors and results of the appraisee. The form is repeatedly redesigned, often becoming increasingly complex and elaborate. Equally common are appraisal forms that have vague and ambiguous rating criteria, many of which have little to do with actual on-the-job performance. Numerical points rather than written descriptions are typically preferred since these are seen to be more objective and enable individual appraisals to be compared.

Credibility, anxiety, and commitment. Typically, the traditional appraisal approach lacks credibility among both appraisers and appraisees. Managers do not like "playing God" and generally lack any strong commitment to the appraisal process. This is often manifested in excessive leniency and bunching of rating scores when completing the appraisal form, i.e., nearly everyone is assessed as "good" or "very good" or, as Caplow puts it, "no one but the rater's sworn enemies receive 'fair' or 'poor'" (Caplow, 1982:132). The appraisal process thus becomes a meaningless ritual. If employees care at all, the APAS tends if anything to engender anxiety and interpersonal conflict and *de*motivates rather than motivates: "Most appraisal systems are more noteworthy for the angst they create than the results they achieve" (Zemke, 1985:24).

2. Improving the Appraisal Process: An Overview

Dissatisfaction with the traditional approach to APAS has resulted in a comprehensive reassessment of individual performance appraisal. On the basis of this reassessment, a broad consensus has emerged among management specialists and practitioners concerning the need for a new approach to APAS. While there are still important differences of opinion about what should be done, there is general agreement about the broad objectives of APAS and how they should be achieved.

The essential features of this new approach to APAS are summarized below.

- The overriding objective of APAS is *to improve individual performance and productivity* in a purposeful manner.

In order to achieve this, it is necessary that:

- Information is assembled and shared, which provides both the individual, the manager, and the organization as a whole with a *learning experience*.

- The appraisal process is accorded *central importance* in the management of human resources and thus of

the organization as a whole. From being of only marginal concern to managers, APAS should become one of the key vehicles for managing personnel and improving their performance. Often, therefore, it is only feasible to introduce this new approach to APAS as part of a concerted attempt to create a new organizational culture. There is always the danger that APAS can be expected to do too much.

- The individual appraisee and his/her needs become the *focus of the appraisal process*. Organizational needs for appraisal of staff members must still be met but these should be of only secondary importance.

- The appraisal process is *dynamic* and *forward looking*. The traditional APAS is concerned only with looking back at an individual's performance. The new approach, on the other hand, is more concerned with the *development* of the individual in the future. It is therefore dynamic and interventionist rather than simply passive.

- The appraisal process serves *multiple functions*. Not only does it *evaluate* the individual performance, it helps management to *motivate* staff, *plan and monitor* their work activities, and generally *develop* their work-related skills. A more appropriate description for the appraisal process is therefore annual performance planning and appraisal.

- The appraisal process, in seeking to improve individual performance, should be strongly *goal-oriented*.

- There is a high level of *participation* in the appraisal process by individual staff members. This in turn requires that there is considerable *openness* between managers and their staff during the appraisal process. The appraisal interview is of greater importance than the appraisal form.

- Considerable *management commitment and competence* in appraising staff is necessary. The appraisal process is "an act" that has to be learned through training and supervised experience.

- Performance must be *accurately, reliably, and equitably* measured. However, this will always involve some degree of *subjectivity*. Managements need to accept and come to terms with this.

- The appraisal process should be *continuous* rather than discrete.

2.1 Motivation: Information feedback, goals, and participation

The explicit use of the appraisal process to motivate staff is one of the most important features of the new approach to APAS outlined above. Motivation is enhanced in three distinct but interrelated ways. First, the appraisal process enables the individual staff member to obtain a clear, unambiguous, and comprehensive assessment of his performance during the previous year. This is essential because individuals, regardless of their culture, have a powerful psychological need to know where they stand in the eyes of their managers. Failure to receive adequate feedback of this kind results in internal tensions and anxieties in the individual staff member which adversely affect motivation and thus performance. For research scientists, in particular, while they may be required to work on their own for long periods and be "self-starters," they still require detailed feedback on their performance. As Ahmad points out, "interest, praise, and recognition are among the most valued rewards of R&D professionals" (Ahmad, 1981:76).

Many managers believe that their staff already know where they stand, without having to undertake a formal appraisal process. However, interviews with individual staff members rarely bear this out. While it is common for the manager and the individual to discuss particular problems, rarely do they sit down and reflect on the job as a whole.

The second way in which the new appraisal process seeks to enhance motivation is by setting well-defined and suitably challenging goals. Again, research has clearly shown that individuals have a fundamental psychological need to know what is expected of them in the future and that well-defined goals are strong motivators.

Third, allowing individuals to participate actively in the appraisal process has strong positive effects on their motivation. While AROs are supposed to be participative and collegial in terms of their management style and decision-making processes, this rarely extends to the appraisal process itself. Because participation is so minimal, it is easy for the appraisal process to be subverted or even rigged.

The annual appraisal interview provides the main opportunity for individual participation in the appraisal process. This is a key event for both the individual and manager because it is here that past performance is reviewed and future work goals and specific actions for

performance improvement are discussed. Critical self-appraisal by the appraisee is seen as an important part of the preparation for the appraisal interview.

Participation should also extend to the actual design and introduction of the appraisal scheme. It is essential that any scheme meets individual needs and goals as well as those of the organization. Thus all staff members must be consulted about the utility, objectives and scope of the proposed scheme.

2.2 Management commitment and competence

The new approach to performance appraisal highlights the need for high levels of management commitment and competence. The tendency in the past has been to focus mainly on the design of appraisal forms and related procedures with relatively little attention being devoted to the role of managers in the appraisal process.

Without high levels of management commitment to the new appraisal process, it is obvious that it will founder: "The focus on papers and processes–how the evaluation forms should be designed, how the information should be collected and presented, how the meeting should be conducted and so forth–is misplaced effort. The real issue is: does line management buy it?... If management does not own the system, forget it. The game is over" (Zemke, 1985:29). Thus, the motivation of management to do a good job in appraising staff is probably the most important factor in determining the success of this approach.

For the majority of agricultural research organizations, such an approach represents a major departure from earlier methods of appraisal. The new approach clearly involves managers giving far greater attention to human resource management, since it makes explicit the overriding responsibility of the manager to improve the performance of his/her staff on the basis of a detailed understanding of their needs as individuals and how these can be met. It also entails acceptance of considerably greater responsibility in judging the performance of staff. The whole appraisal process, being a central part of human resource management, is more time consuming than before. Managers have to be convinced therefore that the payoffs will be sufficiently large to justify this increased level of effort and exposure.

To gain acceptance, this new appraisal process must be strongly supported by senior management. As noted earlier, it is ultimately counterproductive to try to foist a new scheme on an organization's management. However, because such a scheme is a major intervention into the "culture" of an organization, it is inevitable that senior management must play a very active promotional role in ensuring its successful implementation. Most agricultural research managers are likely to view such changes with caution, if not outright resistance, at least in the initial stages of discussion. Of particular concern is likely to be the increased participation and openness of the new approach to annual appraisal. Managers correctly recognize that "the appraisal interview is likely to be one of the most difficult interactions likely to be encountered by a manager" (Pratt, 1984:22). While probably unhappy with the existing appraisal process, they are inevitably fearful of a new form of appraisal which entails important changes in their expected responsibilities and skills as managers of people. Many are likely to justify their resistance by arguing that such an appraisal scheme is incompatible with local culture.

These apprehensions by research managers are understandable. They can only be dealt with effectively by developing the competence of managers to effectively manage the new appraisal process. More than anything else this requires training in the necessary appraisal skills.

3. Performance Review and Development

We have described above some of the key features of what we have called the new approach to performance appraisal. In practice, of course, appraisal schemes based on this approach are different in important respects, in particular the emphasis which is given the various appraisal functions (evaluation, motivation, planning, etc.) and the specific modalities for carrying out the appraisal.

A good example of how the key features of this new approach have been integrated in a comprehensive and coherent manner is the appraisal scheme called performance review and development (PRD) (see Olson 1981).

As can be observed in Figure 1, PRD comprises six interrelated sets of activities which enable the manager to review past and current performance and plan for future performance. PRD focuses on job definition and annual work goals as the primary means for the

assessment of past performance. The appraisal interview is the principal means for the communication of this assessment to the staff member. A future course of action is mutually agreed upon by the manager and the staff member. This specifies operational task objectives in the form of an annual work plan and also identifies specific areas for performance improvement which often will involve training activities.

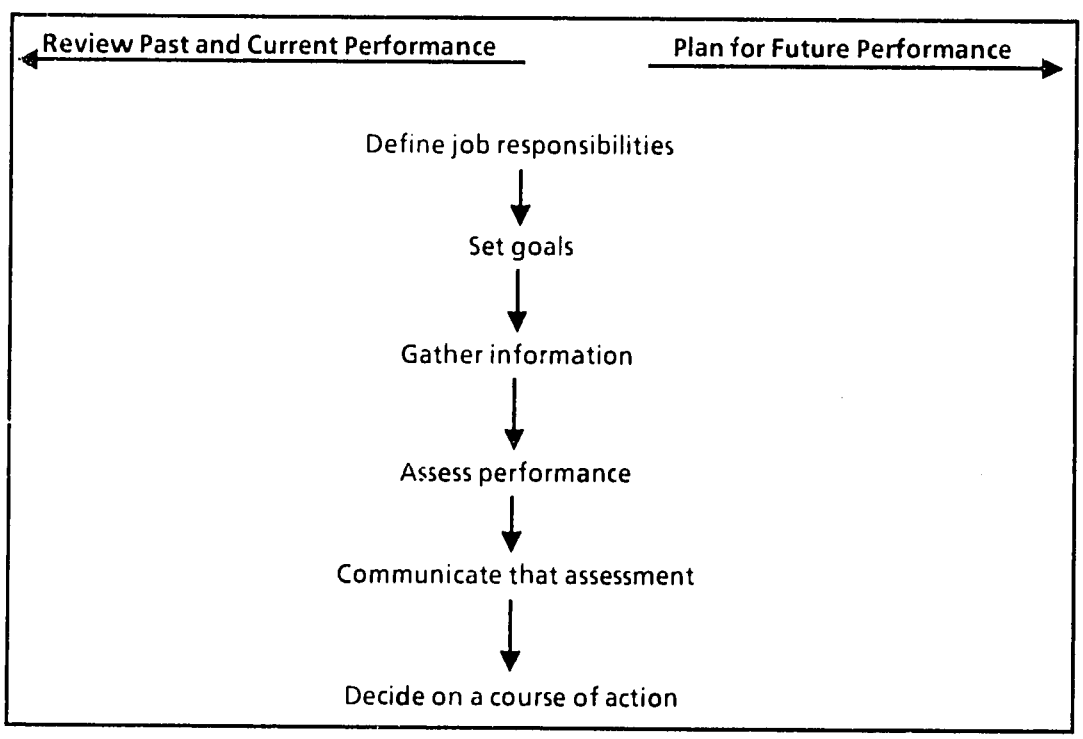
The PRD appraisal scheme is based on individual performance criteria which not only are result-oriented but are clearly linked to well-specified performance objectives. These objectives can be changes in individual behavior, but actual research undertaken or other outputs are generally given most emphasis.

Many appraisal specialists believe that "output-by-objective" APAS are most desirable, especially for research and development organizations which have relatively sizeable numbers of professional and higher technical personnel. Odiorne states that "the best standards for appraisal are those that measure results against goals or objectives set for the organization as a whole or part of it" (Odiorne, 1985:261). Similarly Patten argues that they are "the best tool available for performance appraisal" (Patten, 1982:127).

The implementation of PRD requires that the general objectives of each activity area undertaken by the employee is broken down into detailed short-term objectives which, wherever possible, are quantified in terms of expected outputs and target completion dates. The setting of challenging realistic objectives by the manager and employee enhances motivation and serves an essentially developmental function in improving the performance of the individual.

PRD is another name for the now widely used management system called management by objectives (MBO). MBO/PRD management schemes have been

Figure 1. The main elements of PRD



Source: R.F. Olson (1981:35)

criticized for the following reasons: first, because goals and objectives are set for each individual employee, i.e., they are individualized, this makes the allocation of rewards more difficult. Second, by placing particular emphasis on measurable standards, there is a danger that more intangible factors which are equally important for overall organizational effectiveness are ignored or undervalued. Furthermore, it is often very difficult to develop meaningful and reasonable objectives. As Ahmad points out, "it is one thing to say that outcomes must be measured against objectives but another far more complex thing to come up with a list of assessment items which does justice to the entire range of an individual's professional and organizational involvements" (Ahmad, 1981:73). Third, MBO tends to encourage a short-term rather than a long-term orientation. And finally, it is argued that the organizational/managerial environments in the majority of developing countries are fundamentally incompatible with such an approach. Faced with these problems and difficulties, Badawy observes that, even in developed countries, research managers "tend to reject MBO, and dismiss the possibility of its successful implementation" (Badawy, 1984:36).

Supporters of MBO/PRD respond to criticisms of this kind by arguing that MBO is logical, simple and universally applicable. Whatever the job, performance goals can always be defined. In their view, many of the problems that arise with MBO are due to "misapplications" which can be avoided as long as managers are well trained and committed to what is a new approach to management.

4. Implementing PRD

Utilizing MBO/PRD-type performance criteria involves two distinct sets of activities-goal setting and performance assessment.

It is the joint responsibility of the appraiser *and* appraisee to set the latter's annual performance goals and objectives. Appraisers need therefore to undertake a careful analysis of how their section, department (or whatever area they are responsible for) is functioning and where there is potential for beneficial change. This analysis would seek to answer the following kinds of questions:

- What areas for improvement in efficiency can you identify if you are to use your staff to best effect?
- What activities will have the greatest success in improving your section's overall success?
- What "failures" occurred last year and how can they be avoided in the future?
- What contribution do you expect from each member of your staff?

Once this analysis has been undertaken, managers should be in a good position to develop appropriate goals and objectives for their staff.

The *action plan* forms the basis for setting individual goals. The appraisee is first requested to provide the following information: (1) job title and purpose of the job, (2) main activities and duties, including an indication of their importance and the time likely to be allotted to them, (3) specific objectives which relate directly to operational tasks to be completed as a matter of priority during the coming year (in addition, personal-improvement objectives should, where appropriate, be specified), (4) resources managed, i.e., the staff, expenditure and other resources controlled by the appraisee in order to give a broad indication of the true responsibility for the cost-effective and efficient use of resources. Scientists in AROs that have well-developed strategic planning and programming functions should have little difficulty in specifying what their specific research goals and objectives for the year should be, although frequently an additional effort will have to be made in order to ensure that the anticipated research outputs are measurable and the goals and objectives for nonresearch activities are made specific. With the exception of unskilled manual workers, all technical and administrative support staff should also be required to elaborate their annual work goals and objectives in an action plan.

An example of an action plan form (called in this case a forward job plan) currently used by a large ARO in Europe is presented in Figure 2.

Once the action plan has been completed, the appraisee discusses his ideas with the manager to whom he/she is directly responsible. The manager assesses the individual goals and objectives in order to ensure that they are (1) consonant with the overall objectives of the unit for which he/she has responsibility, (2) sufficiently precise in their definition, and (3) achievable, given the competence of the individual and the likely availability

Figure 2. Forward job plan of an agricultural research organization in Europe

Forward Job Plan

Name ..... Grade ..... Division .....

Set out below the purpose and main duties of your job.

Try to set the duties out in order of importance under a number of headings. Do not forget staff management and training responsibilities.

Job title ..... Percentage

List specific objectives.

These should show what you are expected to do and how well. For some parts of your job this may be in clear-cut terms, e.g. quantity, cost, target dates. But other objectives could be about how the job is done or the effect on other people. Be as specific as possible, so everyone is clear how you are to be assessed. Do not set too many objectives. 4 or 5 may be enough. Be realistic: they should be possible but a challenge.

Give a broad indication of the resources you manage and any changes you plan.

Only a broad indication is required. Examples include the total number of staff you are responsible for and how much expenditure you advise upon and control directly. Are you planning changes to get better value for money?

Timescale of FJP .....

Note changes agreed through the year on the back of this form

Figure 3. PRD report form for an agricultural research organization in Europe

Performance Assessment by the Reporting Officer

Definition of ratings

1 Outstanding	4 Performance not fully up to requirements, some improvement necessary
2 Performance significantly above requirements	5 Unacceptable
3 Performance fully meets normal requirements of the grade	

a. Give a rating 1-5 for each relevant aspect of performance making full use of the space for your comments

Work Activity ☐ Quality of work ☐ Output of work ☐ Planning of work	
Management ☐ Management of staff ☐ Effective use of other resources	
Communication ☐ Oral communication ☐ Written communication	
Working relationship ☐ Relations with other staff ☐ Relations with the public	
Knowledge / skills ☐ Professional and technical knowledge ☐ Application of knowledge and skills ☐ Numeric ability	

b How effectively have each of the main duties been carried out and specific objectives achieved? Give examples of work done well and areas where performance could be bettered

of resources. While the manager must always take the initiative in setting standards and defining the main duties, ultimately the manager and employee must both agree with the goals and objectives that are elaborated. It is important that the manager expresses confidence in and support of the employee.

The goals and objectives contained in the action plan should be discussed and, when necessary, amended throughout the year. They should not therefore be set in concrete.

The action plan is used as the basis for assessing performance. Ideally the employee should be required to make a self-appraisal of his/her own performance in relation to the goals and objectives laid down in the action plan. With this information, the manager then completes a performance-assessment report. The report form used by the large ARO in Europe is presented in Figure 3. In part (b) the manager must assess how effectively the main duties have been carried out and specific objectives achieved. No formal performance rating of these duties and objectives is called for in this form, although, as noted earlier, some forms do have simple rating schemes to help managers gauge objective attainment. In addition, weights can also be attached to these ratings. Part (a) of the form comprises a conventional result-oriented rating scheme.

Once the performance assessment report has been completed by the manager and reviewed by a more senior "countersigning" officer, the appraisee is normally allowed to read the assessment as part of his/her preparation for the annual appraisal review interview with his/her manager.

Traditional APAS, being based on written reports and/or conventional rating and ranking procedures, place little or no reliance on interpersonal interactions between appraiser and appraisee. MBO/PRD-type appraisal schemes, on the other hand, regard the appraisal review interview as the most important aspect of the appraisal process since it enables the appraisee to obtain clear feedback on his job performance in relation to well-defined and agreed-upon objectives and enables the appraiser to perform important coaching and counselling roles.

To be successful, the appraisal review interview must be taken seriously by all the managers involved. The review interview requires considerable skill on the part of the appraiser. Where the necessary attitudes and skills are deficient, the appraisal interview will usually be a disappointment for all parties. More serious still, a badly conducted interview can undermine the appraisee's self-esteem and adversely effect relationships between the appraiser and appraisee. It is essential therefore that appraisers receive appropriate training in order to develop their interview skills and generally build up their commitment to and confidence in the PRD process.

Conclusion

The major conclusion of the foregoing discussion is that APAS should form a central component of the personnel management function in agricultural research organizations in all countries, regardless of their overall level of social and economic development. The primary prerequisite for the establishment of effective APAS is strong commitment on the part of the managers and other appraisers whose job it is to design and implement an APAS.

While PRD-type appraisal schemes are relatively unknown in AROs in developing countries, we believe that they hold out the best opportunity for the establishment of affective APAS in the future. This is not to suggest that PRD offers a simple panacea; on the contrary, PRD appraisal schemes require relatively sophisticated levels of management and well-established planning and evaluation procedures. PRD will need therefore to be adapted in accordance with the specific circumstances of each ARO.

References

Ahmad, A. 1981. Knowledge work: Its evaluation and rewards. R&D Management Vol. 11, No. 2: 69-78.

Badawy, M.K. 1984. Applying management by objectives to R&D labs. Research Management Vol. 35: 35-40.

Miller, D.B. 1986. Managing professionals in research and development: A guide for improving productivity and organizational effectiveness. San Francisco: Jossey Bass.

Odiorne, G.S. 1984. Strategic management of human resources. San Francisco: Jossey Bass.

Olson, R.F. 1981. Performance appraisal: A guide to greater productivity. New York: John Wiley.

Patten, T.H. 1982. A manager's guide to performance appraisal. New York: The Free Press.

Pratt, K.J. 1984. Effective staff appraisal. New York: van Nostrand Rheinhold.

Zemke, R. 1985. Is performance appraisal a paper tiger? Training December 1985: 24-32.

PERFORMANCE ASSESSMENT FACTORS FOR AGRICULTURAL RESEARCHERS

Larry Zuidema

Managers are responsible for the performance of research staff to the extent that they have the policy options and the mechanisms to select, motivate, and support them. One such mechanism is performance management, which includes mutual understanding and agreement, joint planning of activities, continuous and timely feedback, observation, and appraisal. The focus of this paper is on performance planning and appraisals with particular attention to assessment factors that are appropriate for agricultural researchers.

Performance planning and appraisal serves both the organization and the researcher. For managers, it provides essential information for planning for the future use of human resources. For the researcher, it can be decisive in maintaining and improving motivation and even creativity.

The process of *performance planning* involves (1) a prior and periodic elaboration of individual goals to be achieved in relation to program goals and (2) the establishment of criteria by which specific aspects of researcher goal achievement can be measured. *Performance appraisal* involves a periodic and mutual assessment of actual performance in relation to desired (planned) performance. It offers the opportunity to review researcher, management, and organizational factors that may influence researcher performance.

Performance appraisals of agricultural research staff are vital to the maintenance of effective research programs. First, they motivate researchers toward the goals of the research organization by communicating its culture, values, and expectations. Second, they are the basis for personnel actions such as work assignments, promotions, rewards, transfers, and training.

The process of researcher appraisal is usually governed by the codes and procedures of the institutions conducting agricultural research. For those in ministries and departments of agriculture, civil service regulations (which may or may not be related to scientists) usually apply. In a university setting, tenure and promotion guidelines prevail. In either case, research managers need to evaluate these procedures for management purposes and develop complementary procedures when necessary.

This paper reviews what factors influence performance, what assessment strategies have been employed, and why assessments are made. A major section is devoted to a review of what researcher performance assessment factors (criteria) are used. The material in this paper comes from a small sampling of appraisal forms and procedures used by several NARS throughout the world as well as a review of reports about performance appraisal systems in research organizations.

What Factors Influence Performance?

Any system that is used to assess researcher performance needs to take account of the influences of both the individual researcher and the organization itself. Performance assessment procedures need to make clear distinctions between and allow for consideration of the following factors which influence performance:

1. Researcher attributes

Researcher attributes include the personal characteristics and traits that contribute to the behaviors and attitudes of the researcher. Many civil service appraisal systems focus on these characteristics and traits.

2. Researcher knowledge and skills

Researcher knowledge and skills include the technical knowledge resulting from education and experience and the professional skills achieved through training and experience.

3. Organizational policies and procedures

These are personnel policies (including compensation) that influence motivation and organizational procedures and set the conditions for the work environment can have significant influence on researcher performance.

4. Management and support services

This includes the level of financial support for important inputs for research, primarily technicians, and it is critical to the performance of researchers.

5. Program opportunities and activities

The mandates and defined programs of the research organization set the limits for researchers and form the basis for allocation of resources.

Figure 1 shows the components of agricultural researcher performance assessment and demonstrates the relationship of these five influencing factors to the results and impact of research efforts. The inputs are the researchers (personal attributes, knowledge, and skills), organizational policies and procedures, and management and support services. These inputs are applied to the processes that correspond to the program activities of researchers. The activities result in outputs and eventually outcomes. It is important to note that performance assessments can and often do take account of all of these components.

What Strategies Are Used?

The nature of the organization and its institutional framework usually influences performance assessment strategies. As one looks at the various approaches or strategies that have been employed in assessing the performance of researchers, the following characterizations can be made:

1. Employment and autonomy

The approach is to hire very selectively and then let researchers alone to do the job for which they were hired. The rationale is that creativity requires freedom from administrative controls and procedures. In effect, this justifies the absence of a performance management system. Appraisals are not conducted unless the situation is clearly a serious problem. The problem with this strategy is that many national research systems do not control the process of selection and, often, there is a small pool of qualified candidates for the positions offerred. In addition, some NARS only recruit at the BS degree level and then provide opportunities for research degree training early in the researcher's career.

2. Projects, not people

The approach is to put the emphasis on peer assessment of project proposals and project results rather than direct researcher assessment. The rationale is that organizational objectives are met through projects and that this is the appropriate focus of evaluation. This too avoids the necessity of developing a performance management system. Appraisals are conducted only in crisis situations. The problem with this approach is that project reviews are infrequent and irregular with respect to timing and content. This is not conducive to good human resource management since it does not allow for discussions relating to progress and planning for future activities in relation to program goals.

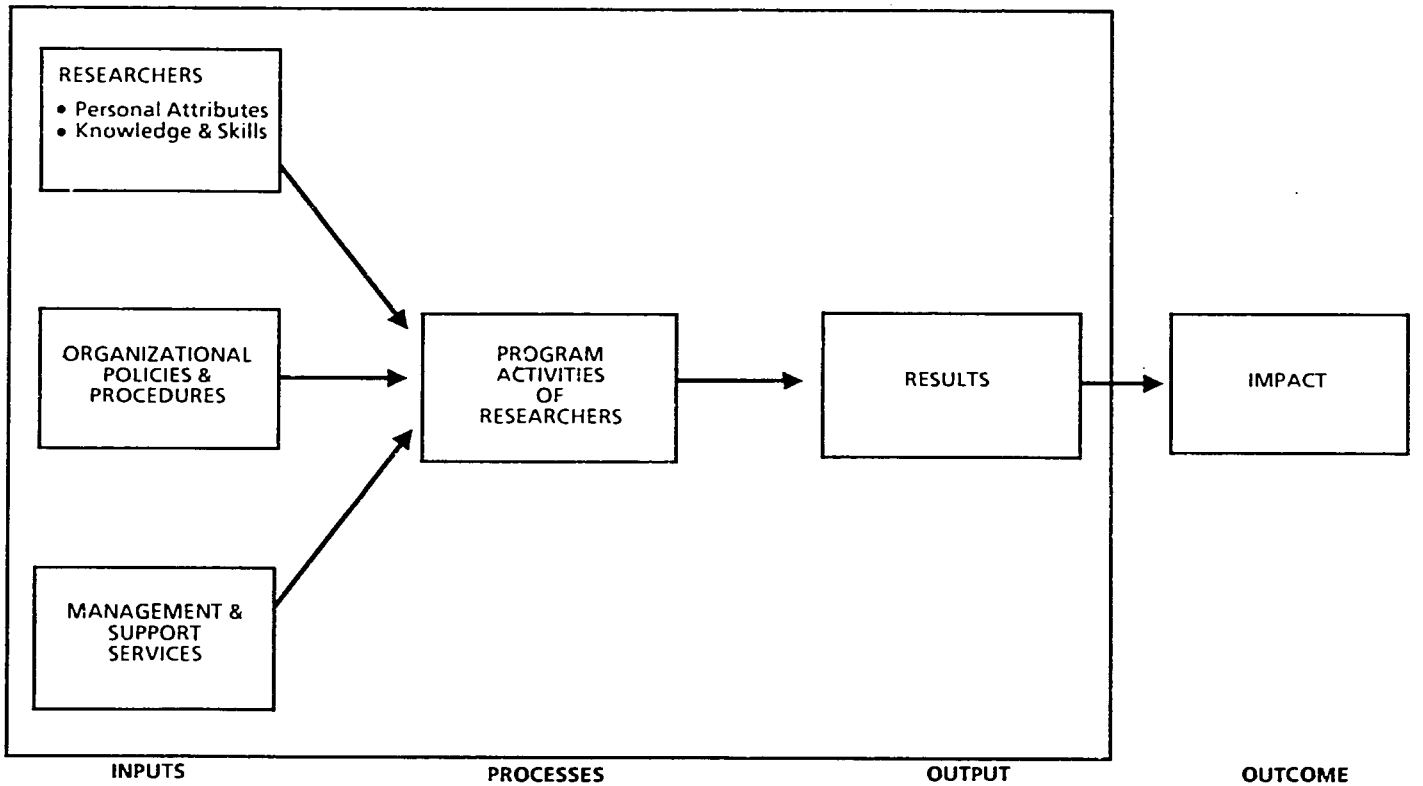
3. (Ap)praise and promote

This approach focuses the performance assessment process entirely on the administrative requirements of the institution. The rationale employed is that the only reason for conducting appraisals is for promotions. This means that appraisals are conducted every three-five years, depending on the system's norms for career advancement. Normally such appraisals focus on the researcher's behavior and results that can be documented by administrators. In the case of university-based researchers, peer reviews are common. The problem with this approach is that the pressure to promote (praise) reduces the value of the exercise. Also, assessments with such a narrow goal and conducted infrequently do not permit effective researcher management.

4. The annual ritual

This approach also places high value on administrative requirements, but on an annual basis. Often the requirements and procedures are generic for all civil service employees and of low applicability to research

Figure 1. Components of Agricultural Researcher Performance Assessment



institutions. The forms used most often stress evaluations of personal attributes and behaviors rather than activities and outputs. The major problem is that it is difficult to relate the process to program planning and evaluation. This is not a research management-oriented process.

5. Backward and forward

The approach is to assess researcher activities and results of a past period against the program plans and objectives agreed upon for that period. Normally, the process includes agreement on and the establishment of individual goals and objectives for the next time period. The rationale is that researchers are best judged on individually planned performance since research is not a uniform activity. The appraisals are conducted annually in conjunction with overall program planning activities. While this is the currently favored approach for agricultural researcher assessment, one problem is that the tendency of those using the approach is to focus more on planning than on assessment of past performance. Also, it is not compatible with most civil service requirements.

Why Make Assessments?

With these strategies in mind, it is now appropriate to ask why it is that we make performance assessments of researchers. The following are the most cited reasons by research managers. These multiple reasons obviously influence both what is assessed and what processes are used to conduct the assessments.

1. Basis for promotion and rewards

The need for an equitable and fair system to allocate rewards and to maintain careers for researchers is often the prime motivation for appraisals. The procedures are often determined by civil service units and are out of the hands of research managers. In a few cases, special systems have been created for scientists. In still fewer cases, a level of autonomy has been reached which permits research institutions to establish their own systems for promotion and rewards.

2. Develop researcher capacity

An effective assessment process yields information about the need for further training of researchers. A desirable output from the whole assessment process is the development and up-dating of a comprehensive training plan, both degree and nondegree. Both the organization and the individual benefit from this outcome of the assessment process.

3. Improve motivation and performance

The best outcome of a performance assessment process is a more highly motivated researcher with a desire for and capability to improve levels of performance. This will depend on the factors that are assessed and the process used. The process that reviews past performance against past plans and then proceeds to develop mutual and specific goals for the future will most likely succeed in improving motivation.

4. Facilitate progam and work planning

Assigning researchers to priority research areas and programs requires an understanding of their current capabilities and commitments. Only if the assessment process includes an element of forward planning is it likely to contribute to effective program planning for the research organization. The accumulation of individual work plans is, de facto, the summation of program plans for the organization.

Another way in which one can answer the question of why we make performance assessments is to provide regular, organized, and periodic feedback to both researchers and managers. This is a more positive and contructive approach to performance assessment. It makes the whole process acceptable for all parties and changes the ambiance from a process to be dreaded and feared to a process anticipated and welcomed. In the end, the four reasons for conducting performance assessments remain, but the approach and process stresses feedback.

This process is designed to provide feedback to managers for (1) promotion and rewards, (2) staff development planning and counseling, and (3) program planning. Feedback to researchers would be for (1) self-development, (2) motivation, and (3) work planning. The concept of feedback is relevant to the content of the following section on what factors are assessed.

What Factors Do We Assess?

A review of instruments (forms) used for making assessments of agricultural researchers throughout the world shows that a wide variety of factors are included. Most forms, however, emphasize a few and utilize both rating scales and behaviorally oriented statements. The

following are six factors that are used for assessing the performance of researchers. Each of these factors is reviewed in some detail and questions are raised for readers to contemplate and about which to draw conclusions in relation to their own system. Attention is called to figure 1 which shows the relationship of these factors to each other.

1. Personal attributes.....what they are
2. Technical knowledge.....what they can do
3. Professional skills .....what they can do
4. Professional activities and behaviors .....what they do
5. Outputs/results .....what they accomplish
6. Outcomes/impact .....consequences

The first three factors may be considered to be predictors of performance. Activities and results are more direct measures of performance, while impact serves to validate and substantiate performance evaluated in some previous time frame. In reviewing the utility of these factors, it is important to think about their effectiveness in relation to the reasons given above for performance assessments. In particular, how do assessments of each of these factors relate to the achievement of program goals and objectives?

1. Personal attributes

Personal attributes (characteristics and traits) are usually measured on a graphic scale that is quantified and comparable, but based on the general judgment of the rater. It is also possible to describe and rank personal attributes qualitatively. For example, the top ranking for "judgment" could be "outstanding ability for defining objectives, formulating programs, and evaluating results or trends from data and reports." The bottom ranking would be "requires assistance in evaluating results of his/her own projects." Combinations of qualitative and quantitative evaluations are also used to score personal characteristics. The criteria selected often reflect the organization's concept of the personality profile of a productive employee.

The following are several criteria that have been taken from performance appraisal forms used to evaluate personal attributes of researchers.

maturity	responsibility
motivation	accuracy
initiative	speed
integrity	imagination
cooperativeness	enthusiasm
decisiveness	self-reliance
judgment	drive
foresight	creativity
reliability	attitude
punctuality	resourcefulness
manners	personality
intelligence	loyalty
appearance	innovativeness

This is a wide spectrum of attributes, and most would agree that many are not appropriate for the evaluation of research staff. In fact, there is considerable doubt that performance assessments should include any reference to personal attributes at all. The following are some questions for contemplation. Which of these attributes are most critical for researchers? In particular, how important are those selected as contributors to actual performance? For those that are important, how do we assess them objectively? Furthermore, how much change in these personal attributes can managers stimulate?

2. Technical knowledge

Required knowledge is usually reflected in the job description for the position. Often, staff are hired with the required technical knowledge, and an evaluation occurs in the recruitment process. In other cases, generalists are employed at the BS level with the expectation that those worthy will be given the opportunity to obtain increased technical knowledge through degree and nondegree training on the job. Usually, it is expected that the employee will maintain and improve knowledge in technical areas. Therefore, it may be appropriate to periodically evaluate progress made against expected and planned improvements in technical knowledge.

Some examples of areas for assessment relating to technical knowledge include

1. educational qualifications
2. accumulated experience
3. continued degree study
4. participation in short-term training
5. involvement in on-the-job training activities

Most of these areas are best assessed upon entry to an organization, but they are also appropriate for reassessment at the time of consideration for a promotion or new assignment within the organization.

The following are some questions that are relevant to assessment of technical knowledge. Is education an accurate reflection of technical knowledge? Do high levels of technical knowledge ensure high levels of performance? What is the best way to proceed to assess levels of technical knowledge? At what point is investment in improving technical knowledge most beneficial to the organization?

3. Professional skills

In addition to technical knowledge, researchers are expected to possess skills which permit the effective use of knowledge in a research environment. Furthermore, it is expected that researchers will improve these skills throughout their careers through experience and training.

Some of the skills that are required of nearly all researchers are as follows:

1. oral and written communications
2. interpersonal relations
3. leadership
4. program management
5. supervision of staff
6. statistical analysis
7. organization of work activities

If the research organization values these skills, there must be a way to assess the level of their application by researchers and then to provide opportunities for improvement. Most of these skill areas can be observed and evaluated somewhat objectively.

Some relevant questions are as follows: What other areas can be identified?
How important are professional skills to the job performance of researchers?
How would one conduct skill evaluations? How much change is possible in a researcher's career?

4. Professional activities and behaviors

Many professional activities and behaviors contribute to output. Their assessment is particularly useful for those program areas where output is not frequent or easily measured. The following are professional activities and behaviors that are valued by agricultural research institutions:

1. keeping up with the scientific literature
2. ability to define research problems
3. ability to design, undertake, and interpret experiments
4. timely reporting of experimental results and conclusions
5. effective documentation for potential users
6. active participation in professional meetings
7. effective training of support and junior staff
8. collaboration with other researchers on teams
9. joint activities with extension workers

These and other activities and behaviors should be a evaluated as a part of the assessment process since they convey what the research organization desires of its researchers. Some questions for consideration are as follows: What other activities and behaviors are desirable and important to evaluate? Do job descriptions adequately reflect expected and desirable behaviors and activities? What are the best ways to assess behaviors? How much change in researcher behavior is possible?

5. Outputs and results

Outputs and results are usually measured in gross terms such as "quantity of work" and "quality of work" and using graphic scales from "outstanding" to "poor." Normally, this is not sufficient for effective researcher assessment. Standards of performance are sometimes employed to measure quantity and quality in terms of numbers, time periods, and expense. These objective measures may be reviewed in absolute terms against a set standard or in relative terms comparing output of similar staff.

For agricultural research, both objective and subjective measures of output are useful. In most cases, standards of performance should be directly related to a plan of work agreed upon as part of a previous performance planning and appraisal process. Both the plan of work and the standards of performance should take into account the capabilities of the researcher and be realistic in terms of time, financial support requirements, and institutional capabilities.

Researcher outputs/results evaluated by agricultural research managers include media output, plant varieties, prototypes, patents, etc. In the case of a journal article, it is important to evaluate the quality of the article as well as the publication in which it appears. Criteria for such an evaluation would include relevance, responsiveness, and utility for the national program. The following are some examples of outputs/ results of agricultural researchers:

1. scientific journal articles
2. books written and edited (including chapters)
3. research reports
4. research abstracts
5. conference reports and papers
6. extension publications
7. position papers
8. radio/TV/video tapes
9. news articles
10. designs released
11. patents received
12. varieties released
13. prototypes produced
14. proposals accepted

It is relatively easy to count these items. However, variability among the norms for specific positions and disciplines needs to be taken into account when evaluating quantity of output. But more important, the quality of that output needs to be assessed. Some important questions are as follows: Is it enough to make judgments from outstanding to poor? Is it possible to employ criteria like relevance, responsiveness, and usefulness? For client-oriented research, can we use adoption as a criteria for researcher appraisal?

6. Outcomes/impact

The ultimate tests of the effectiveness of an agricultural research institution and its staff are client acceptance and adoption of researcher products. These are almost always observable only in some distant time frame and, in fact, may not be easily attributable to any one person. Nevertheless, the evaluation of researchers should include measures and criteria relating to outcomes and impact if they can be attributed and assessed.

Some examples of measures of impact are

1. honors and awards received (particularly from client groups)
2. widespread acceptance and adoption of a technology (e.g., a variety)
3. frequent citations of professional papers by other researchers

This third example is the subject of considerable research and debate since citations do not always correlate with quality. In all cases, the measures of effective impact should include considerations of relevance, responsiveness, usefulness, and cost-effectiveness.

Some questions about the assessment of impact are as follows: Can outcomes/impact be easily attributed to a single researcher? Do outcomes reflect program objectives? Does the technology favor one group at the expense of another?

Conclusions

This discussion paper has reviewed six assessment factors that are used to evaluate agricultural researchers. All have some utility in the process of evaluating researcher performance, but clearly, those that reflect output/results/products have a high value for managers. Why is it that other factors like personal attributes are retained in performance appraisal forms and procedures? Perhaps it is because we have not made the shift from evaluating predictors of performance required for researcher recruitment and selection to actual activities and outputs required for effective performance assessments. Table 1 shows the relative usefulness of the six assessment factors for both selection and performance assessment.

An effective performance planning management process will provide enough information for management to take specific actions. It is important that all parties have reasonable expectations about the possibilities of actions resulting from the process. Further, it is important that managers communicate these actions effectively so that it is clear that the process is designed to actually improve the performance of the entire organization. Three types of management actions may be involved:

1. Those directed at the researcher, including transfer, promotion, training, awards, increases in compensation, etc.;

2. Those required of management, including provision of supplies, improved facilities, more technicians, etc.;

3. Those required of program planners such as the incorporation of individual plans into the overall plans of the organization.

These actions are the primary means by which human resources are guided to achieve program objectives, and they serve as the basis for future increases in researcher productivity. Performance management systems that emphasize both performance planning and assessment offer the best opportunity for motivating researchers to meet program objectives.

Table 1. Agricultural Researcher Performance: Usefulness of Factors for Selection and Assessment

ASSESSMENT FACTORS	RESEARCHER SELECTION	PERFORMANCE ASSESSMENT
Personal Attributes	M	L
Technical Knowledge	H	M
Professional Skills	H	M
Professional Behaviors & Activities	M	H
Products/Results	L	H
Impact	L	H

KEY: *L* = Low, *M* = Medium, *H* = High.

LESSON: We need to make a shift from predictors of performance required for selection to actual activities and output required for performance assessment.

ANNUAL PERFORMANCE APPRAISAL AT THE NATIONAL INSTITUTE OF AGRICULTURAL RESEARCH

Paul Bennell

Introduction*

Mr. John Doonil, the newly appointed Director of Human Resources for the National Institute of Agricultural Research (NIAR) sat quietly in his office preparing his thoughts for his first important meeting later that morning with the Director of NIAR, Professor Amil Haddad. Doonil had only been in the job a month but it was already clear to him that many of NIAR's human resource management policies and practices were inappropriate and outdated. He had spent the previous ten years as the personnel manager of a successful private agribusiness company, Agroproducts, and could see no reason why NIAR should not have similar human resource policies.

Doonil was particularly unhappy with NIAR's scheme of annual individual performance appraisal. He was not the only one. Already he had received numerous complaints from his research manager colleagues who thought the scheme too vague and subjective. Many of them would have preferred to avoid the hassle and have no appraisal scheme at all, especially for research scientists. Most NIAR staff also had little to say in support of the appraisal scheme, mainly because they did not feel that it was an accurate method for assessing their contributions towards meeting NIAR's overall goals and objectives. Indeed, rather than improving performance, it seemed to Doonil that NIAR's appraisal scheme had a negative impact on staff performance. It certainly did not seem to increase individual commitment and motivation.

Doonil had to convince his Director that a new approach to annual performance appraisal was needed in NIAR. When Doonil was appointed, Haddad had stated quite specifically that he expected him to introduce new ideas and generally "modernize" NIAR's personnel management policies and practices.

The National Institute for Agricultural Research

NIAR was established in 1964 with a national mandate for all crops and livestock research in the Republic of Bratan. It was also responsible for a number of services, for both government and farmers, most notably soil testing, seed certification and livestock grading. NIAR was a semi-autonomous organization under the overall control of the Ministry of Agriculture.

NIAR had a total staff of 495 in 1986, of whom 125 were research scientists. These scientists worked at ten main research institutes and stations and covered over fifteen crops and livestock specializations (Table 1). They were generally young and inexperienced, which was indicative of the very high rates of annual attrition among senior staff in NIAR, particularly among those scientific specializations in high demand by private-sector employers, e.g., plant breeders, weed scientists and chemists.

The Civil Service Appraisal

In common with all other public-sector organizations in Bratan, NIAR was formally required to comply with

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**This case was prepared by Paul Bennell. The case is designed to serve as the basis for class discussion, rather than to illustrate either effective or ineffective management policies or practices. The case is based on information drawn from a variety of unpublished sources. Material herein is not to be quoted, cited, reproduced, or published in any form.*

Table 1. Location and Specialization of Research Scientists Employed by NIAR, September 1987

Specialization / *Institution*	Crop Breeding	Agronomy	Soil Sciences	Pathology	Nematology	Entomology	Horticulture	Animal Breeding	Animal Production	Animal Nutrition	Range Management	Economics	Stat/Biometrics	Communications	Management
Head Office													4	2	3
National Crop Breeding R.I.	8														1
National Horticultural R.I.							10					1			1
Soil R.I.			12												1
Plant Protection R.I.				6	4	5									1
National Animal Production R.I.								8	4			1		1	1
National Grasslands R.S.										7					1
National Range Management R.S.											6				1
Kangoor Regional R.S.	2	4	1			1		2				1			1
Triplet Regional R.S.	1	3	2	1								1			1
Meont Regional R.S.	1	2	1				2					1			1
Nunmoolin Regional R.S.	1	3		1		1						1			1
Totals	13	12	16	8	4	7	12	10	4	7	6	6	4	3	14

the annual performance appraisal scheme for government employees as laid down and supervised by the Public Service Commission. The Department of Human Resources which Doonil headed had the responsibility for administering this scheme within NIAR.

The civil service annual appraisal process was based mainly on the completion of an appraisal form that was the same for all employees. The form had a number of rating scales which were weighted according to their relative importance as perceived by the PSC (see Table 2). For NIAR research scientists, the form was completed by their station or institute head every December. This was done in strict confidence and with no formal consultation with the research scientist being appraised. The appraisee was only informed of the results of the appraisal when he/she was assessed as being "below average" or "unsatisfactory." Deputy directors of crops and livestock were required to review the completed appraisal form for research scientists in each of their divisions in order to ensure fairness and consistency. Finally, the appraisal results were forwarded to the PSC. Those for 1987/88 for research scientists were very similar to previous years (Figure 1).

If job performance was rated as satisfactory or above for two consecutive years, then the NIAR staff member received a fixed salary increment (Table 3). The annual appraisal results were also taken into consideration by NIAR promotion committees when individual staff members sought promotion from one major job grade to another. For research scientists this was usually every five to seven years.

The Professional Scientific Bonus

In addition to the civil service appraisal scheme, NIAR also had its own annual appraisal scheme for research scientists that was used to allocate individual scientific bonus payments. This bonus scheme had been introduced in the late 1970s in an attempt to provide a significant additional financial incentive to scientists and to generally adopt a more meritocratic, objective basis for the allocation of rewards to scientists.

The size of the scientific bonus was assessed on the basis of three performance indicators–publications, achievements and distinctions. The level of managerial responsibility of the scientists was also taken into account. Each type of publication produced by the NIAR scientist was awarded a specific number of bonus points (Table 4). With multiple-author publications, the number of points obtained was divided by the number of named authors. The frequency distribution of points for publications among NIAR researchers had not changed significantly since the introduction of this system (Figure 2). It was generally accepted that the bonus scheme had increased publications output, at least among a minority of scientists. However, some scientists in NIAR complained that it was unfair because it was easier for scientists in certain specializations to publish than others. And, some NIAR managers were worried about the effect it had on the type of research carried out.

Achievement and distinction bonus points were awarded on the basis of the actual research results obtained by NIAR scientists, their potential beneficial impact on the welfare of producers and consumers, and the extent to which they fulfilled other government objectives. Scientists with postgraduate training obtained a disproportionate number of these points compared with scientists who had only a first degree (Table 5). Evaluation committees for crops and livestock met annually to assess research outputs by NIAR scientists. These committees were comprised of senior NIAR management and researchers.

Bonus points for responsibility were awarded on the basis of the position of the NIAR scientist in the management hierarchy. In 1987 all NIAR scientists received at least one responsibility point.

The scientific bonus actually paid to a scientist was calculated as a percentage of normal annual income according to a specific formula. In monetary terms, this meant that a bonus point was worth approximately B$1000 to each scientist. Many NIAR scientists felt that the bonus was too small, especially in relation to their base incomes (Table 6). Many also contended that the relative importance of the bonus had fallen in recent years.

Performance Review and Development

Doonil had successfully introduced a new approach to annual performance appraisal–called performance review and development (PRD)–when he had been personnel manager at Agroproducts. While there were

Table 2.
Rating Scales and Weights for Annual Civil Service Appraisal Form

Criterion	Weighting Factor	Points Rating (1-5)	Weighted Rating
Critical and creative faculties	4x		
Judgment	4x		
Professional competence	4x		
Organizing ability	3x		
Written communication	3x		
Oral communication	1x		
Output	2x		
Dependability	4x		
Self-reliance and drive	4x		
Human relations	3x		
Leadership	2x		
Enthusiasm	1x		

Figure 1. Distribution of weighted, rated points for NIAR scientists, 1987-88

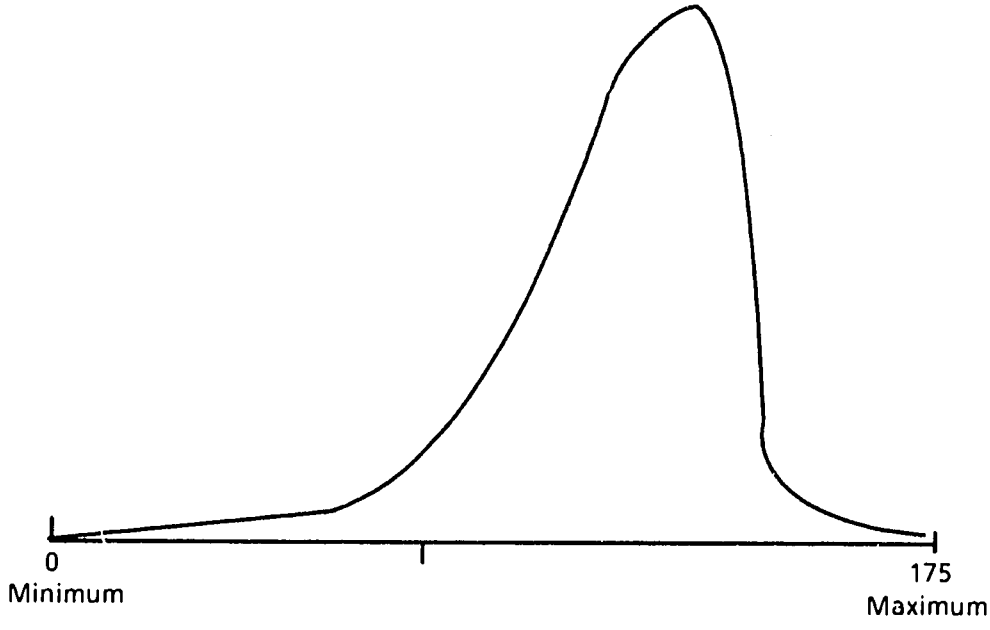


Table 3.
Grade Structure and Salary Index for NIAR Research Scientists, 1987/1988

Chief R.S.	Principal R.S.	Senior R.S.	R.S.I.	Assistant R.S.
204				
202				
198	187			
	184			
	179			
	174			
	169	159		
		155		
		147		
		144		
			138	
			134	
			130	
			126	**110**
				105
				100

Table 4.
Annual Scientific Bonus Points for Different Types of Publications

Book with reputable publisher	10-15
Article in refereed international journal	5-8
Article in refereed national journal	3-5
Article in conference, workshop proceedings	2-4
NIAR research series	2-3
Annual report	1-3
Major extension/advisory handbook	8-12
Normal extension/advisory publication	4-7
Minor extension/advisory publication (i.e., leaflet)	2-4
Newspaper or similar article	1-2

Figure 2. Percentage frequency distribution of publications awarded to NIAR research scientists, 1987-88

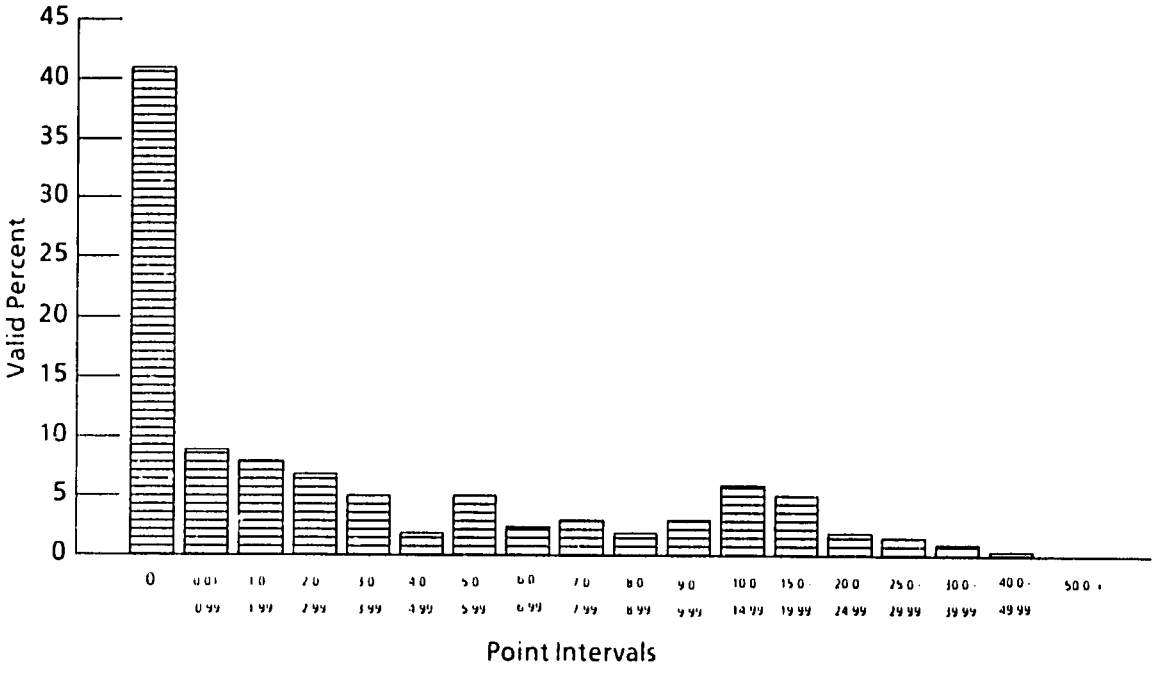


Table 5.

Number and Percentage Distribution of Annual Scientific Bonus to NIAR Research Scientists, 1987/88

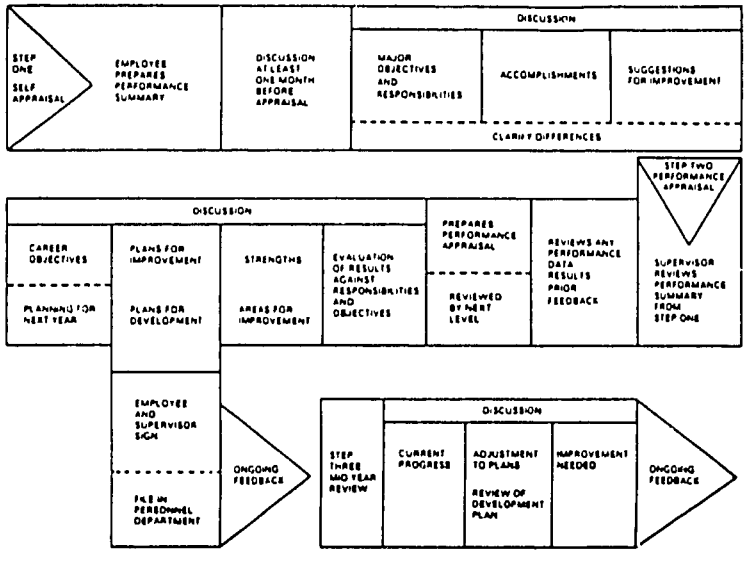
Points	1st degree only			Postgraduate			All	
	Total	%	Mean	Total	%	Mean	Total	%
Publications	214	31.4	1.00	1444	61.2	7.9	1658	54.6
Achievements	18	17.3	0.55	364	15.4	1.8	482	15.8
Distinctions	21	3.1	0.10	107	4.5	0.5	128	4.2
Responsibilities	328	48.2	1.54	445	18.9	2.2	773	25.4
Totals	681	100.0	–	2360	100.0	–	3041	100.0

Table 6.

Percentage Frequencies of the Annual Scientific Bonus Points (Expressed as a Percentage of Base Salary), by Main Qualification Group

% basic salary	First degree only		MSc		PhD	
	%	Cum.%	%	Cum.%	%	Cum.%
0- 3.99	68.0	68.0	22.5	22.5	0.0	0.0
4.0- 6.99	15.8	83.8	19.5	42.0	9.8	9.8
7.0- 9.99	5.7	89.5	10.7	52.7	12.2	22.0
10.0-12.99	1.3	90.8	14.2	66.9	7.3	29.3
13.0-15.99	3.1	93.9	7.7	74.6	14.6	43.9
16.0-18.99	1.3	95.2	4.1	78.7	7.3	51.2
19.0-21.99	1.7	96.9	3.6	82.2	4.9	56.1
22.0-24.99	0.4	97.4	2.4	84.6	7.3	63.4
25.0-27.99	0.9	98.2	7.1	91.7	9.8	73.2
28.0-29.99	0.4	98.7	2.4	94.1	4.9	78.0
30.0-33.99	0.0	98.7	0.6	94.7	2.4	80.5
33+	1.3	100.0	5.3	100.0	19.5	100.0

Figure 3. PRD at Agroproducts



obvious differences in the activities of NIAR and Agroproducts, he still believed that PRD had enormous potential for NIAR and that it should therefore replace the traditional civil service scheme, at least for professional staff.

PRD is closely related to a broad approach to management known as management by objectives (MBO). MBO has been widely used by private- and public-sector organizations in Europe and North America with mixed results.

PRD is based on individual appraisal criteria that are strictly result-oriented and closely linked to well-specified annual performance objectives for each individual. These objectives are set by individuals and their manager at the beginning of the year on the basis of open discussions. The objectives must be clearly defined and, if possible, quantifiable. Objectives concerned with specific improvements in individual behavior and skills will also normally be specified. The agreed-upon goals and objectives form the basis of the individual's action plan for the year. At the end of the year, the individual's performance is assessed in relation to the objectives of this action plan. This assessment is again undertaken in an open, supportive manner by the manager, whose primary concern is to use the appraisal process to improve his/her staff member's performance. Appraisees are required therefore to self-critically review their own work during the year, and the manager then uses this information to make his/her own written assessment. This is discussed with the appraisee at the annual performance review interview. At the end of this interview, appraisees should have a clear idea of where they stand in the eyes of management.

Doonil had already discussed the PRD approach at a meeting of research station directors earlier in the month. He described the scheme he had developed at Agroproducts. The responses of these managers had been far from encouraging. Looking at the notes he had taken at the meeting, Doonil saw that they had at least five major criticisms of PRD.

- "You cannot set measurable objectives for agricultural research activities. . . . We are scientists engaged in complex and often quite unique research. . . . We are not car salesmen selling the same or similar products" (Dr. Rushdi).

- "How do you compare the performance of one individual with another? . . . This PRD scheme seems to be totally individualized. . . . Objectives will inevitably vary from one individual to another in terms of their difficulty, timescale, etc. So how am I to allocate rewards between them?" (Dr. Salmi).

- "Without extra salary incentives, PRD will never work. Goals in themselves are not enough to really motivate my people" (Dr. Singh).

- "The performance review interviews will never be accepted. Managers will strongly resist talking face to face with staff about their performance. . . . PRD is too subjective and personalized" (Dr. Rushdi).

- "The whole thing is too labor intensive. . . . We would have to carry out appraisals all year round. . . . I want fewer forms to fill out, not more" (Mr. Vinali).

The Meeting

Doonil realized that selling PRD to Haddad was not going to be easy. Fortunately, Haddad had been out of town when PRD had been discussed by the station directors but by now he would certainly know about their adverse reactions. While Haddad was keen to change NIAR management policies and practices, actually doing something was another thing altogether.

Doonil ran through the questions in his mind that he wanted to discuss with Haddad. What, first of all, were the main strengths and weaknesses of the present appraisal scheme? Was it really that bad? Couldn't it be modified rather than thrown out altogether? Second, what were the pros and cons of introducing a PRD appraisal scheme to NIAR? Should it be adapted in any way to meet the special requirements of a public-sector agricultural research organization such as NIAR? And third, if Haddad accepts the need for a PRD scheme, how should it be introduced into NIAR?

As Doonil collected up his papers and walked down the corridor to the Director's office, he became increasingly anxious about the outcome of the meeting.

SESSION 6

PERFORMANCE IMPROVEMENT

ORGANIZATIONAL BEHAVIOR FACTORS: A BRIEF SYNOPSIS OF LEADERSHIP, MOTIVATION, AND CONFLICT MANAGEMENT

Paul Marcotte

All of us spend part or all of our working lives as members or directors of organizations. It is the contention of those that study the field of organizational behavior that the way these organizations are structured and managed influences our work, the effectiveness of our performance, and our feelings about ourselves (Arnold and Feldman 1986: 3).

Of particular interest for those who are directors, managers, and leaders, is that there are common misperceptions and misunderstandings of what effective managers do or should do.

The most common misperception is in regard to what managers actually do. The common stereotype of managers is that they give orders, make decisions, analyze technical reports, and develop sophisticated plans. While that would be wonderful, the truth is much more mundane. Empirical studies indicate that the characteristics of the actual management job are quite different and are as follows:

- Managers produce a large quantity of work, varying from 22 to 77 activities on an average workday.
- Activities are brief, varied, and fragmented.
- Activities are highly structured, allowing for little creativity or reflection.
- Verbal contact takes precedence over studying written reports or analyzing information.
- Managers spend anywhere from one-third to three-fourths of their time dealing with subordinates rather than making decisions and giving orders.

The implications of this characterization are clear. While technical knowledge and skills are necessary for specialized and analytical positions, managers need skills in organizing, performing tasks quickly and efficiently, and communicating clearly with subordinates.

The study of the skills required for management is a field in itself and is known as organizational behavior. The underlying assumption of the field is that thorough knowledge, understanding, and the acquired skills of the management of behavior will allow the manager to perform duties with efficiency and effectiveness and thus return to the original stereotype of a manager.

The skills or dimensions commonly ascribed to "organizational behavior" are motivation, leadership, communication, conflict management, delegation, decision making, and team building (see Figure 1). Each of these dimensions has also become a field of study having theoretical frameworks, models, and empirical studies.

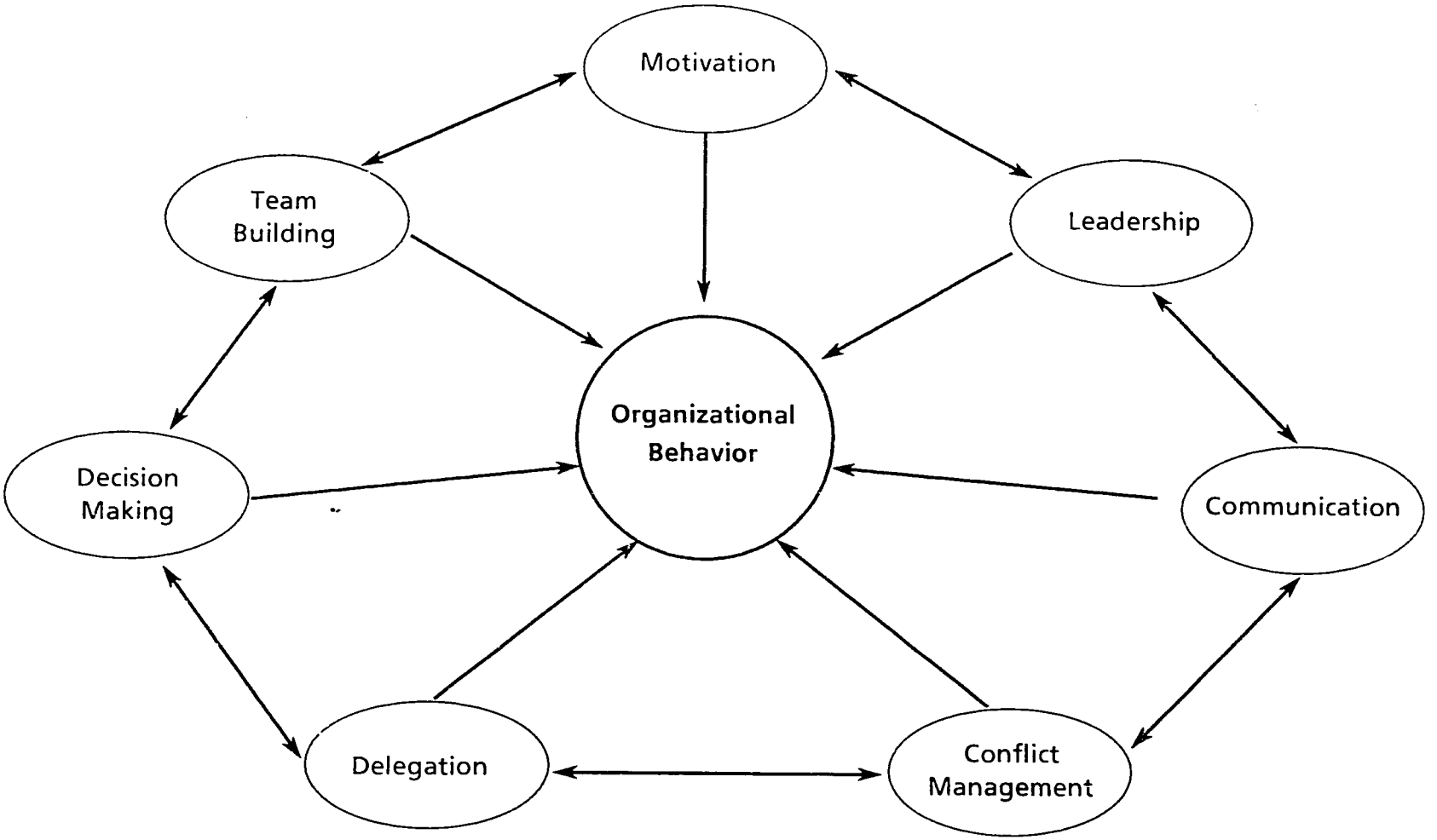
All of these areas cannot be thoroughly covered in a brief paper so the following is a selection of three important areas: leadership, motivation, and conflict management. For each of these, there is a brief introduction to the theory and current models.

Leadership

What exactly is leadership? While there have been as many definitions of the topic as there have been researchers, for the purpose of this paper the following definition will be used:

Leadership is a process by which one person attempts to

Figure 1. Dimensions of organizational behavior



influence the behavior of another (or a group) with the expressed purpose of achieving a goal (or goals).

In the study of leadership, three major theories have emerged: trait theory, behavioral theory, and situational or contingency theory.

A. Trait theory

The first of these, trait theory, has been characterized as the "great person" theory of leadership. According to this theory, leaders are born, not made. The focal point of trait theory studies is to identify the traits of leaders, such as physical characteristics, personality characteristics, social characteristics (including background and participation), and task-related characteristics such as need for achievement and initiative. Criticism of this has been that, while the theory is considered necessary, it is not sufficient in and of itself, as not all leaders have the same traits, and the traits required are different for different situations.

B. Behavioral theory

The inadequacies of the above approach led to behavioral theory. Basically, the behavioral approach focuses on what the leader actually does and then attempts to understand the relationship between leader action and subordinate reaction. While this theoretical approach has been labeled Theory X and Theory Y, the Ohio State studies, and the Michigan studies at various periods of its development, there were two main styles of leadership behavior that were identified: concern with the task and concern with people.

A summary of the terminology for the two styles is as follows:

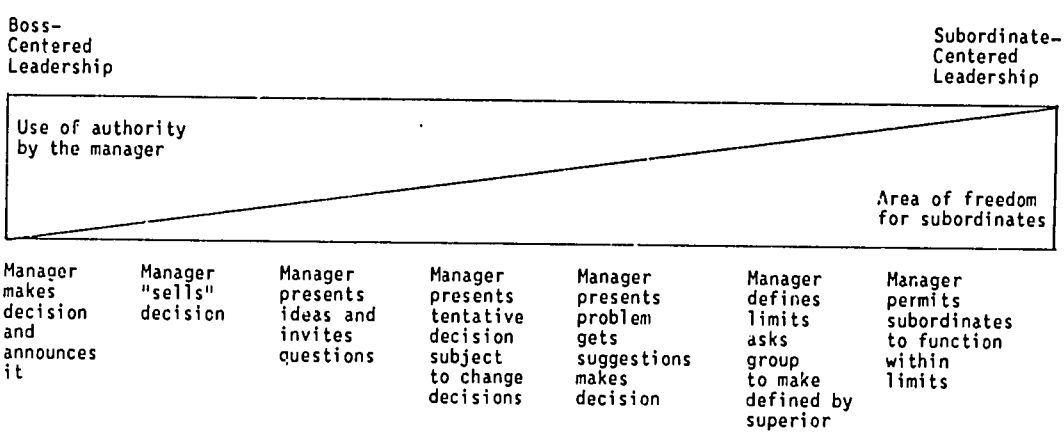
Concern with task	Concern with people
Initiating structures	Consideration
Task behavior	Support behavior
Concern for results	Concern for relationship
Autocratic	Democratic
Theory X	Theory Y
Boss-centered (authoritarian)	Subordinate-centered

In an attempt to identify the relationship of the two types of behavior as a continuum, Tannenbaum and Schmidt (1973) constructed the design below.

While the behavioral approach expanded the analysis of leadership to include interaction, there were two major constraints to the approach. One, by focusing on the relationship between the leader and follower, the situation within which the relationship takes place was not considered. And two, the separation of behavior to either task-oriented *or* people-oriented was too restrictive.

C. Situational leadership

The inability of either of the two above approaches to address the problem in its entirety has led to the most recent theory, situation or contingency theory. This approach attempts to achieve a fit between the leader's behavior and the demands of a particular situation. While this theoretical approach has also gone through several evolutionary phases, such as Fiedlers



Continuum of Leadership Behavior (HBR: May/June 1973: 164)

Contingency Theory, Path-Goal Theory based on research by Evans and House, and the Vroom and Yetton Model, the current, and probably simplest of the examples, is the Blanchard model of situational leadership.

Simply put, the situational leadership model attempts to match four basic leadership styles with the development level of the followers that the leaders are trying to influence. These four basic leadership styles are the result of a two-by-two matrix defined by the combination of directive and supportive leadership behavior. By definition, directive behavior is the extent to which a leader engages in one-way communication in defining follower roles, while supportive behavior is the extent to which the leader engages in two-way communication, listens, encourages, incorporates followers, etc. Specifically the styles are as follows:

- Style 1 (S1) is high on direction and low on support. This type of leadership behavior is referred to as "directing," where the leader defines the roles, makes decisions, and closely supervises.

- Style 2 (S2) is high on direction and support. This type of leadership is referred to as "coaching," where the leader still provides direction but attempts to incorporate the follower's input. Control over decisions remains with the leader.

- Style 3 (S3) is high on support and low on direction. This type of leadership is referred to as "supporting," where problem solving and decision making shifts from leader to follower, and the leader provides recognition and facilitation.

- Style 4 (S4) is low on support and direction. This type of leadership is referred to as "delegating," where leaders and followers jointly agree on problem definition and then decision making is delegated to the follower.

Empirical evidence has shown that of the four basic styles, none is considered "best" to maximize productivity, satisfaction, and development. Rather, successful leaders are those who adapt their style to the situation.

In order for the style to be adapted to the situation, i.e., *when* to use *which* style, the Blanchard model maintains that the key factor that affects choice of style is the "development level" of the follower. Development level is a function of the competence and commitment of the follower, where competence is knowledge and skills gained from education (as opposed to natural ability) and commitment is confidence and motivation.

The model identifies four levels of development that represent the various combinations of competence and commitment, where

D1 = Low
D2 = Low to Moderate
D3 = Moderate to High
D4 = High

The levels of development can also be characterized as moving from enthusiastic beginner to disillusioned learner to reluctant contributor to peak performer when the individual is given appropriate amounts of direction and support.

In the final synthesis of the model, the style of leadership is matched to the development level of the follower. In summary, the four possibilities are as follows:

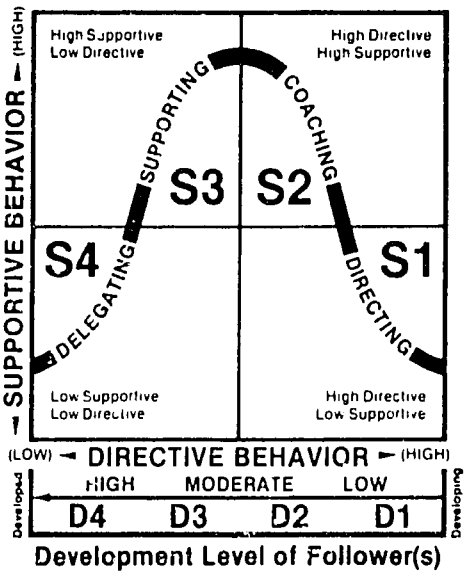
1. directing style (S1) that provides clear direction and close supervision for an enthusiastic beginner (D1) who has high commitment but low competence;

2. coaching style (S2) that provides directive behavior with supportive behavior to instill confidence to a disillusioned learner (D2) who has some competence but lacks commitment;

3. supporting style (S3) that provides a share in the decision with facilitating behavior to a reluctant contributor (D3) who has competence but lacks confidence;

4. delegating style (S4) that allows the competent and motivated peak performer (D4) to take responsibility.

In summary, the situational leadership model contends that successful leaders are those who know their staff well enough to change their leadership style accordingly. Development levels of followers must be continuously assessed so that correct leadership styles can be adopted. Thus situational leadership depends on a continual readjustment of leadership style. "It is this shifting forward and backward in style that makes Situational Leadership a truly developmental model for both managers and subordinates" (Blanchard 1985: 10).



The Four Leadership Styles

A precondition for the efficient use of the above model is an understanding of the concept of power by the leader. Power is an integral part of influencing behavior and as such requires understanding by the leader to assure that there will be compliance of followers. As is the case with the situational leadership model, this requires a knowledge not only of leadership power but also the correct fit to the levels of maturity of the followers and their understanding of power as it affects their response or compliance. The following table identifies power bases defined by maturity levels and their corresponding follower expectations and needs (Table 1).

Motivation

The second area of organizational behavior to be discussed is motivation. By definition, motivation is a process by which people are stimulated to action to achieve desired goals. There are two interrelated issues in theories of motivation: the choice people make regarding action and the intensity of action once the choice is made.

The classic example of motivation theory is Maslow's hierarchy of needs (1943). Maslow hypothesizes that people act in order to satisfy a set of personal needs ranging from the need to survive to the need for growth and development. He contends that these needs are hierarchical. Once a need is satisfied at a given level, it ceases to motivate. If a need is not satisfied, its importance becomes preeminent over successive hierarchical levels.

Herzberg (1968) refined and expanded Maslow's hierarchy by discriminating between factors which dissatisfy, i.e., hygiene factors, and those which motivate. Hygiene factors provide a feeling of contentment (or dissatisfaction) but do not necessarily motivate, while the motivating factors provide stimulation for intensity of action towards the desired goal.

McGregor's (1969) Theory X, Theory Y, as described in the Leadership section above, defined management's approach based on the leader's understanding of the nature of the followers.

Gilbert's performance engineering model is concerned with productivity and the incentives which enhance performance. The underlying assumption of this approach is that people want to perform well, and the incentives required are the access to resources and support.

A final approach is reinforcement theory which argues that behavior is largely determined by its consequences. Simply, if an action produces a positive response it will be repeated. However those actions which stimulate negative responses will be less likely to be repeated. This approach was popularized by Skinner (1953).

Figures of the various models are attached.

Conflict Management

The third area is conflict management. According to Lewis A. Coser, conflict, as defined in the International Encyclopedia of the Social Sciences, is "a struggle over values or claims to status, power, and scarce resources, in which the aims of the conflicting parties are not only to gain the desired values but also to neutralize, injure, or eliminate their rivals" (IESS 1968: 232).

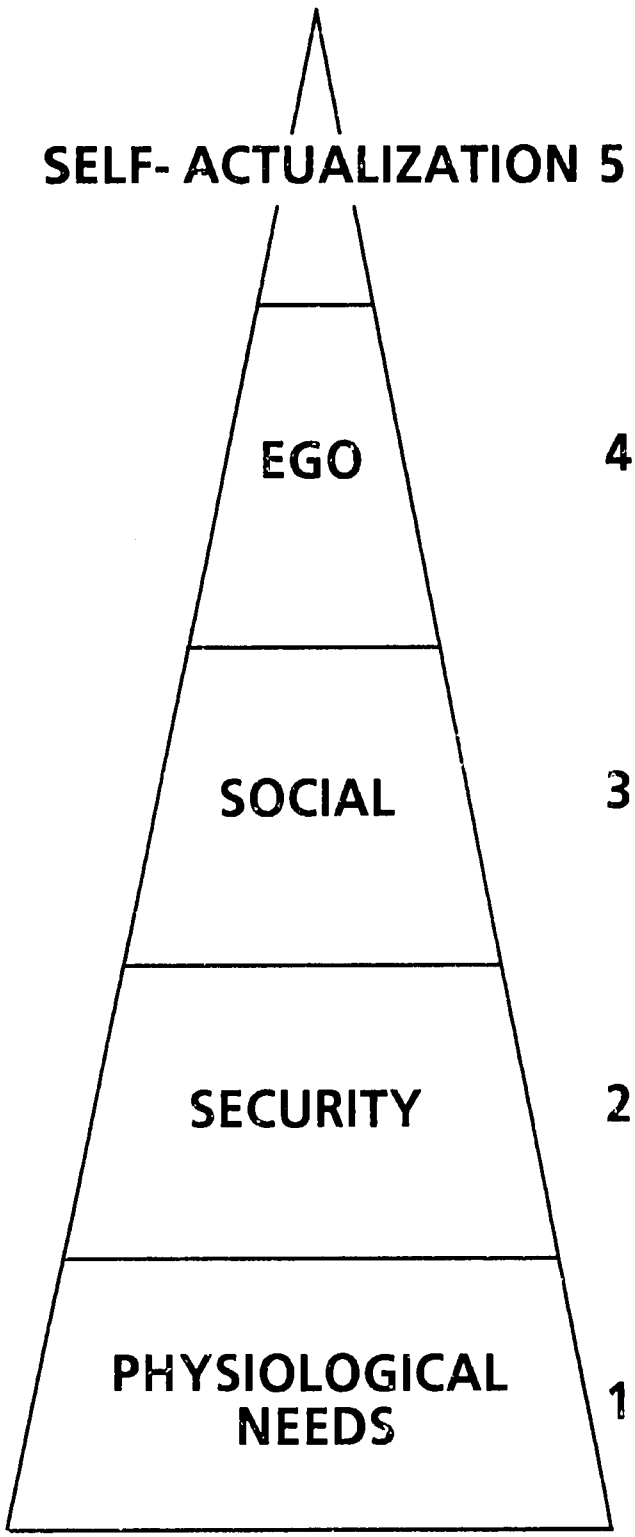
The first step in the management of conflict is the recognition that it exists and is an integral part of human communicative behavior. The second step is that once conflict is recognized, it should not be repressed, but rather should be channeled into positive endeavors.

When viewed as a common, normal social phenomenon of individuals and groups, conflict can be seen as

Table 1: Power Relationship

	POWER	
High Maturity	**Leader**	**Follower**
Expert	Based on expertise and skill. Facilitates behavior with expertise.	Needs little direction or support–will perform on own.
Information	Based on access to information. Others need information.	Needs information to improve or maintain performance.
Referent	Based on personal traits. Administration and identification influence.	Needs little direction but communication and support required.
Legitimate	Based on position. Others feel leader has right by position.	Will comply with legitimized position in organizational hierarchy.
Reward	Based on ability to provide rewards. Compliance leads to positive incentives.	Needs supportive and directive behavior enhanced by reward.
Connection	Based on connections. Induced compliance for favor or avoidance of disfavor.	Directive behavior required. Supportive behavior also important.
Coercive	Based on fear. Induced compliance. Failure leads to punishment.	Needs strong directive behavior. Sanctions induce compliance.
Low maturity		

Maslow's Hierarchy of Individual Needs



SELF- ACTUALIZATION
1. Chance to contribute
2. Chance for advancement
3. Chance for personal growth
4. More control over one's environment
5. Challenging work
6. Relief from monotony

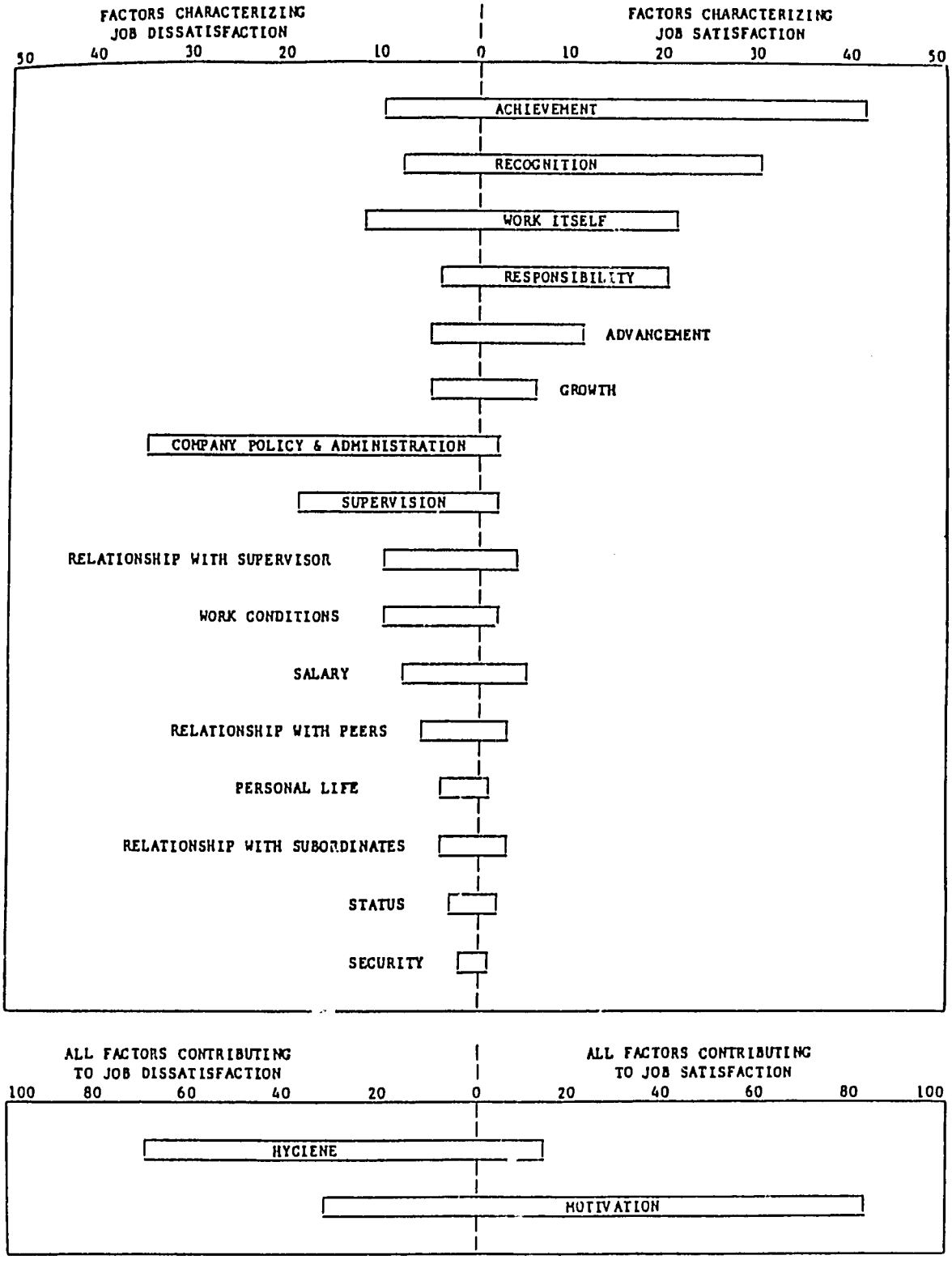
EGO NEEDS
1. Status / prestige
2. Sense of self-worth
3. Human dignity
4. Individual consideration
5. Impartial treatment
6. Recognition / appreciation
7. Pay -- as a status indicator
8. Achievement

SOCIAL NEEDS
1. Sense of belonging to a worthy group / team member
2. Acceptance by one's fellows
3. Congenial work climate
4. Participation

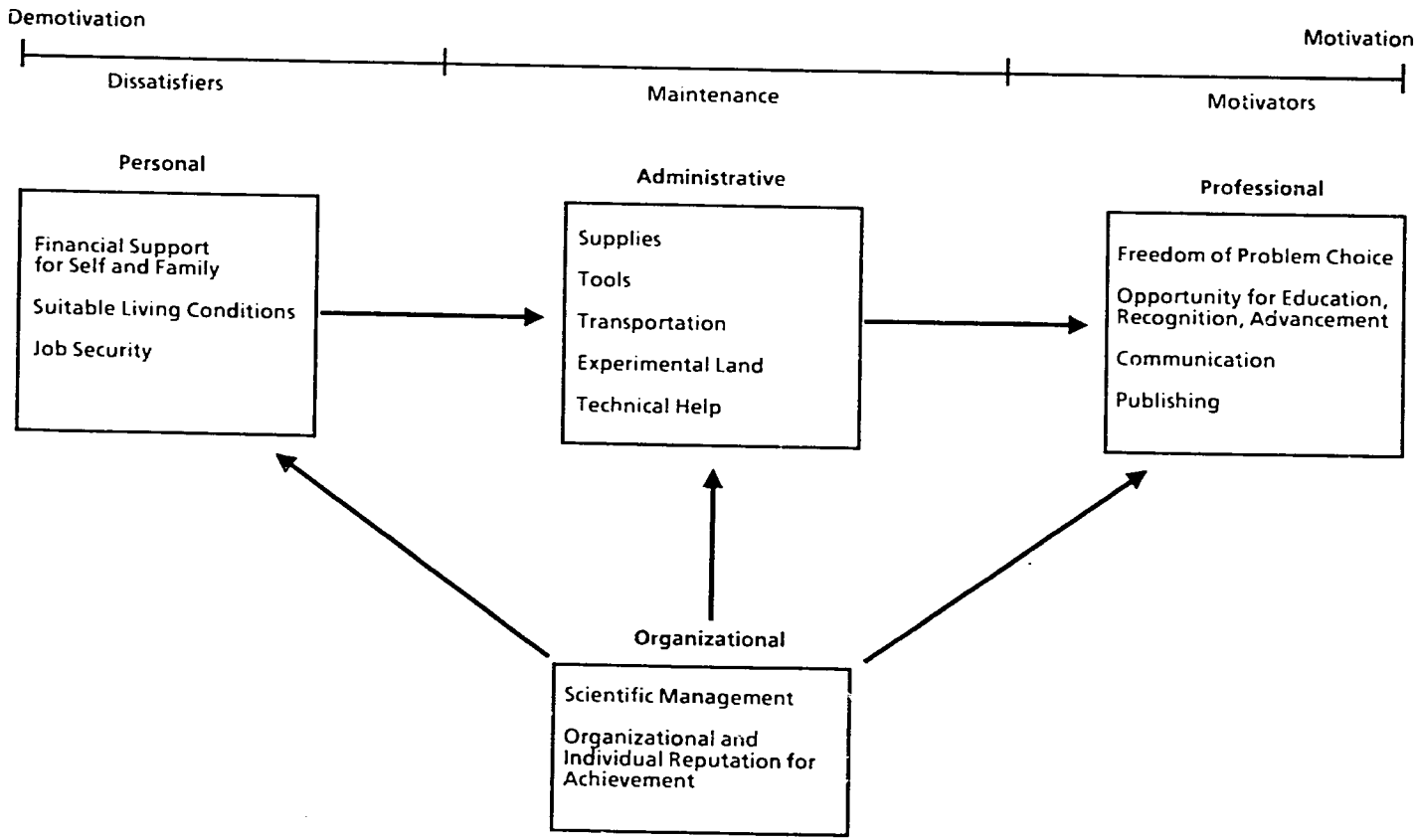
SECURITY NEEDS
1. Knowing expectations
2. Information / Feedback
3. Training
4. Belonging to good company
5. Fair Supervision
6. Job Security
7. Continued Income
8. In the right job

PHYSIOLOGICAL NEEDS
1. Food
2. Work Conditions
3. Relaxation
4. Bodily Safety
5. Pay

Herzberg's Hygiene-Motivation Factors



Agricultural Research Factors/Behavior Models



McGregor: Theory X, Theory Y

Theory X	Theory Y
People by nature:	People by nature:
1. Lack integrity.	1. Have integrity.
2. Are fundamentally lazy and desire to work as little as possible.	2. Work hard towards objectives to which they are committed.
3. Avoid responsibility.	3. Assume responsibility within these commitments.
4. Are not interested in achievement.	4. Desire to achieve.
5. Are incapable of directing their own behavior.	5. Are capable of directing their own behavior.
6. Are indifferent to organizational needs.	6. Want their organizations to succeed.
7. Prefer to be directed by others.	7. Are not passive and submissive.
8. Avoid making decisions whenever possible.	8. Will make decisions within their commitments.
9. Are not very bright.	9. Are not stupid.

Managers with Theory X assumptions will therefore exercise tight controls, will not delegate, will keep all information to themselves, will not trust subordinates, and will drive, push and shove people towards greater production. Persons managed this way will tend to display the very qualities they are assumed to have: they will behave as if they were dishonest, lazy, indifferent, etc. On the other hand, persons managed under Theory Y assumptions will tend to demonstrate the positive qualities implied.

NOTE: This material was summarized from the AMA Management Handbook (1970) by George Mulenga, Management Services Board, Lusaka, Zambia.

Gilbert's Performance Incentives

The goals, objectives, outcomes that need to be achieved are clear to the staff member.

These goals are both substantive (not set too low) and realistic (not set too high).

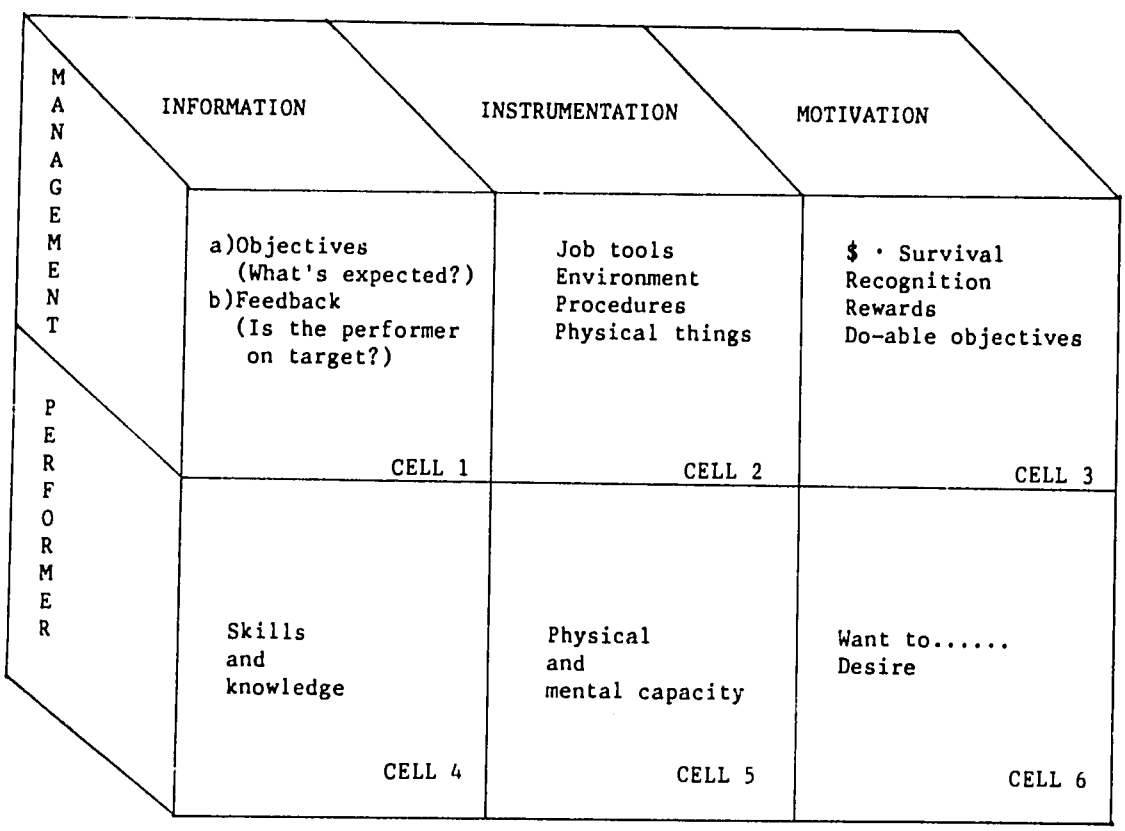
The staff member has the tools/resources needed to achieve these goals.

The staff member receives both confirmatory and corrective feedback from his/her superior and relevant others (for instance, team members, clients) on his/her performance.

The staff member receives training and whatever other developmental experiences are needed to help him/her to cope with new responsibilities.

The staff member is challenged to develop task-relevant unused resources.

The staff member is challenged to move beyond self-defeating attitudes that interfere with performance.



The Six-Cell Performance Engineering Model

positively functional for organizations in the following ways:

1. It can prevent stagnation.

2. It can stimulate interest and curiosity.

3. It can be the medium through which problems can arise and be discussed openly.

4. It can be the root of personal and social change.

5. It can be part of the process of personal testing and assessment.

6. It can demarcate groups from one another and thus establish group identity and personal allegiance.

7. It can foster internal cohesiveness to deal with external conflict (Simmel 1955).

Thus, conflict should be considered desirable as it fosters creativity and constitutes a relationship (not the absence of one) which allows for creative resolution.

One of the most lucid statements on conflict comes from one of the early students of conflict and its management (Coser 1956). Despite the fact that the statement is now over 30 years old, it clearly delineates the fundamental principles upon which the debate and the evolution of the various approaches depend.

> In loosely-structured groups and open societies, conflict which aims at a resolution of tension between antagonists, is likely to have stabilizing and integrative functions for the relationship. By permitting immediate and direct expression of rival claims, such social systems are able to readjust their structures by eliminating the sources of dissatisfaction. The multiple conflicts which they experience may serve to eliminate the causes for dissociation and to re-establish unity. These systems avail themselves, through the toleration and institutionalization of conflict, of an important stabilizing mechanism.
>
> In addition, conflict within a group frequently helps to revitalize existent norms; or it contributes to the emergence of new norms. In this sense, social conflict is a mechanism for adjustment of norms adequate to new conditions. A flexible society benefits from conflict because such behavior, by helping to create and modify norms, assures its continuance under changed conditions. Such a mechanism for readjustment of norms is hardly available to rigid systems: by suppressing conflict, the latter smother a useful warning signal, thereby maximizing the danger of catastrophic breakdown.
>
> Internal conflict can also serve as a means for ascertaining the relative strength of antagonistic interests within the structure, and in this way constitute a mechanism for the maintenance of continual readjustment of the balance of power. Since the outbreak of a conflict indicates a rejection of a previous accommodation between parties, once the respective power of the contenders has been ascertained through conflict, a new equilibrium can be established and the relationship can proceed on this new basis (Coser 1956: 154-55).

While a number of strategies and typologies have been constructed over time based on this initial understanding (Rapoport 1960; Boulding 1962; Deutsche 1973), the most useful of those for managing intergroup conflict for us here is the Arnold and Feldman (1986) table that follows (Table 2).

Briefly, there are four basic strategies for resolution of intergroup conflict. The first of these strategies is *avoidance* wherein the conflict is kept from coming into the open. There are two basic approaches that managers use in avoidance. The first is ignoring the conflict because the matter is either trivial or symptomatic of larger problems. The second circumstance for which an avoidance strategy is appropriate is imposing a solution from a higher level when decisive action is required or a consensus is unlikely.

The second type of strategy is *defusion* wherein the conflict is kept in abeyance by smoothing, playing down its importance, or diverting attention by appealing to superordinate goals.

The third type of strategy is *containment* which attempts to contain the conflict by controlling the issues and the manner in which they are discussed by either bargaining or structuring the interaction.

The fourth type of strategy is *confrontation* whereby attempts to integrate or reconcile are made so that the needs of both conflicting parties are met or organizations are redesigned so that conflict from lack of coordination can be eliminated.

Table 2: Conflict Management Strategies

Conflict Resolution Strategy	Type of Strategy	Appropriate Situation
Ignoring the conflict	Avoidance	When the issue is trivial When the issue is symptomatic of more basic, pressing problems
Imposing a solution	Avoidance	When quick, decisive action is needed When unpopular decisions need to be made and consensus among the groups appears very unlikely
Smoothing	Defusion	As a stop-gap measure to let people cool down and regain perspective When the conflict is over nonwork issues
Appealing to superordinate goals	Defusion	When there is a mutually important goal that neither group can achieve without the cooperation of the other When the survival or success of the overall organization is in jeopardy
Bargaining	Containment	When the two parties are of relatively equal power When there are several acceptable, alternative solutions that both parties would be willing to consider
Structuring the interaction	Containment	When previous attempts to openly discuss conflict issues led to conflict escalation rather than to problem solution When a respected third party is available to provide some structure and could serve as a mediator
Integrative problem solving	Confrontation	When there is a minimum level of trust between groups and there is no time pressure for a quick solution When the organization can benefit from merging the differing perspectives and insights of the groups in making key decisions
Redesigning the organization	Confrontation	When the sources of conflict come from the coordination of work When the work can be easily divided into clear project responsibilities (self-contained work groups) or when activities require a lot of interdepartmental coordination over time (lateral relations)

SOURCE: Arnold and Feldman (1986: 225)

Needless to say, it would be a unique manager who has acquired the skills or has the temperament to successfully operate at all levels. Thus, it is incumbent upon managers who attempt to successfully use conflict to advantage to, first, identify their own styles and, second, make sure the style is appropriate to the situation. If their style is not appropriate to the situation, then they must either adopt a different style or operate in such a manner that a desirable, predictable outcome can occur, one that is acceptable to all parties concerned.

There are a variety of methods to assist managers in identifying their strengths in conflict resolution strategies, such as the Myers-Briggs Type Indicator and Keirsey-Bates Temperament Sorter. These simple questionnaires are designed to assist in the identification of preferred style of conflict resolution so that a determination can be made on whether a style is consistent with the various situations in which managers find themselves.

Bibliography

Adair, John. 1984. The Skills of Leadership. Gower Publishing, Hants.

Arnold, Hugh J. and Daniel C. Feldman. 1986. Organizational Behavior. McGraw-Hill, New York.

Association of Project Managers. 1984. Closing the Gaps in Project Management Systems. Systems Gap Working Party Report. Bullerworths, UK.

Blanchard, Kenneth H. 1985. A Situational Approach to Managing People. BTD, California.

Boulding, K.E. 1962. Conflict and Defence. Harper, New York.

Briggs Myers, Isabel. 1986. Introduction to Type. Consulting Psychologists Press, Palo Alto, California.

Buchanan, Paul C. The Leader Looks at Individual Motivation. Looking into Leadership Series.

Callaham, Rober E., C. Patrick Fleenor and Harr R. Knudson. 1986. Understanding Organizational Behaviour. Merrill, Columbus.

Carroll J. Stephen et al. 1977. The Management Processes Cases and Readings. 2nd Edition. MacMillan.

Coser, L. 1956. The Function of Social Conflict. Free Press, Clencoe, Ill.

Deutsch, Morton. 1973. The Resolution of Conflict. Yale University Press, New Haven and London.

Hart, Lois Borland. 1981. Learning from Conflict: A Handbook for Trainees and Group Leaders. Addison-Wesley, Reading, Massachusetts

Hersey, Paul and Kenneth H. Blanchard. 1977. Motivation and Behavior. Chapter 2 from Management of Organizational Behavior: Utilizing Human Resources. 3rd Edition. Prentice-Hall.

Herzberg, Frederick. 1968. One More Time: How Do You Motivate Employees? Harvard Business Review January-February 1968:53-62.

International Encyclopedia of the Social Sciences (IESS). 1968.

Jandt, Fred E. (Ed). 1973. Conflict Resolution through Communication. Harper and Row, New York.

Jenkins, W.O. 1947. A Review of Leadership Studies with Particular Reference to Military Problems. Psychological Bulletin, Vol. 44:54-79.

Jessey, Francis V. 1972. Job Enrichment. The 1972 Annual Handbook for Group Facilitators, University Associates, Inc., pp. 127-129.

Keirsey, David and Marily Bates. 1984. Please Understand Me. Prometheus Nemesis, Del Mar, California.

Longenecker, J.G. and Charles D. Pringle. 1984. Management. 6th Edition. Merrill, Columbus.

Marjoribanks, John. 1982. Leadership. Mananga Agricultural Management Center, L6311, Swaziland.

Maslow, Abraham H. 1943. A Theory of Human Motivation. Psychological Review. 50:370-396.

McGregor, D. 1969. The Human Side of Enterprise. McGraw-Hill, New York.

Mintzberg, H. 1973. The Nature of Managerial Work. Harper and Row, New York.

Moore, P.H. and Thomas H. 1976. The Anatomy of Decisions. Penguin Management Texts, UK.

Owen, Ja. .es. 1974. You Can Lift Morale and Productivity. Supervisory Management July 1974:30-38.

Pedler, Mike and John Burgoyne. 1986. A Manager's Guide to Self-Development. 2nd Edition. McGraw-Hill Book Co., London.

Pedler, Mike, John Burgoyne and Tom Boydell. 1978. A Manager's Guide to Self-Development. McGraw-Hill, London.

Pfeiffer, Sandra L. 1972. The Maslow Need Hierarchy. The 1972 Annual Handbook for Group Facilitators. University Associates, pp. 125-126.

Rapoport. 1960. Fights, Games, and Debates. University of Michigan Press, Ann Arbor, Michigan.

Reitz, H. Joseph. 1981. Behavior in Organizations. Irwin, Homewood.

Rue, Leslie W. and Lloyd L. Byars. 1980. Motivation: The Moving Function. Chapter 9 from Management Theory and Application. Richard D. Irwin, Inc.

Scott Myers, M. 1964. Who Are Your Motivated Workers? Harvard Business Review January-February 1964:73-88.

Sills, David L. (Ed). 1986. International Encyclopedia of the Social Sciences. Free Press, New York.

Simmel, G. 1955. Conflict. Free Press, New York.

Skinner, B.F. 1953. Science and Human Behavior. McMillan, New York.

Stogdill, R.M. 1948. Personal Factors Associated with Leadership: A Survey of the Literature. Journal of Psychology. Vol. 25, 1948:35-71.

Tannenbaum, R. and W.H. Schmidt. 1973. Harvard Business Review. May-June.

Tannenbaum, R. and W.H. Schmidt. 1958. How to Choose a Leadership Pattern. Harvard Business Review March-April 1958.

Zinyemba, A. 1988. Leadership and Management Styles. ZIPAM, Zimbabwe.

INDENTIFYING HUMAN RESOURCE CAPABILITIES AND CONSTRAINTS IN NATIONAL AGRICULTURAL RESEARCH SYSTEMS: TEST OF A METHODOLOGY; CASE STUDY, ECUADOR

Paul Marcotte and Krystyna Stave

Introduction

In ISNAR's strategy document, entitled "Working to Strengthen National Agricultural Research Systems," it is recognized that while modes of collaboration will vary due to differing circumstances in NARS, there is a three-stage process that ISNAR follows. This process, by which ISNAR proceeds in its partnership with national governments, consists of diagnosis of system constraints, planning system-building strategies, and implementing system-building programs. The process stages, key actors, activities, and products of each of the stages are illustrated in Figure 1.

The purpose of this paper is to describe the process as it was followed in the Ecuadorian mission in June 1988 with respect to the human resources element. As this is a work in progress, the material that follows is basically in two sections.

The first section is the prediagnosis stage, where methodology was discussed and a survey instrument was prepared to assist in information collection during the review. The second section is the information that was prepared and selectively incorporated into the mission report. As ISNAR is presently collaborating with the Ecuador NARS in the development of a workplan, the planning stage is not yet complete. However for the purposes of the workshop, it will be very useful for all parties concerned if you as NARS managers can provide comments on the information, what it would mean to you, and how you could develop work plans if this information was available to you on your system.

Prediagnosis Stage–Development of Methodology

In accordance with this strategy and in response to a perceived need by the advisory services, a survey instrument was developed to facilitate human resource analysis in ISNAR's country review and advisory services' missions. The instrument was designed to collect information for two purposes: (1) to describe the characteristics and current use of human resources in the research system, and (2) to identify attitudes, interests, and objectives that motivate those researchers.

The instrument was tested in four ISNAR workshops in sub-Saharan Africa, and in NARS reviews in Senegal and the Philippines. The instrument was then adapted for the Ecuadorian mission through a negotiated process including NARS representatives, ISNAR advisory services, and members of ISNAR's research section. The ultimate version (in English) is attached for your reference.

The instrument is divided into six sections. Section 1 collects demographic and educational information. This background information can be used both to create a planning document for human resource management and to provide control variables for analyzing data from subsequent sections.

Section 2 seeks information about work activities and career development. It contains questions about the type of work the researcher does, his/her future career plans, and perceived criteria for career advancement.

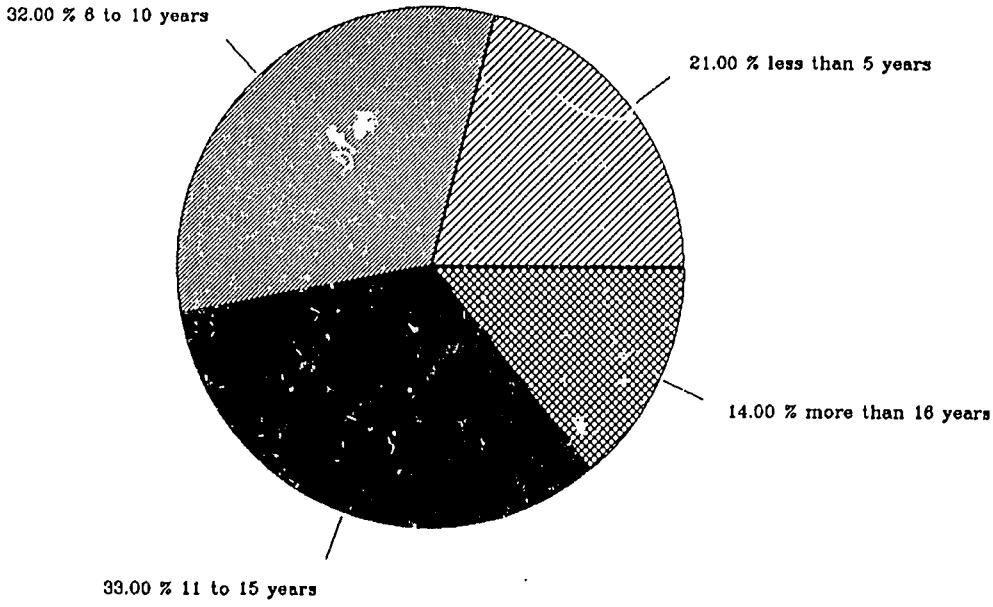
Section 3 collects information on research productivity and research beneficiaries. Questions focus on the type and quantity of the research product and on the perceived actual and ideal research beneficiaries.

Section 4 looks at research objectives and resources. It contains questions about the adequacy and importance of resources for research, the importance of listed research objectives, limitations to research, and criteria

Figure 1. ISNAR/NARS three-stage partnership process

Actor	- ISNAR - NARS Collaborate	- ISNAR/NARS Partnership	- NARS - ISNAR: Backstop Catalyst
Activity	- Broad-based system review - Specific process, policy, or organization review	- Strategy developed - Priorities Set - ISNAR overview and breadth NARS Local interpretation	- Adapt and institutionalize management procedures
Product	- Recommendations	- Operational strategy supported by adequate evidence - Development of work plans	- Incremental build-up of system's capacities - More effective and better-managed research systems

Figure 2. Percent distribution of work experience



used to measure research productivity.

Section 5 measures the number of researchers that are active in professional societies and meetings.

Section 6 identifies some difficulties that researchers have with management activities.

The survey results were stored and organized on a microcomputer using dBASE III+, a commercial database management software program by Ashton-Tate. One record in the database represents one complete survey form. Each field in the record corresponds to an item of data in the survey.

The survey information was summarized using standard dBASE III+ reports. For each NARS surveyed, individual records were summarized by institute. The tables generated include age distribution, educational discipline, agricultural research experience, and distribution of work activities. Percentages were calculated from the tables. Selected data were then entered into DB Graph, a graphics program by Microrim, in order to produce graphic representations of the data.

Scientists: The Human Resource

"It has been posited that 'human resources are the basic determinants of the rate of development of science, technology and social institutions'" (Lacy et al. 1983: 11). It is human resources, in the form of scientists, that provide the knowledge and expertise for scientific development. This recognition dictates that one of the most important functions of a national agricultural scientific research system is the development, retention, and continued motivation of a body of scientific professionals. It is therefore of critical importance that the scientists themselves be understood in order to understand the scientific enterprise. This understanding will facilitate decision making on staff recruitment, selection, training, performance, motivation, and utilization of human scientific resources.

With the recognition that management must accomplish these functions as described above and that it requires an understanding of the scientists in order to do so effectively and efficiently, there are a number of essential questions that must be answered. Basically these are the objective questions of who are the scientists? what do they do? where do they work? and how do they work? The subjective questions are how do they see their work environment? and why do they do what they do?

The following case study of Ecuador is an example of agricultural scientists' responses to the questionnaire that was developed, an illustration of how this information can be analyzed and displayed, and a conclusion which includes a summary of the information and critique of the process. The questionnaire was completed by 148 researchers, or 65% of the total NARS professional staff.

Demographic profile

An examination of the demographic characteristics of the agricultural scientists reveals that their average age is 39 years with an age range from 21 years to 70 years. This group of scientists has spent an average of 10 years in agricultural research, excluding their training. The distribution of this work experience is 21% with five years or less, 32% with six to 10 years, 33% with 11 to 15 years, and 14% with 16 years or more (Figure 2).

While women represent only 5% of the scientific population (a figure that is consistent with statistics from other countries), they are distributed in a variety of disciplines. This diverges from previous studies of public-sector agricultural scientists where women were concentrated in a limited number of sciences, such as nutrition, social science, and food science (Busch and Lacy 1983).

An examination of the educational level of the scientists indicates that 1% have obtained PhDs, 22% have obtained Master's degrees, and 74% have either a Bachelor's degree or local equivalent. The remaining 3% have other degrees, such as associate degrees (Figure 3). This level of education is considerably below the average levels found in a 32-country study of Third World nations, where 9% had obtained PhDs, 27% had obtained Master's degrees and 64% had a Bachelor of Science or equivalent (Oram and Bindlish 1981). Recently, the preliminary data from the ISNAR Agricultural Research Indicator Series (Pardey and Roseboom *in press*) on 79 countries show that 12% have obtained PhDs, 35% have a MSc, and 53% have a BSc, thus confirming the relatively low level of education in this NARS. In addition to being considerably below the international norm, the level of PhDs at only 1% is significantly below the 20% target proposed by a World Bank policy paper.

Figure 3. Percent distribution of educational degrees

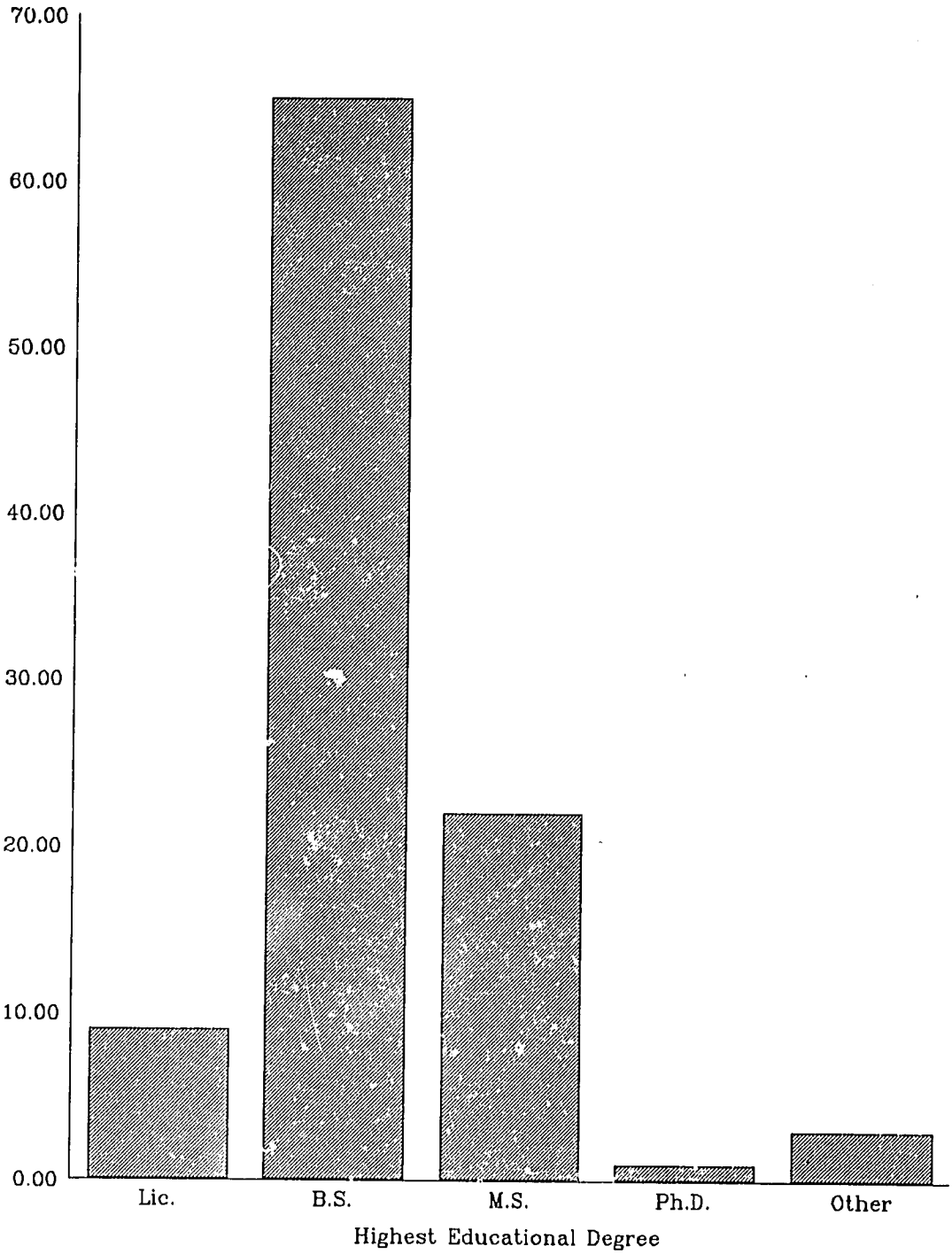
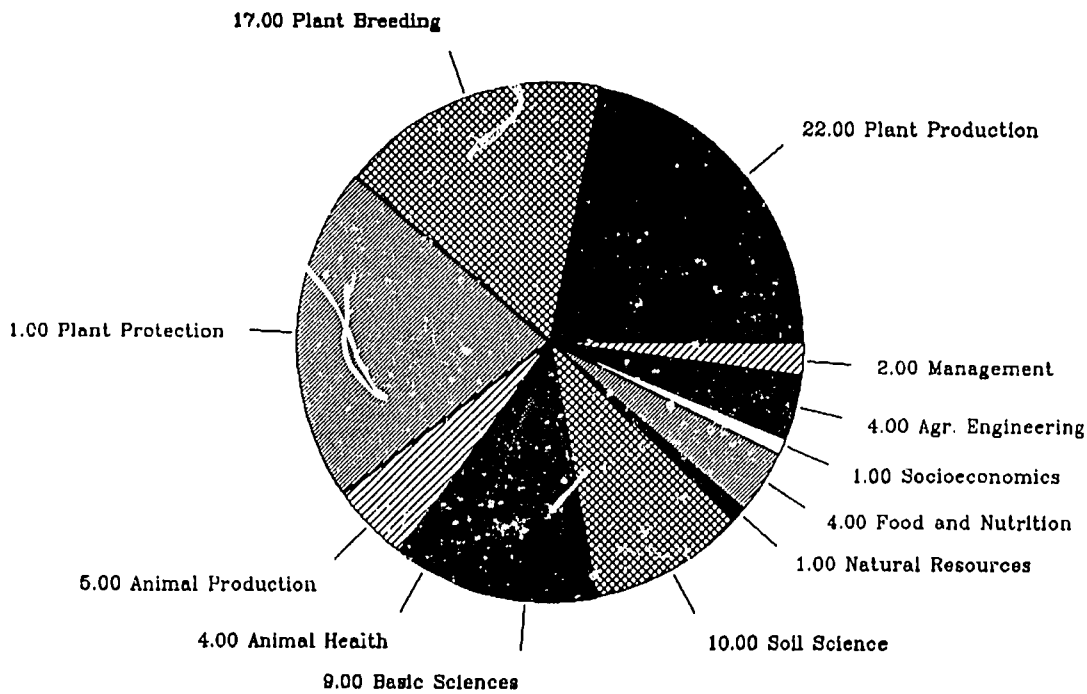


Figure 4. Percent distribution of educational disciplines



One strength of the human resource capability in this NARS is that the distribution of skills across age cohorts is equitable, showing that there is not an overreliance on the older, more experienced cohort, nor is there an overabundance of younger, less experienced researchers. Another strength is that while there are relatively few female researchers, they are not confined to those categories traditionally thought to be female-oriented; thus, it can be assumed that they are working in their chosen, and presumably most efficient, areas of interest and expertise.

A weakness may be indicated in the levels of expertise achieved as evidenced by the relative lack of education in this NARS. A caution should be noted here, however. If the organization has defined as its mission that research be restricted to adaptive research, then it may well be that Master's level scientists have the technical expertise necessary to accomplish the task. More education in the form of PhD training may be superfluous.

Disciplinary capability

Scientists were requested to indicate educational discipline and current discipline from a prepared list of 12 disciplinary categories (Figure 4, Table 1). The crop sciences, which included plant production, plant breeding, and plant protection constituted 60% of the educational disciplines and 61% of the current disciplines. The animal science component, which included animal production and animal nutrition, accounted for 9% of the educational disciplines and 8% of the current disciplines. The remaining support sciences, which included basic science, soil science, natural resource management, socioeconomics, agricultural engineering, food and nutrition, and management, accounted for 30% of the educational disciplines and 31% of the current disciplines. Figure 4 illustrates the percent distributions of the specific educational disciplines.

While it does not appear that the disciplinary capability has been altered from education to current practice, as the clusters of disciplines are virtually identical, within groups there has been considerable change. For example, in the crop science cluster, plant breeding has increased from 17% to 27% at the expense of plant production, which has decreased from 22% to 12%. In the support sciences, the combination of basic science and soil science has decreased from 19% to 7%, while nutrition has increased from 4% to 11% and management has increased from 2% to 6%. In the animal science cluster, there is virtually no capability as there is no critical mass at any research station. And there is only one research station that has representation from both components of the animal science cluster (Table 1).

A number of issues/questions arise from this comparison: first, is the shift in the crop science cluster intentional (i.e., planned) or has it occurred due to changing organizational needs? The response to this question has consequences for the training offices and the types of educational opportunities provided the scientists. Second, is the relative lack of critical mass in animal sciences consistent with organizational goals and objectives? Is this lack of scientific capacity absorbed by private industry? Third, with respect to support sciences, while only two people have been professionally trained in the management sciences, this constitutes a relatively large effort in terms of staff time, particularly in the central office. Recognition of this continuing need should inform and thus alter the training plan.

Scientific Orientation

The scientists were requested to identify the percentage of their time that was spent in various work activities, such as research, administration, teaching, extension, travel/conferences, and other. As is shown in Figure 5, the majority of the work activity was spent in research: 60%. Administration, combined with "other," constituted 23%, and teaching, extension, farming, and travel/conferences constituted 5%, 4%, 4%, and 4%, respectively.

When requested to characterize their research for the last five years, the scientists identified 25% in basic research (defined as new scientific knowledge), 48% in applied research (defined as practical use for existing knowledge), and 27% in adaptive research (defined as tailor-applied research to specific locations).

Concerning professional advancement, the scientists were requested to select from a list provided the three most important criteria that actually and ideally contributed to their professional advancement. Results from these questions are presented in Table 2. Experience was ranked the most important criterion

Table 1.
Distribution by Discipline

DISCIPLINE	EDUCATION n	EDUCATION %	CURRENT n	CURRENT %	DIFFERENCE in%
Plant Production	25	22	15	12	− 10
Plant Breeding	19	17	32	27	+ 10
Plant Protection	24	21	26	22	+ 1
Animal Production	6	5	7	6	+ 1
Animal Health	4	4	2	2	− 2
Basic & Support Science	10	9	3	2	− 7
Soil Science	11	10	7	5	− 5
Natural Resource Management	1	1	1	1	0
Socioeconomics	1	1	5	4	+ 3
Agricultural Engineering	5	4	2	2	− 2
Food and Nutrition	5	4	13	11	+ 7
Management	2	2	7	6	+ 4

both actually and ideally, with effort devoted to research and academic/technical qualifications also considered to be important both actually and ideally. Surprisingly, peer or supervisor evaluations were actually important, but the scientists felt that ideally these should not be accorded such importance. Conversely, professionalism as defined by motivation and/or initiative was ranked 6th actually but ideally was almost as important as effort devoted to research. Organizational policies and attendance at seminars/ conferences were not of relative importance either actually or ideally.

Next the scientists were requested to identify what they considered to be the three most serious limitations to their career advancement (Table 3). The most important limitation was considered to be peer or supervisor evaluation. This is consistent with the above information where they ranked evaluations as being ideally less important than they actually are. Experience was considered to be the second most serious limitation to career advancement. This may well be a reflection of the age distribution within the organization. Verification of this phenomenon could be accomplished by controlling the limitation variables by the age cohort variable.

Impact/use of research results and seminars/ conferences attended received approximately the same number of points concerning limitations to advancement. This is interesting because neither was considered relatively important, actually or ideally, as a criterion for advancement. Academic qualifications were also considered as a relatively serious limitation;

Figure 5. Percent distribution of work activities

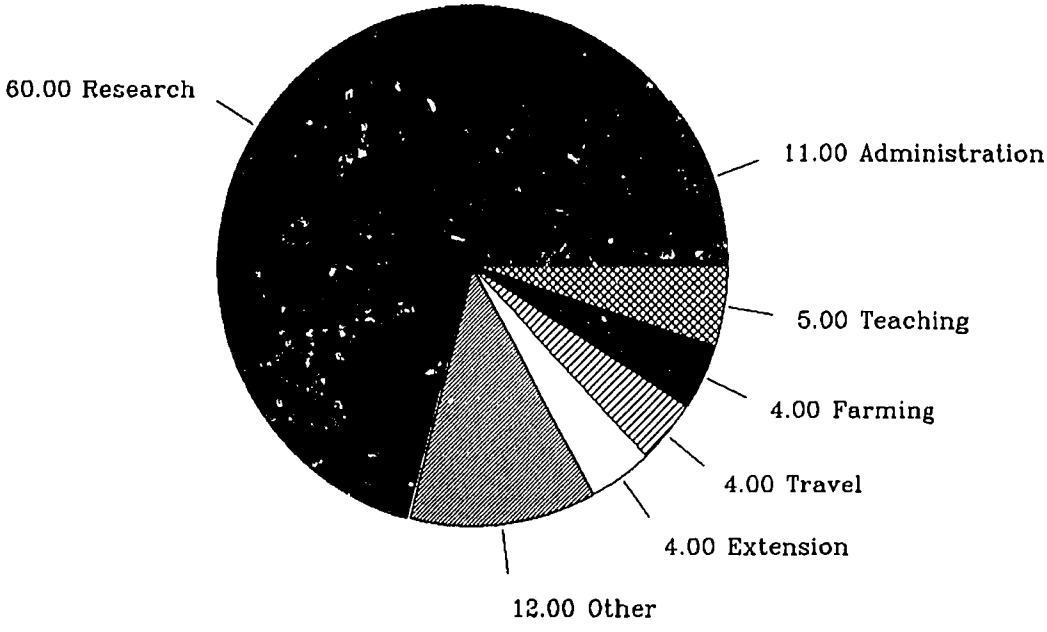


Table 2.
Criteria for Professional Advancement

CRITERIA	Actual (n = 141)					Ideal (n = 123)				
	1st Most Important	2nd Most Important	3rd Most Important	Total Points	Rank	1st Most Important	2nd Most Important	3rd Most Important	Total Points	Rank
Experience	195	93	16	304	1	175	96	17	288	1
Academic/Technical Qualifications	185	45	10	240	2	95	33	12	140	4
Effort Devoted to Research	110	78	10	198	3	95	93	14	202	2
Peer or Supervisor Evaluation	125	39	10	174	4	25	3	4	32	7
Research Result Reported	70	69	16	155	5	55	36	16	107	6
Professionalism (i.e., motivation)	65	33	18	116	6	95	54	24	173	3
Impact/Use of Research Results	25	30	25	80	7	55	39	24	118	5
Organizational Policies or Attitude	25	36	7	68	8	15	9	3	27	8
Other	35	9	6	50	9	0	0	1	1	10
Seminars/Conferences Attended or Organized	20	9	15	44	10	10	9	7	26	9

NOTE: Agricultural Researchers were requested to select the three most important criteria (actual and ideal) for professional advancement within their institutions. Total points were computed by multiplying the number of respondents that selected the various criteria by a factor of 5 for the most important, 3 for the second most important, and 1 for the third most important.

Table 3.
Limitations to Career Advancement

Criteria	1st Most Serious	2nd Most Serious	3rd Most Serious	Total Points
Peer or Supervisor Evaluation	130	42	15	187
Experience	115	33	5	153
Impact/Use of Research Results	65	30	16	111
Seminars/Conferences Attended or Organized	40	48	21	109
Academic Qualifications	60	30	10	100
Research Results Reported	25	57	9	91
Effort Devoted to Research	35	36	5	76
Professionalism	35	15	11	61

NOTE: Agricultural researchers were requested to select the three most serious limitations to their career advancement. Total points were computed by multiplying the number of respondents that selected the various criteria by a factor of 5 for the most serious, 3 for the second most serious, and 1 for the third most serious.

however, as is the case with experience, this may be a manifestation of the younger age cohort. The least serious limitation was professionalism, last no doubt because, as they consider themselves professional and they consider it important, it is not a serious limitation.

Resources: Adequacy and Importance

In order to conduct effective and efficient research, a number of resources are required. A series of items, adopted from Hargrove (1978) and Lacy et al. (1983) and expanded for this study, were used to gather information on scientists' attitudes towards these items. The scientists were requested to indicate both the adequacy of these items in their current research and the importance of these items for the success of their research. A five-point scale was constructed, where 1 = very adequate and very important and 5 = very inadequate and very unimportant. The 26 items were divided into four general categories: personal, administrative, professional, and organizational.

The categorization of these items is intended to be an adaptation of the resources known to be necessary for successful research. They have been put into hierarchical order to approximate the factors in classical organizational behavior literature, such as Maslow's (1943) hierarchy of needs and Herzberg's (1966) hygiene-motivation factors. According to Maslow (1943), people are motivated by their own needs, which occur in a hierarchial order that proceeds from physiological, to safety, to social, to ego, and finally to self-actualization. Once a need is satisfied at one level, then it ceases to be a motivator. Conversely, if satisfaction of a need is blocked, its importance becomes preeminent, to the detriment of successive levels.

Herzberg (1966) refined this approach by identifying factors that were determinants of dissatisfaction, which he referred to as hygiene or maintenance factors, and factors that were determinants of satisfaction, which were called motivators.

For the categories of resources for agricultural research, the cluster of personal factors are roughly equivalent to Maslow's (1943) physiological and safety needs. These would be considered dissatisfiers or

demotivators if they were inadequate. The cluster of administrative factors are basically those physical resources necessary to successfully accomplish scientific experimentation, and as such, their absence would be a demotivator. The cluster of professional factors are those which positively motivate research. They are a combination Maslow's (1943) ego needs and Herzberg's (1966) motivating factors. The final cluster of organizational factors are those that influence positive performance by creating expectations. While they are considered motivators and are an approximation of Maslow's (1943) self-actualization level, they also affect the other clusters. An illustration representing this approach is attached as Figure 6.

With respect to the individual factors necessary to conduct research, all but one were within the range of 1.21 to 1.99. Thus, all were considered to be important to very important. Financial support for self and family, management's reputation for scientific achievement, and quality of trained technical help were the three most important factors. The factor that was least important was the opportunity to gain scientific recognition.

With respect to the adequacy of the resources, the majority of the factors were less than adequate. The organization's reputation for scientific achievement, availability of experimental land, and personal freedom to determine research problems ranked 1, 2, and 3, respectively; however, the adequacy score of each was considerably less than their importance scores. The least adequate resource was financial support for self and family.

With respect to the differences between adequacy and importance, *all* of the factors were considered less adequate than they were important. The lowest differences were in the management's and organization's reputation for scientific achievement and in personal freedom to determine research problems. The largest difference was in financial support for self and family, which was considered to be the *most* important but *least* adequate resource. Details of this information are in Table 4.

A summary of the data for the clusters of factors indicates that the personal factors were considered the most important and the least adequate. As was the case with individual factors, all clusters were considered less adequate than important, with the differences largest in the personal factors, becoming progressively less through administrative, professional, and organizational factors.

Several conclusions can be obtained from this array of data. First, the scientist's perception is that there is inadequate financial support for self and family. That this factor, at the most basic level, is the least adequate and also the most important confirms the classical theory that, if not satisfied, the physiological or hygiene factors will become preeminant. However, despite this confirmation, the scientific process has continued. Thus, despite the preeminance of a demotivating factor, activities have proceeded at subsequent levels. The implication of this progression is either acceptance of the less-than-adequate situation or a realization that organizational control over this factor is limited.

Regardless of the disposition, this will enable managers to identify certain factors (i.e., professional) that are fully within their control, relatively cost-free, and considered important by the scientists. This recognition should be seized as an opportunity to create a social and organizational milieu which supports the professional factors and thus motivates individual scientists.

Importance of Research Objectives

The agricultural researchers were requested to indicate the importance of objectives to their research on a scale where 1 = of no importance and 5 = of highest importance. All of the factors identified by the scientists as objectives of agricultural research were above 3.0 on the scale, with the range from 4.79 to 3.14. The most important research objective according to the scientists was increased agricultural productivity, with the development of new knowledge or improved methodology the second most important. These results are generally consistent with previous studies of developed and developing countries (Marcotte et al. 1982; Busch and Lacy 1983; Lacy et al. 1983) with the following exceptions. All factors were considered more important than indicated by U.S. scientists, and decreasing production costs was relatively more important than in previous studies. Details are illustrated in Table 5.

Research Beneficiaries

The agricultural scientists were requested to indicate how their research does and should benefit potential beneficiaries, using a scale of 1 to 5, where 1 = not at all

Figure 6. Agricultural research factors/behavior models

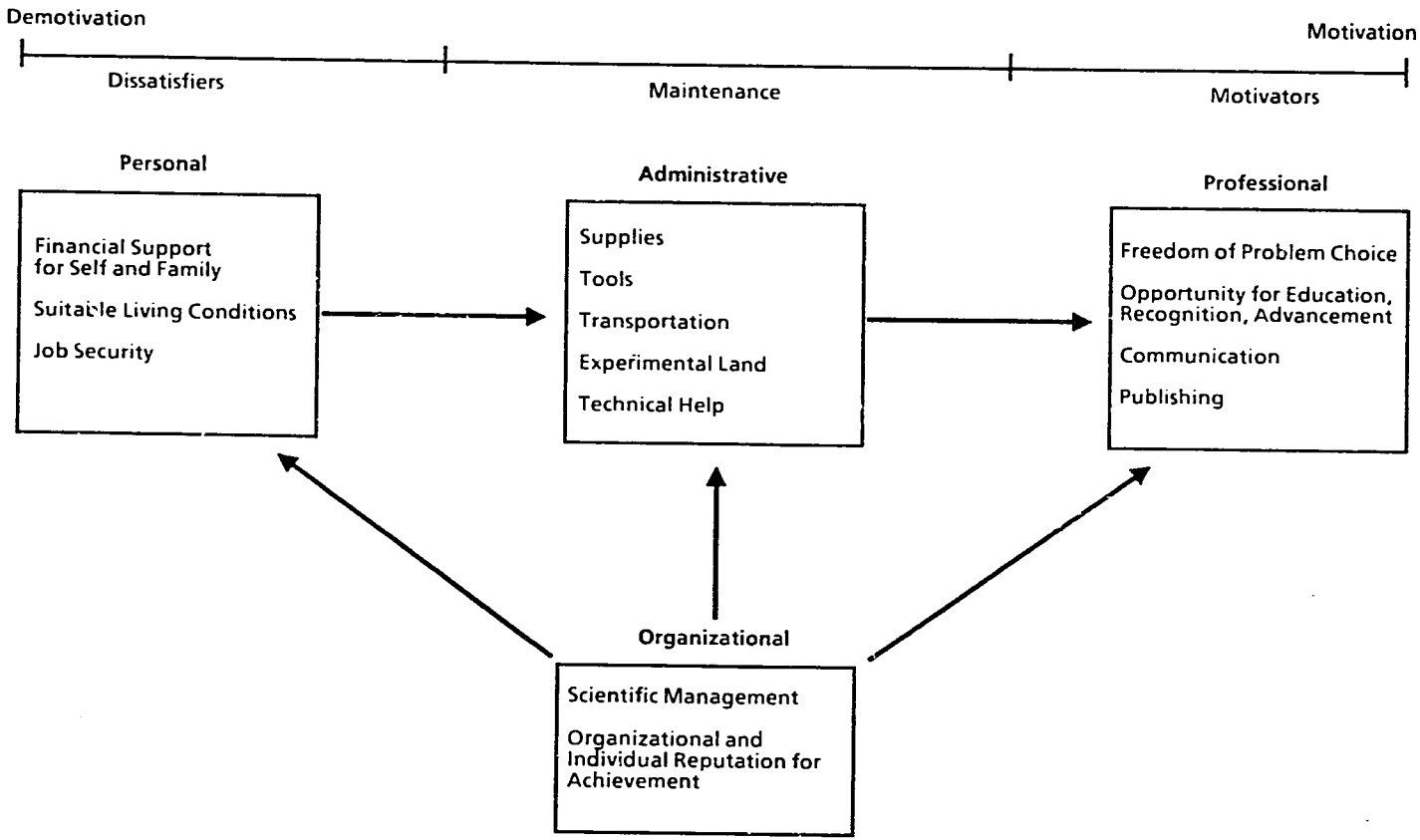


Table 4.
Resource Adequacy and Importance

	Adequacy (1)	Importance (2)	Difference (1) – (2)
1) PERSONAL			
Financial Support for Self and Family	3.59	1.21	2.38
Suitable Living Conditions	3.11	1.34	1.77
Job Security	2.50	1.46	1.04
Personal Average	3.07	1.34	1.73
2) ADMINISTRATIVE			
Operating Supplies and Materials	3.09	1.36	1.73
Transportation	3.21	1.49	1.72
Availability of Experimental Land	2.39	1.64	0.75
Equipment and Tools to use in Research	3.06	1.35	1.71
Office and Laboratory Facilities	3.04	1.68	1.36
Availability of Labor	3.30	1.67	1.63
Quality of Labor	3.27	1.75	1.52
Scientific Literature/Library	3.28	1.35	1.93
Availability of Trained Technical Help	2.82	1.33	1.49
Quality of Training for Technical Help	2.59	1.29	1.30
Availability of Advice from Experienced Researchers	3.28	1.76	1.52
Administrative Average	3.03	1.52	1.51
3) PROFESSIONAL			
Personal Freedom to Determine Research Problems	2.44	1.55	.89
Contact with Other Scientists	3.01	1.43	1.58
Opportunities for Advanced Education	3.20	1.51	1.69
Opportunities to Gain Scientific Recognition	3.38	2.01	1.37
Opportunities for Professional Advancement	3.26	1.60	1.66
Opportunities for Promotion Based on Merit	3.27	1.44	1.83
Opportunities for Training People Who Work under Your Direction	2.94	1.54	1.40
Opportunities for Practical Implementation of Output	2.85	1.46	1.39
Opportunities to Publish Research Findings	2.77	1.41	1.36
Professional Average	3.01	1.55	1.46
4) ORGANIZATIONAL			
Scientific Training of Management	2.52	1.41	1.11
Management's Reputation for Scientific Achievement	2.54	1.73	0.81
Organization's Reputation for Scientific Advancement	2.12	1.27	0.85
Organizational Average	2.39	1.47	0.92

NOTE: Agricultural researchers were requested to identify the adequacy and importance of a number of resources on a five-point scale, where 1 = very adequate, very important and 5 = very inadequate, very unimportant.

Total n = 148; however, individual variables may be less due to missing data. Scores were calculated by a standard statistical formula for means.

Table 5.

Importance of Research Objectives

Objectives	*Importance Score*
Increase Agricultural Productivity	4.79
Develop New Knowledge or Improved Methodology	4.51
Decrease Production Cost of Farm Products	4.34
Improve Level of Rural Living	4.28
Improve Protection from Insects, Disease, Other Hazards	4.17
Provide Input to Other Researchers	4.16
Protect Consumer Health and Improve Nutrition	4.09
Expand Demand by Developing New Products or Enhancing Product Quality	3.96
Improve Support Services	3.92
Promote Community Improvement	3.52
Improve Marketing Efficiency	3.45
Reduce Import Expenditures	3.28
Expand Export Receipts	3.14

NOTE: Agricultural researchers were requested to indicate the importance of objectives of agricultural research on a five-point scale, where 1 = of no importance and 5 = of highest importance. n varied from 143 to 128. Scores were calculated by a standard statistical formula for means.

Table 6.

Research Beneficiaries

	Will or Does Benefit (1)	Should Benefit (2)	Difference (2) - (1)
Small Farmers	3.71	3.71	0.0
Extension	3.69	4.66	0.97
Scientists in Own Discipline	3.69	4.75	1.06
Agribusiness	3.56	4.17	0.61
Local/State Government	3.54	4.41	0.87
Farming Systems Research Groups	3.49	4.44	0.95
Rural Residents	3.43	4.46	1.03
Foreign Groups, Institutions, or Governments	3.22	3.69	0.47
Other	3.17	3.81	0.64
Other Scientific Disciplines	2.92	3.65	0.73
General Public	2.83	3.73	0.90

NOTE: Agricultural researchers were requested to indicate how their research does or should benefit a series of potential beneficiaries. A scale of 1 to 5 was provided, with 1 = not at all and 5 = a great deal. n = 148; however, it may be less for the individual variable due to missing information. Benefit scores were calculated by a standard statistical formula for means.

Table 7.

Limitations to Research

Criteria	1st Most Serious Limitation	2nd Most Serious Limitation	3rd Most Serious Limitation	Total Points
Financial Resources	370	75	8	453
Human Resources	75	102	29	206
Physical Resources	25	117	28	170
Experience	50	15	8	73
Organizational Norms and Attitudes	15	27	25	67
Other	25	3	7	35
Academic/Technical Qualifications	25	0	7	32
Professionalism (Motivation, Initiative)	5	15	6	26

NOTE: Agricultural researchers were requested to select the three most serious limitations to their research. Total points were computed by multiplying the number of respondents that selected the various criteria by a factor of 5 for the most serious, 3 for the second most serious, and 1 for the third most serious.

Table 8.

Difficulty of Management Activities

Management Activities	1st Most Difficult	2nd Most Difficult	3rd Most Difficult	Total Points
Obtaining Additional Resources	130	66	23	219
Improving Use of Operating Resources	90	51	16	157
Implementing Policy and Planning Priorities	85	30	20	135
Evaluating Past Activities	75	36	9	120
Improving Morale of Nonprofessional Staff	45	39	8	92
Maintaining Physical Facilities	45	30	8	83
Monitoring Ongoing Activities	25	15	5	45
Communicating with Farmers and Other Clients	15	21	3	39
Talking to Staff about Their Problems	10	12	3	25
Other	10	9	5	24
Maintaining Effective Control and Discipline of Staff	0	9	6	15

NOTE: Agricultural researchers were requested to select the three most difficult management activities to perform. Total points were computed by multiplying the number of respondents that selected the various criteria by a factor of 5 for the most difficult, 3 for the second most difficult, and 1 for the third most difficult.

and 5 = a great deal. The range for will or does benefit was from 3.71 to 2.83, with small farmers, scientists in own discipline, and extension being considered the primary beneficiaries. Only other scientific disciplines and the general public received a score of less than 3.

When responding to the same list of potential beneficiaries in terms of which "should" benefit, the results changed considerably. First, the scores for all potential beneficiaries were higher, with the exception of small farmers. Thus, there is apparently some question on the part of the scientists that results may not be reaching those who should benefit from the research. Second, while it was suggested that small farmers as a group should benefit, there were eight other potential beneficiaries that the scientists thought should take precedence over the small farmer. The results of this scale are illustrated in Table 6.

Limitations to Research

The scientists were requested to select the three most serious limitations to research: the most serious limitation = 5 points, the second most serious = 3 points, and the third most serious = 1 point.

The most serious limitation to research was clearly financial resources, which received a total of 453 points. Second and third were human and physical resources respectively. In relative terms, academic qualifications and professionalism were of no consequence. Details of this scale are illustrated in Table 7.

Difficulty of Management Activities

The final section of the questionnaire requested agricultural researchers to select three management activities that they found the most difficult to perform to their satisfaction. The first most difficult received 5 points; the second, 3 points; and the third, 1 point. The results of their individual difficulties indicated that again the availability of resources and the efficient use of resources were the most difficult for them to manage. Communications and control activities were the least most difficult to manage. Details of the results are attached in Table 8.

Conclusion

A number of specific conclusions can be drawn from the data as they displayed and analyzed. For example, the demographic profile indicated that the educational level was relatively low by comparison to other LDCs and considerably below internationally recognized targets. Additionally, there was considerable shifting from educational disciplines to current disciplines. The importance of information of this type at the planning level is that it can be used to identify expertise gaps and lack of critical mass, and can assist in linking capabilities to organizational objectives. For managers, this information can also be used to compare organizational problems, such as limitations and constraints, across categories of age, sex, education, and position by using the information as control variables.

With respect to a process that has been followed in testing a methodology, the exercise has been successful in that a survey instrument has been field-tested and adjusted according to information received. With the information gathered, it was possible to describe an organization in respect to its scientists and capability. In addition, a number of serious questions were highlighted as a result of the data analysis. The true test yet to be accomplished is the incorporation of the information into a work plan for corrective action. Work on this aspect has already begun.

Bibliography

World Bank. 1988. World Development Report. Oxford University Press.

Ghai, D.P. 1983. Stagnation and Inequality in African Agriculture. *In* Growth and Equity in Agricultural Development. Edited by A. Maunder and K. Ohkawa. Aldershot: Gower.

Jain, H.K. 1988. Role of Research in Transforming Traditional Agriculture: An Emerging Perspective. *In* Food and Nutritional Strategies: Concepts–Objectives–Application. Edited by R. Delleré and J.J. Symsens. Technical Center for Agriculture and Rural Cooperation (CTA), Royal Academy of Overseas Sciences, Brussels.

Lele, Uma and Arthur A. Goldsmith. 1987. The Development of N: ional Agricultural Research Capacity: India's Experience with the Rockefeller Foundation and Its Significance for Africa. Discussion paper prepared for the World Bank's Develoment Research Department. World Bank, Washington, DC.

Schultz, Theodore W. 1964. Transforming Traditional Agriculture. The University of Chicago Press.

World Bank/ISNAR. 1987. Guidelines for Strengthening National Agricultural Research Systems in Sub-Saharan Africa. World Bank, Washington, DC.

Hargrove, Thomas R. 1978. Rice Breeders in Asia: A 10-Country Survey. International Rice Research Institute, Los Banos, Philippines.

Herzberg, Frederick. 1966. Work and the Nature of Man. World Publishing Co, Cleveland.

Maslow, Abraham H. 1943. A Theory of Human Motivation. Psychological Review 50: 370-396.

Marcotte, Paul, Lawrence Busch and William Lacy. 1982. An Analysis of an International Agricultural Science Community. Unpublished paper presented at the Annual Rural Sociological Meeting, San Francisco.

Harmon, Lindsey R. 1965. Profiles of PhD's in the Sciences. National Academy of Sciences, Washington, DC.

Lacy, William B., Lawrence Busch and Paul Marcotte. 1983. The Sudan Agricultural Research Corporation: Organization, Practices, and Policy Recommendations. Agricultural Experiment Station, University of Kentucky, Lexington, Kentucky.

Busch, Lawrence and William B. Lacy. 1983. Science, Agriculture, and the Politics of Research. Westview Press, Boulder.

Oram, Peter A. and Vishva Bindlish. 1981. Resource Allocations to National Agricultural Research: Trends

Human Resource Survey – 1988

One of the most important functions of a national scientific research system is the development, retention, and continued motivation of a body of scientific professionals. It is human resources, in the form of scientists, that provide the knowledge and expertise for development. It is, therefore, of critical importance that the scientists themselves be understood in order to understand the research enterprise. This understanding will assist management in making better decisions on staff recruitment, selection, training, performance, motivation, and utilization.

Your cooperation in completing this questionnaire will greatly assist in this understanding. Thank you for your time and information.

A. Background Information: This set of questions provides information about your background and education.

Please give year of birth: 19___

Please check:

Sex: Male _____ Female _____

Highest degree obtained:

PhD _____
MSc _____
BSc _____
Other _____

What was your academic discipline in your highest degree obtained? What discipline are you currently working in? Please check ___ one in each of the following columns.

Educational Discipline	Current Discipline
___ Plant Production	___ Plant Production
___ Plant Breeding	___ Plant Breeding
___ Plant Protection	___ Plant Protection
___ Animal Production	___ Animal Production
___ Animal Health	___ Animal Health
___ Basic & Support Sciences	___ Basic & Support Sciences
___ Soil Science	___ Soil Science
___ Natural Resource Management	___ Natural Resource Management
___ Socioeconomics (including Extension)	___ Socioeconomics (including Extension)
___ Agricultural Engineering	___ Agricultural Engineering
___ Food & Nutrition	___ Food & Nutrition
___ Management	___ Management

Do you now work with a specific commodity or commodities?

Yes _____ No _____

If yes, please list.

_____

At what station or institute are you working?

_____

What is your current job title?

_____

How many years have you been involved in agriculture as a scientist (excluding training)?

_____

How many years have you worked for your present research organization (excluding training)?

_____

What was your job title when you began working for your present organization?

_____

B. Career Development: The following set of questions provides information on your perceptions of career advancement.

During the last year what percentage of your time has been devoted to:

_____% research
_____% administration in agriculture
_____% teaching
_____% extension
_____% travel/conference, etc.
_____% farming
_____% other (specify)

What type of work would you like to be doing in 10 years? Please rank your first two preferences: (1 = first preference, 2 = second preference)

_____ research
_____ administration in agriculture
_____ teaching/training
_____ extension/demonstration
_____ travel/conference/workshops, etc.
_____ farming
_____ other (specify)

What type of organization would you prefer to be working for in 10 years?
Please rank your first two preferences: (1 = first preference, 2 = second preference)

_____ government research organization
_____ non-profit research organization
_____ agricultural college or university
_____ private company, business or industry
_____ government extension service
_____ farming
_____ other(specify)

Using the categories below:
How would you characterize your research during the last 5 years? What do you think it should be?

Actual %		Ideal %
_____	Basic Research (new scientific knowledge)	_____
_____	Applied Research (practical use for existing knowledge)	_____
_____	Adaptive Research (tailor applied to location specific)	_____

What percentage of your research is performed in the following categories:
What percentage of your research should ideally be performed in the following categories:

Actual %		Ideal %
_____	Experiment Station Field	_____
_____	Laboratory	_____
_____	Farmers Fields	_____
_____	Other (specify_____)	_____

How many of the following persons are currently working under your direction?

_____ technicians _____ laborers _____ other

Ideally, how many of the following persons should be working under your direction in your present program?

_____ ___ technicians _____ laborers _____ other

What do you think are the three most important criteria for career advancement? What should be the three most important criteria for career advancement? (1 = most important, 2 = second most important, 3 = third most important)

Actual Criteria:	Ideal Criteria:
_____ achievement	_____ achievement
_____ training	_____ training
_____ type of experience	_____ type of experience
_____ length of experience	_____ length of experience
_____ publications	_____ publications
_____ number and quality of projects	_____ number and quality of projects
_____ results from project experiments	_____ results from project experiments
_____ general competence	_____ general competence
_____ motivation/interest	_____ motivation/interest
_____ other, please list _____	_____ other, please list _____

What are the three most serious limitations to your career advancement?
(1 = most serious, 2 = second most serious, 3 = third most serious)

_____ inadequate qualifications
_____ inadequate training
_____ limited work experience
_____ lack of motivation/interest
_____ limited resources for research
_____ limited resources for compensation
_____ poor direction/guidance by supervisors
_____ poor research policies
Other, please list _____

C. Publishing: The next set of questions is about publishing productivity and potential beneficiaries of your research.

Have you published research results in the last three years?

Yes _____
No _____

How many of the following types of publications have you authored or co-authored in the last 3 years?

	Domestic/Local	Foreign/International
Journal Article	_____	_____
Books	_____	_____
Book Chapters	_____	_____
Abstracts	_____	_____
Reports-	_____	_____
Bulletins	_____	_____
Other (specify)	_____	_____

Do you believe that your research and publishing over the past 5 years has or will benefit any of the following? In your opinion who should your research benefit?

Will or Does Benefit (Not at All 1 2 3 4 5 A Great Deal)		Should Benefit (Not at All 1 2 3 4 5 A Great Deal)	How do the beneficiaries receive the research information
1 2 3 4 5	Scientists in own discipline	1 2 3 4 5	_____
1 2 3 4 5	Other scientific disciplines	1 2 3 4 5	_____

1	2	3	4	5	Small farmers	1	2	3	4	5	_____
1	2	3	4	5	Agri-business	1	2	3	4	5	_____
1	2	3	4	5	Rural residents	1	2	3	4	5	_____
1	2	3	4	5	General public	1	2	3	4	5	_____
1	2	3	4	5	Extension	1	2	3	4	5	_____
1	2	3	4	5	Farming Systems Research Groups	1	2	3	4	5	_____
1	2	3	4	5	Local or state governmental agencies	1	2	3	4	5	_____
1	2	3	4	5	Federal agencies	1	2	3	4	5	_____
1	2	3	4	5	foreign groups, institutions or governments	1	2	3	4	5	_____
1	2	3	4	5	Other	1	2	3	4	5	_____

D. Research: The next set of questions provides information about resources to conduct research and objectives of the research.

In conducting research, a number of resources are necessary. Below there is a list of such resources. Please note how adequate each of these items are in your current research. Then indicate how important each resource is for the success of your research. They are divided into 4 general categories.

How Adequate?						How important?				
Very Adequate				Very Inadequate		Very Important				Very Unimportant
1. Personal										
1	2	3	4	5	Financial support for self and family	1	2	3	4	5
1	2	3	4	5	Suitable living conditions	1	2	3	4	5
1	2	3	4	5	Job security	1	2	3	4	5
2. Administrative										
1	2	3	4	5	Operating supplies and materials	1	2	3	4	5
1	2	3	4	5	Transportation	1	2	3	4	5
1	2	3	4	5	Availability of experimental land	1	2	3	4	5
1	2	3	4	5	Equipment and tools to use in research	1	2	3	4	5
1	2	3	4	5	Office and laboratory facilities	1	2	3	4	5
1	2	3	4	5	Availability of labor	1	2	3	4	5
1	2	3	4	5	Quality of labor	1	2	3	4	5
1	2	3	4	5	Scientific literature/ Library	1	2	3	4	5
1	2	3	4	5	Availability of trained technical help	1	2	3	4	5

1	2	1	4	5	Quality of trained technical help	1	2	3	4	5
1	2	3	4	5	Availability of advice from experienced researchers	1	2	3	4	5

3. Professional

1	2	3	4	5	Personal freedom to determine research problems	1	2	3	4	5
1	2	3	4	5	Contact with other scientists	1	2	3	4	5
1	2	3	4	5	Opportunities for your advanced education	1	2	3	4	5
1	2	3	4	5	Opportunities to gain scientific recognition	1	2	3	4	5
1	2	3	4	5	Opportunities for professional advancement	1	2	3	4	5
1	2	3	4	5	Opportunities for promotion based on merit	1	2	3	4	5
1	2	3	4	5	Opportunities for training people who work under your direction	1	2	3	4	5
1	2	3	4	5	Opportunities for practical implementation of outputs	1	2	3	4	5
1	2	3	4	5	Opportunities to publish research findings	1	2	3	4	5

4. Organizational

1	2	3	4	5	Scientific training of management	1	2	3	4	5
1	2	3	4	5	Management's reputation for scientific achievement	1	2	3	4	5
1	2	3	4	5	Organization's reputation for scientific achievement	1	2	3	4	5

Below is a list of possible objectives of agricultural research. How important i objective to <u>your</u> research?

Of No Importance				Of Highest Importance	
1	2	3	4	5	Increase agricultural productivity
1	2	3	4	5	Improve protection from insects, diseases, other hazards
1	2	3	4	5	Decrease production costs of farm products
1	2	3	4	5	Expand demand by developing new products or enhancing product quality
1	2	3	4	5	Improve marketing efficiency
1	2	3	4	5	Expand export receipts
1	2	3	4	5	Reduce import expenditures

1	2	3	4	5	Protect consumer health and improve nutrition
1	2	3	4	5	Improve level of rural living
1	2	3	4	5	Promote community improvement
1	2	3	4	5	Develop new knowledge or improved methodology
1	2	3	4	5	Provide input to other researchers
1	2	3	4	5	Improve support services

Please rank the 3 most serious limitations to your research?
(1 = most serious, 2 = second most serious, 3 = third most serious)

_____ availability of supplies/equipment
_____ availability of administrative support/advice
_____ availability of funds for research
_____ availability of technical support
_____ lack of clear direction
_____ lack of opportunity to define research problems
_____ lack of personal interest/motivation
_____ lack of adequate reward structure

What criteria <u>are used</u> to measure your research productivity?
List in order of importance.

1. _____
2. _____
3. _____
4. _____

What criteria do you think <u>should be used</u> to measure your research productivity? List in order of importance.

1. _____
2. _____
3. _____
4. _____

List your most significant contributions in the past 3 years.

1. _____
2. _____
3. _____
4. _____

E. Professional Indicators: The following set of questions will provide information on how active you are in professional activities.

Do you belong to a professional society?

Yes _____
No _____

Have you received an award within the last 3 years?

Yes _____
No _____

Have you attended a national or international meeting in the last 3 years?

Yes _____
No _____

What kind of training do you feel you need in order to achieve your career objectives?

Type	Duration	Location
_____	_____	_____
_____	_____	_____
_____	_____	_____

F. Management: The following question provides information on management activities.

Listed below are different management activities. Which three have you found the most difficult to perform to your satisfaction? (1 = most difficult, 2 = second most difficult, 3 = third most difficult)

____ Evaluating past activities
____ Implementing policy and planning priorities
____ Talking to staff about their problems
____ Maintaining physical facilities
____ Improving morale of non-professional staff
____ Improving use of operating resources
____ Communicating with farmers and other clients
____ Maintaining effective control and discipline on staff
____ Obtaining additional resources
____ Monitoring on-going activities
____ Other (specify) _____

Are there any important points not covered in this survey that you think should be discussed?

SESSION 7

COMPENSATION

COMPENSATION SCHEMES FOR AGRICULTURAL RESEARCHERS

Paul Bennell

Introduction

Human resource planning and management is centrally concerned with the establishment of appropriate reward or compensation schemes. The main objective of any compensation scheme is to seek to maximize employee productivity in accordance with organizational objectives. Thus, it is necessary to establish what the major determinants of individual productivity are, both in general terms for all employees and among specific occupational groupings. Inevitably, much of this analysis in the past has focused on how and why individuals are motivated to work because the level of motivation is most directly influenced by the compensation scheme.

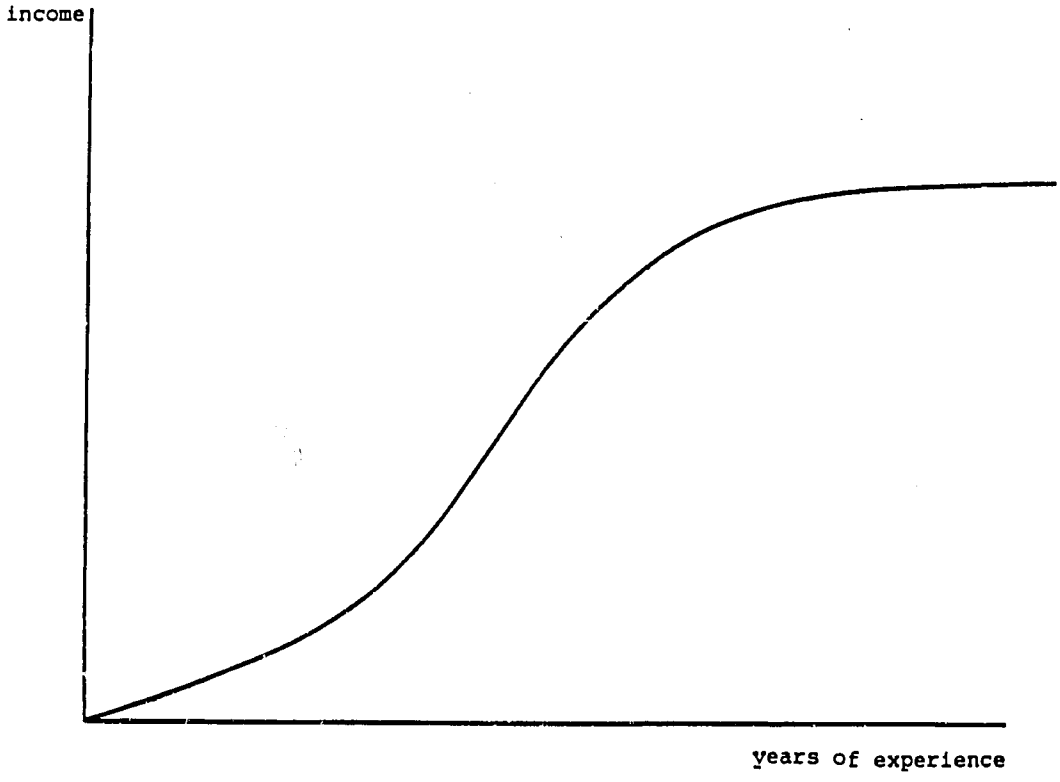
A considerable amount of literature now exists which is concerned with the motivational needs and responses of research scientists. A common assertion is that the optimal compensation scheme for research scientists is likely to differ from other occupations or professions mainly because researchers place considerably more value on nonfinancial "extrinsic" rewards such as the need for professional recognition and autonomy, opportunities for achievement, challenge, and "self-actualization" than conventional "intrinsic" rewards based on material gain, i.e., salary and other benefits. While this may be the case, it is equally clear that attractive careers based on appropriately designed grade and salary structures are an essential prerequisite if researchers are to be well motivated in carrying out their duties and responsibilities.

The Optimal Compensation Scheme

With regard to agricultural researchers, their compensation scheme should, in general terms, have the following characteristics:

- It must be simple in conception so that it can be easily understood by all employees and implemented by management in a straightforward manner.
- Grades and associated incomes should be based on (1) detailed job analysis and evaluation in order to ascertain the "size of the job" (according to skill, knowledge, and responsibility requirements) and (2) national and, where appropriate, international salary surveys of similar jobs and occupations.
- Effective promotion and financial incentives should be in place throughout the entire career of the researcher up until retirement. There should therefore be regular opportunities for significant promotion, and these should be associated with relatively sizable percentage increases in remuneration.
- There should be a set of job titles which allow both colleagues and outsiders to readily identify the seniority and/or competence of the individual, and which also help provide a clear sense of career progression.
- There should be well-specified promotion criteria and requirements which place primary emphasis on demonstrated job performance but, where appropriate, also give adequate recognition to the attainment of job-relevant qualifications. Seniority criteria should generally play a limited role. Furthermore, promotion should not be dependent on the availability of vacancies in fixed establishments for each grade or job level.

Figure 1. Ideal income-experience curve corresponding to underlying productivity levels of researchers



- There should be provision for accelerated advancement of especially competent and highly motivated researchers who have made exceptionally valuable contributions to research programs. Without this flexibility, there is the likelihood that "high flyers" (who normally play such important roles in scientific research) will leave to take up more attractive employment opportunities elsewhere.

- There should be an income growth curve that corresponds with the underlying relationship between the age (or experience) of researchers and their level and rate of growth of individual productivity. The probable shape of this curve is shown in figure 1.

- There should be a provision for dual career ladders. Research organizations are faced with a dilemma: when a good scientist is made a manager, a good scientist is lost–yet promotion to management is the reward for competence in scientific work. In order to resolve this dilemma, some research organizations have established parallel or dual career ladders which allow the most able scientists to attain the status and salary levels of senior management while remaining in their mainstream scientific activities. While there are a number of problems that typically arise with dual career ladders, in general it is considered to be an effective "organizational fix."

- Only under exceptional circumstances should employees be permitted to engage in additional income earning activities outside their normal employment. Such activity often gives rise to a conflict of interests and, in general, adversely affects the time devoted and commitment of the researchers to their work.

These characteristics of the compensation scheme for agricultural researchers should ideally provide the overall framework within which the precise levels of remuneration must be established. While pay structures and levels are closely interrelated, there are additional factors which have to be taken into account in determining appropriate levels of professional remuneration.

Intrinsic valuations

It is commonly asserted that the income received by a particular occupational group should be concomitant with the intrinsic value of the activities undertaken by this group. Thus, the UNESCO resolution on the status of scientific researchers states that "governments must demonstrate that they attach high importance to the scientific researcher receiving appropriate moral support and material compensation for the creative effort which is shown in his work." Similarly, agricultural researchers themselves argue that they should receive higher pay given the nature of their skills and impact of their work in increasing agricultural productivity.

This type of "intrinsic value" argument is particularly important where the bulk of a profession is employed by public-sector organizations and thus what they are paid is ultimately dependent on the decisions of the relevant government policymakers rather than the impersonal operation of market forces. In other words, with this type of "administered" labor market, pay levels are largely determined by government policies and practices. The degree of success of agricultural researchers in making their case for improved incomes will, therefore, depend on their ability to demonstrate the precise long- and short-term impacts of their activities. A well-organized professional association of researchers can play an important role in this negotiation process.

Closely related to the intrinsic value argument is the issue of income equity. If agricultural researchers are of a value equal to or greater than other professional occupations employed in the public sector, then they should enjoy at least the same level of material rewards as these other professionals. Where income differences do exist, then the incomes of agricultural researchers should be increased until the differences are eliminated.

Considerations of labor market and "ability to pay"

Conditions prevailing in the relevant local labor markets do have some effect on the income levels of agricultural researchers. It is necessary therefore to analyze the balance between, on the one hand, the availability, i.e., supply of agricultural researchers of different skills and competencies, and, on the other, the level and pattern of (effective) demand by employers for these types of personnel. If demand exceeds supply, then there are likely to be upward pressures on pay levels, and vice versa if supply exceeds demand. However, because the public sector is generally such a major employer of agricultural researchers in most developing countries, pay levels are unlikely to respond

Table 1.
Details of Case Study Organizations

Country	Institution	Date Established	Parent Ministry	Organi-zational Status	Main Responsi-bilities	No. Main Stations/ Institutes	No. of Researchers 1984/85	Researchers 1984 (1975=100)	% Women Researchers	Budget 1984 (000 US$)
Argentina	National Institute for Agricultural Technology (INTA)	1958	Agriculture	Autonomous	National research and extension	30	995		16.9	
Jordan	Department of Agricultural Research and Extension (DARE)	1958	Agriculture	Ministerial department	National research and extension	4	58	120	16.9	950
	Faculty of Agriculture University of Jordan(FOA/UJ)	1973	Education	University faculty	Teaching and research	1	57	n.a.	7.0	1410
Sri Lanka	Research Division (RD)		Agricultural Research & Development	Ministerial department	National food crops research	12	246	350		2036
	Department of Minor Exports Crops (DMEC)	1972	Agricultural Research & Development	Ministerial department	cocoa, spices	1	23	210	19.2	373
	Coconut Research Institute (CRI)		Coconut Ministry	Semi-autonomous	coconut	1	26	123	26.9	1388
	Rubber Research Institute (RRI)		Plantation Industries	Semi-autonomous	rubber	1	30	158	12.9	539
	Tea Research Institute (TRI)		Plantation Industries	Semi-autonomous	tea	1	31	94	14.3	1036

very quickly to changes in supply and demand conditions for these personnel. Thus, other indicators need to be identified in order to ascertain the overall state of the labor market.

At the organization level, the most important indicators are the trends over time in the rates of attrition and recruitment of the major categories of research personnel and, where there are fixed establishment levels, vacancy rates. At the national level, a key indicator is the trend in the rate of unemployment among agricultural researchers. Clearly, steadily rising unemployment rates are indicative of a situation of increasing excess supply in relation to demand (at least in the short term).

Considerable importance is also attached to the size of any differentials between public- and private-sector pay because it is commonly believed that private-sector incomes are a more accurate indicator of the "market price" for agricultural researchers and that therefore, public-sector employers should increase the salaries of their researchers to the same level. This is sometimes justified on the basis of "the principle of fair comparison." In practice, however, relatively high incomes in the private sector are not so much the consequence of prevailing supply and demand conditions but rather stem from the simple ability of private-sector employers to pay more.

Finally, ability to pay is also of crucial importance in determining the extent to which a research organization can increase salaries in line with increases in the cost of living. This is clearly a major issue for those public-sector research organizations which are directly dependent on central government funding.

Unfortunately, the compensation schemes for agricultural researchers employed in developing country NARS usually bear little resemblance to the ideal policies and practices described above. This is illustrated (albeit in a limited way) by the findings of three case studies of human resource planning and management of the NARS in Argentina, Jordan, and Sri Lanka undertaken by myself under ISNAR auspices in 1985 (which formed the basis for the document "Human Resource Management for Agricultural Research: Overview and Issues" by P. Bennell and L. Zuidema, ISNAR, 1988). Summary details of the main organizations of the NARS of each of these countries are given in table 1. The case studies focused mainly on agricultural researchers.

Changes in the organization and structure of these NARS in recent years are likely to have important consequences for their compensation schemes. However, as a basis for discussion, it is useful to summarize their prevailing compensation policies and practices in 1985.

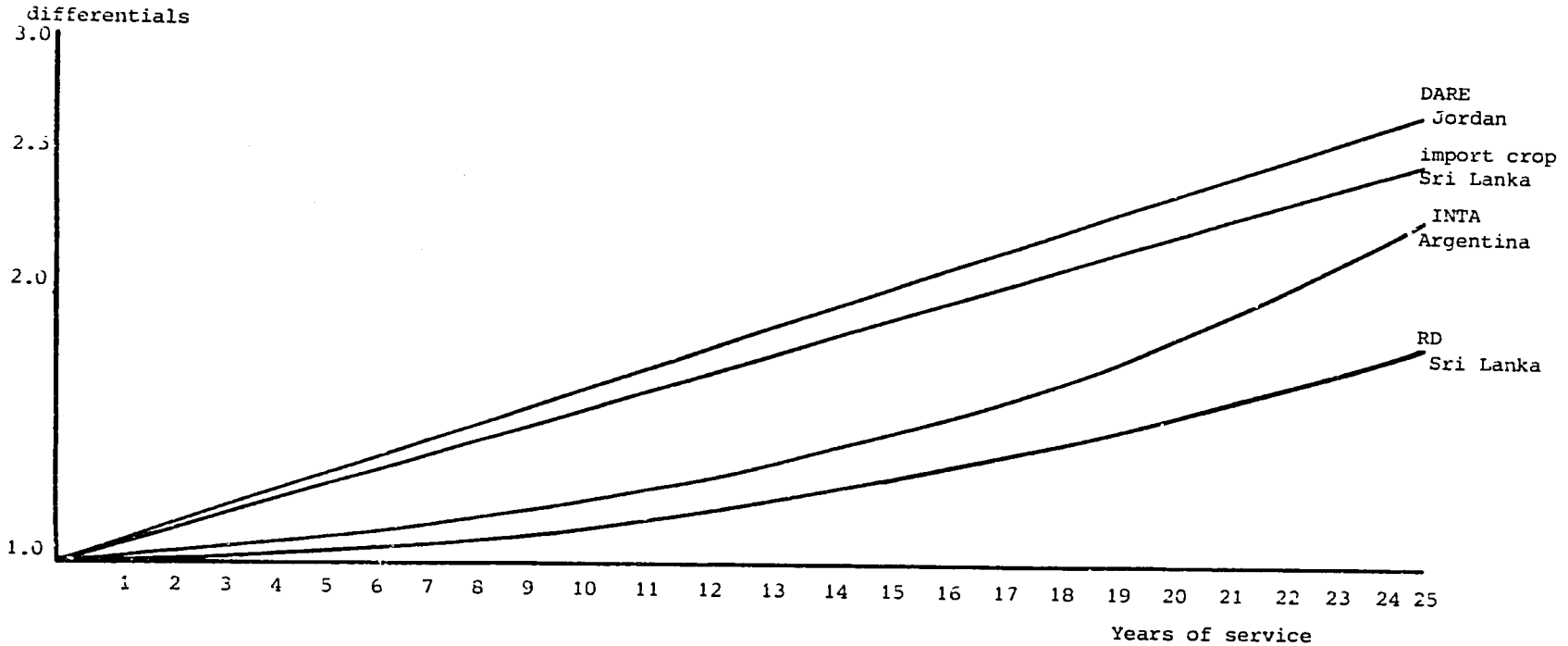
All of the case study organizations had relatively simple and straightforward basic income scales. However, in INTA Argentina and, to a lesser degree, in DARE Jordan, there were numerous additional allowances which considerably complicated their compensation systems. In INTA, for example, the *escalafon* granted the following allowances or supplements for professional staff: full-time employment ("exclusive dedication"), family status, first degree qualification, location, seniority, management responsibilities, priority programs and disciplines, and locational displacement. In total, these allowances typically represented between 80-90% of the professional's total income, thereby relegating basic income to a minor role. In DARE Jordan, additional allowances (most notably for professional membership, postgraduate qualifications, and marital status) comprised 40-60% of the total compensation of most researchers.

Whereas these types of allowances were relatively unimportant in the other case study organizations, there had been considerable demands for their introduction. To a large extent, these allowances represented ad hoc and essentially pragmatic attempts to improve material rewards in the face of usually strong government resistance to any significant increase in the basic salaries of agricultural researchers and other personnel. In other words, it generally has been easier to justify the introduction of a new allowance or an increase in the value of existing allowances than to give preferential treatment to a specific professional group such as agricultural researchers in terms of basic income levels.

Job evaluations and salary surveys

The case study organizations had generally not undertaken either detailed job evaluations of their professional staff or national salary surveys. This was due to both a lack of suitably trained staff but, more important still, the general belief that there was little point in completing such exercises when the likelihood of the appropriate government authorities responding positively to any recommendations was minimal. There was however, a growing realization of the necessity for

Figure 2. Relationship between median income differentials and years of service for researchers employed in case study research organizations



job analysis, and this was reflected in the proposed reforms of the grading structures for professionals in INTA Argentina, as well as a new agricultural research and development organization in Jordan.

Promotion

Agricultural researchers employed by the core group of case study organizations (INTA, DARE, and RD) had relatively limited promotion opportunities. Generally speaking, they progressed steadily from one salary grade and/or increment to another with no sizable (in percentage terms) salary increases associated with regular promotions. As can be observed in figure 2, the smooth upward slope of the years of service-relative (median) income profiles of researchers in the three organizations is indicative of this situation. It is also noticeable that annual income growth for the average researcher was consistently small, especially in INTA Argentina and RD Sri Lanka, during the early stages of the career, with the result that top-bottom median income differentials were low in all three organizations. In RD Sri Lanka, it can be observed that agricultural researchers with 25 years of service usually did not even earn double the starting salary of a fresh graduate recruit.

Job titles

The generally unattractive promotion possibilities for agricultural researchers in the three core case study organizations was reinforced by the absence of well-specified employment hierarchies based on a set of job titles. Consequently, a young graduate was recruited as a "researcher" and kept this same title for his/her entire career. In the universities in Jordan and Sri Lanka and among the export crop institutes in Sri Lanka, on the other hand, promotion was based on advancement from one distinct employment position to another, each of which was associated with a specific job title.

Age-productivity relationships

Although no data were collected on the productivity of researchers employed by the case study organizations, the income profiles presented in figure 2 were unlikely to correspond with the underlying patterns of productivity growth during the career of the researcher. This was mainly because advancement and rewards were based mainly on seniority criteria and the availability of vacancies rather than being directly related to the actual output and productivity of the researcher.

Accelerated advancement

There was little or no scope for accelerated advancement for the especially able researcher in the three core case study organizations. In INTA Argentina, the researcher who obtained an exceptionally high annual evaluation could advance two instead of one categories but was only allowed to do this twice in his/her career. In DARE Jordan and RD Sri Lanka, no formal schemes existed and the acquisition of postgraduate degree qualifications per se continued to remain the most important means of obtaining increased income. Where promotion was based on meritocratic criteria, as in the university sector, the issue of accelerated advancement tended not to arise given the absence of years of service preconditions for career advancement.

Dual career ladders

None of the case study organizations had formal, dual, scientific- management career ladders. However, there were relatively strong financial incentives to take up management positions in these organizations, often at a relatively early stage of the researcher's career. This problem was well recognized but the association of higher incomes with management positions was so rooted in the prevailing administrative cultures that the scope for improvement had been limited.

Real income levels

During the last decade, the serious deficiencies of the grading, promotion, and pay systems had assumed secondary importance compared with the dramatic decline in the real incomes of researchers employed by the case study organizations. Unfortunately, reliable time series data were not available, but most researchers who were interviewed stated that they were considerably worse off than they had been five to 10 years earlier. While such estimates are likely to be overexaggerated, it is nonetheless quite clear that, in terms of material rewards, a career as an agricultural researcher in these organizations had become increasingly unattractive. The reasons for this deterioration relate directly to the fiscal inability of the state (particularly in Argentina and Sri Lanka) to maintain the real incomes of high- and medium-level

public-sector employees in the face of high rates of inflation. Understandably, governments have concentrated what little additional resources that were available in trying to maintain the real incomes of the lowest level of workers in the public sector which, in most cases, were already at or below subsistence levels. Typically, therefore, percentage salary increases awarded to the managerial and professional groups had been much lower than the rate of inflation.

The consequences of this situation for the case study organizations were very serious. Not surprisingly, the motivation of researchers had been adversely affected. Many researchers had resigned to take up higher paid jobs in the private sector (especially in Jordan and in Argentina) or at local universities or other parastatals (Jordan and, to a lesser extend, Sri Lanka). While, in numerical terms, international immigration had generally been limited, those who had gone overseas had been of key importance to the overall research effort.

Secondary employment

In Jordan and Sri Lanka, researchers commonly undertook additional, unauthorized work, both after and increasingly during their normal working day. In order to supplement their dwindling incomes, they had become, therefore, de facto part-time researchers with serious consequences for organizational output and productivity. While additional remunerative employment by professionals in INTA Argentina was forbidden, with rapidly increasing private-public income differentials, management had proposed that senior researchers be allowed to engage in a limited amount of outside employment, either in teaching (20% of their time at local universities) or consultancy (a maximum of 30 days per annum). Concessions had already been granted for researchers employed by RD Sri Lanka to be granted unpaid leave in order to take up temporary appointments either locally or overseas. These arrangements were pragmatic responses by the managements of the case study organizations to try to offset some of the negative consequences of stagnating or declining real income levels.

Professional associations

Relatively well-organized professional associations for agriculturists existed in Argentina and Jordan. In both countries all agriculturists were required by law to be officially registered, and this activity had become a major responsibility for their respective national professional associations. However, they had not played any major role with regard to improving the conditions of service of public-sector researchers. (However, it is interesting to note that the Association of Agricultural Engineers in Jordan had been successful in establishing a minimum starting salary for agricultural graduates in the private sector.)*

There was no equivalent profession-wide association for agriculturists in Sri Lanka. Researchers in the research division had their own association which made occasional submissions to the director of agriculture and the government. Again, however, the impact of this association in improving conditions of service appeared to be relatively limited.

Scope for Improvement

The case studies provide good illustrations of the difficulties faced by agricultural research organizations in the developing country context in trying to provide attractive career opportunities for their professional personnel. Given these constraints, what, if anything, can be done to improve conditions of service for researchers? Perhaps the most common proposal or plea advanced by ministry-based organizations is that, given the alleged incompatibilities between prevailing civil service career structures and the grading, promotion, and pay systems which are deemed appropriate for research organizations, there is no alternative but to grant them sufficient institutional autonomy to be able to design and implement their own compensation scheme for research personnel. This argument has formed one of the major justifications for the proposed establishment of a new research organization in Jordan.

In Sri Lanka, on the other hand, greater organizational autonomy for RD is considered to be such a remote possibility that no serious proposals on this subject have been made. Indeed, with the notable exception of Jordan, the most noticeable trend among the case study organizations (at least up until 1985) had been towards *less* organizational and financial autonomy and corresponding increases in central government control. This was the direct consequence of the protracted financial difficulties facing these governments.

Given the that the achievement of improved compensation via the attainment of greater institutional

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* *It is interesting to note that the Association of Agricultural Engineers in Jordan were succesful in establishing a mininum starting salary for agricultural graduates in the private sector.*

autonomy is unlikely, most agricultural research organizations will have to continue to seek improvements within the existing organizational context. Arguments at this level have inevitably focused on presenting a "special case" for the agricultural profession, and agricultural researchers in particular. Invariably, however, submissions to government have been weak both conceptually and empirically, with the result that the appropriate government authorities, faced with similar "special-case" submissions from a variety of other professional organizations, have refused to grant any major concessions. Thus, any strategy to improve compensation for agricultural researchers must be based on comprehensive, realistic, closely argued and empirically substantiated submissions to governments, coupled with the individual skills and organizational support required to negotiate effectively with the relevant authorities.

The central argument of any submission for improved compensation for agricultural researchers must be that the direct economic and social value of their activities is very high, both in absolute terms and in relation to the outputs of other occupational groups. To directly assert the former and imply the latter without producing any supporting empirical evidence, as is typically the case, is a recipe for failure. Although evidence cannot be produced without fairly detailed and systematic analysis, most research organizations, perhaps with some assistance from outside specialists with management or social science training, should be able to cope with such a task.

The submission should demonstrate not only the direct economic value of agricultural researchers but also how the proposed changes in the compensation of these personnel will stimulate improvements in organizational output and productivity which should substantially justify any increases in resource expenditures. For example, INTA's new escalafon emphasizes the need for increased accountability of professional personnel via the introduction of meritocratic promotion criteria coupled with considerably more rigorous performance-appraisal procedures. In return, it is intended that these staff members receive substantial increases in salary.

Given the reluctance of most governments to tamper with basic salary scales for professional or other personnel categories, improvements in compensation are more likely to arise from obtaining specific allowances and other nonfinancial benefits. We have seen that this has been a pervasive tendency in Argentina and Jordan. While such allowances complicate grading and salary systems, they can be of considerable importance in material terms. Research managements may have little alternative therefore but to focus on obtaining new or increased allowances for their staff. Given the remoteness of many agricultural research stations, it is usually possible to present a strong case for additional locational allowances.

ANALYZING COMPENSATION ISSUES USING EARNINGS FUNCTIONS

Howard Elliott

Introduction

A key factor leading research managers to seek an autonomous status for their institutes is the presumed autonomy they gain in setting conditions of service that will attract, motivate, and retain productive scientists. Implicit in this is a recognition of the fact that scientists have valuable skills, both technical and personal, for which there is a market outside of publicly funded research institutes.

This paper puts forward one analytical tool which may be used to integrate our thinking about two key issues:

- the role of salary level and salary structure in recruitment and staff retention;
- the relationship between salary policy and training policy.

With respect to the first issue, NARS leaders are often concerned about

- their inability to compete with other potential employers of trained scientists;
- the loss of scientists after a few years on the job and the perpetuation of an "immature" system;
- their difficulty in dealing with "cohort" problems–where large numbers of scientists are hired at one time and it is difficult to provide a satisfying career path for all of them.

With respect to training policy, NARS leaders find themselves continuously hiring and training replacements for departing staff. In some cases, this high turnover is underwritten by donor-financed projects with very little coordination among projects competing for the best trainees; in other cases this high turnover comes at great cost to the government. Clearly there is a link between training policy and compensation policy which can benefit from rigorous analysis. The earnings function can be used to shed light on two issues:

- how far it pays the individual and the government to carry training to successively higher degree levels;
- whether the combination of training policy and compensation policy is rational, given the goals of the government and its available resources.

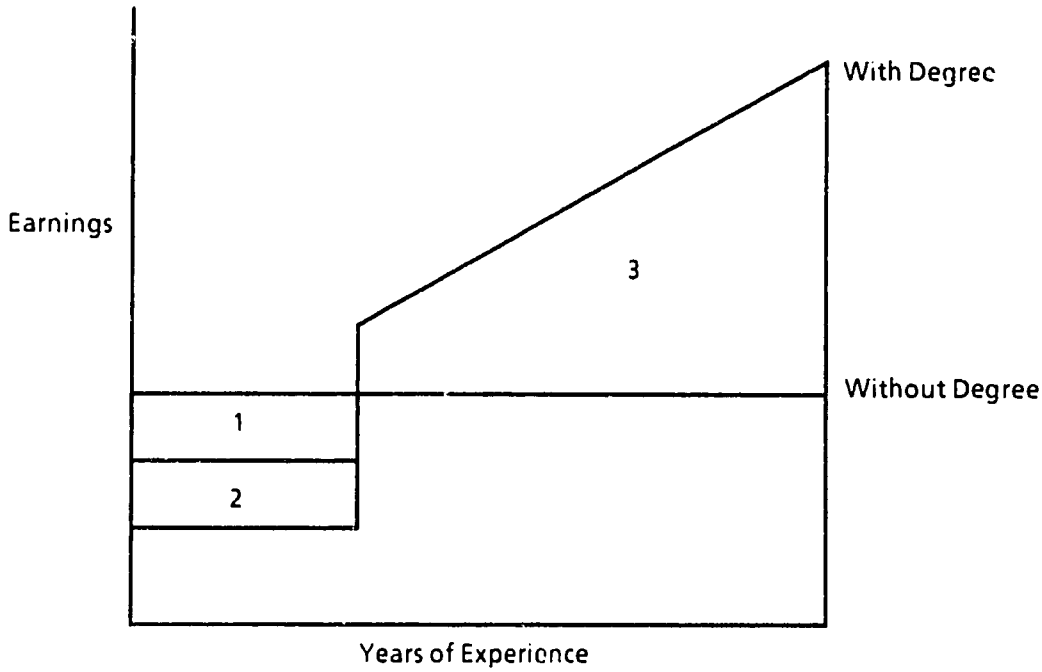
With these issues in mind let us turn to the theoretical basis for the earnings functions approach.

The Theoretical Basis: A Human Capital Approach

The human capital approach treats investment in individuals in the same way as investment in physical capital. An individual (and/or his/her employer) incur training costs and accept a lower production in the present in order to enhance productivity in the future.

Figure 1 shows the income stream of a person with and without additional training. During the training period, the individual has lost income (Area 1) and incurs direct costs of training (Area 2). The extra income he/she earns after training is the area lying above the income curve depicting what he/she would have earned without training (Area 3). As long as the present value of Area 3 is greater than the present value of Areas 1 and 2 combined, the training is economically

Figure 1. Human capital framework



Area 1 - Foregone Earnings
Area 2 - Direct Costs
Area 3 - Extra Earnings with Degree

attractive to the individual. How attractive it is can be expressed as a rate of return on investment in training.

The Earnings Function

This paper draws on a number of ISNAR studies to illustrate the way earnings functions have been used to shed light on important issues.

The earnings function relates current income to a number of educational, experiential, and personal factors that have some theoretical basis for consideration as determinants of earnings. By looking at a cross-section of employees with different characteristics, we can formulate the basic model as follows:

$$\text{Ln Sal} = a + b\,\text{EDUC} + c\,\text{EXPER} + d\,\text{EXPERSQ} + e\,\text{OTHER} + \text{RESIDUAL}$$

where:

EDUC = Number of years of formal education or a series of variables representing BS, MS, and PhD degrees.

EXPER = Number of years of experience since completing formal schooling.

EXPERSQ = The square of the number of years of experience.

OTHER = An array of control variables representing personal and institutional factors.

RESIDUAL = A residual representing a set of unobservable variables which are assumed on the average not to be correlated with the observed variables that affect salary.

Figure 2. Experience-earnings profiles

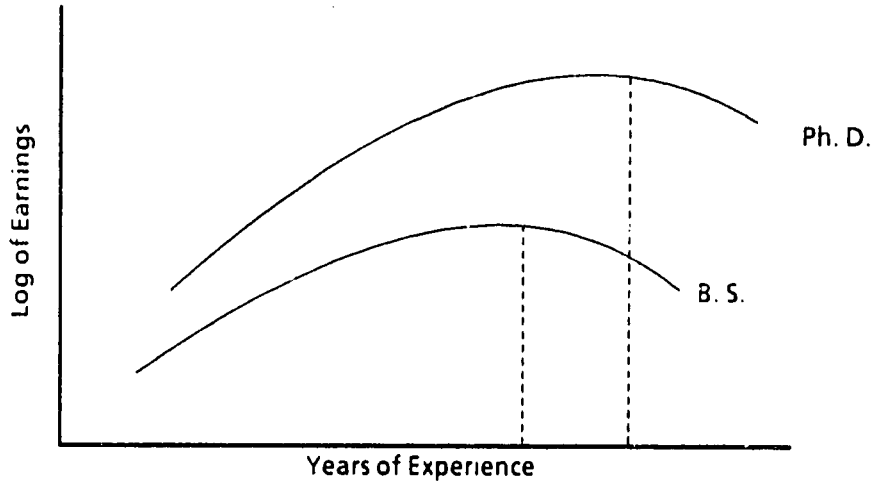
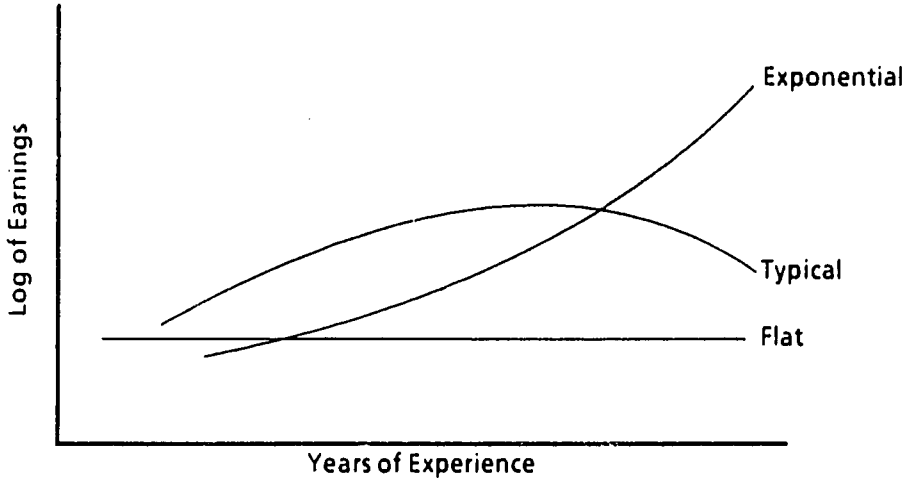


Figure 3. Types of experience-earnings profiles



The results of a regression model, formulated as above, can be expressed in two-dimensional form as an experience-earnings profile with monthly salary on the vertical axis and years of experience on the horizontal axis. Higher levels of education or "other" characteristics (sex, location, employer, discipline) can be represented as upward or downward shifts in the height of the curve depicted in Figure 2 below:

In the diagram we depict the expected shape and level of the income-experience profile in which the earnings of an individual with an advanced degree *rise faster*, *peak higher*, and *peak later* than an individual with a lower level of training. In short, higher levels of formal training are complementary to on-the-job experience and enable an individual to profit more from experience.

The experience-earnings profile shown above is the most common. Salaries rise rapidly early in one's career and investment in on-the-job training raises productivity (salary) rapidly. Later in one's career, less is invested in on-the-job training or in formal training, skills became obsolete, and productivity (salary) rises at a less rapid rate or even declines.

However, there are other possibilities, as shown in Figure 3.

The "typical" profile owes its shape to investment early in one's career and declining investment and hence productivity thereafter. The "flat" profile characterizes low-skilled occupations. There is low cost of training, low productivity gain over time, and little incentive for workers to remain or for employers to attempt to reduce turnover. Work becomes organized in a way that lives with turnover. The "exponential" profile is usually associated with organizations that reward experience, offer entry only at the lower levels, and make an effort to retain (and hopefully maintain the productivity of) long-service employees. It sometimes characterizes the "protected bureaucracy". One encounters each of these types of functions in NARS.

Earnings Functions from Four Countries

In this section we bring together some examples from analyses that ISNAR has done in different systems. The precise formulation of the earnings function has been adjusted to examine issues considered important in the particular country, but the basic model is the same: salary is a function of education, experience, and other personal or institutional characteristics. Table 1 presents the "best" equations that were retained in each case. The basic experience-earnings profiles are depicted in Figure 4a-4d.

In the case of the Dominican Republic, we call attention to the following points:

- salaries rise almost linearly with experience at under 3% per year;
- a *licenciado*, formally equivalent to the *ingeniero agronomo*, earns 12% less than the engineer;
- women with equivalent characteristics earn 14% less than men;
- gaining an MS degree raises salary by 19% over that of an engineer;
- becoming a program leader does not have an independent effect on salary but becoming director of a center does.

In the case of Zimbabwe, the reference group for the equation was the agricultural technician. We note the following:

- salaries rise at over 5% per year of experience in the early part of the curve but at diminishing rate (i.e., a "typical" profile);
- a BS degree earns its holder 28% more than what a technician earns; an MS, almost 15% more than a BS; and a PhD, 21% more than an MS;
- there is no discernable effect of gender on salary.

In the case of Thailand, the reference group was the group of BS scientists. We note the following:

- salaries rise relatively rapidly in the early years of one's career but at a diminishing rate (again, a "typical" profile);
- a Master's degree earns only 4.5% more than a BS but a PhD is associated with a 22% increase over the BS degree;
- women earn 1.6% more than men (but this differential is statistically significant only at a low level of confidence);

Figure 4a. Dominican Republic (experience-income profiles)

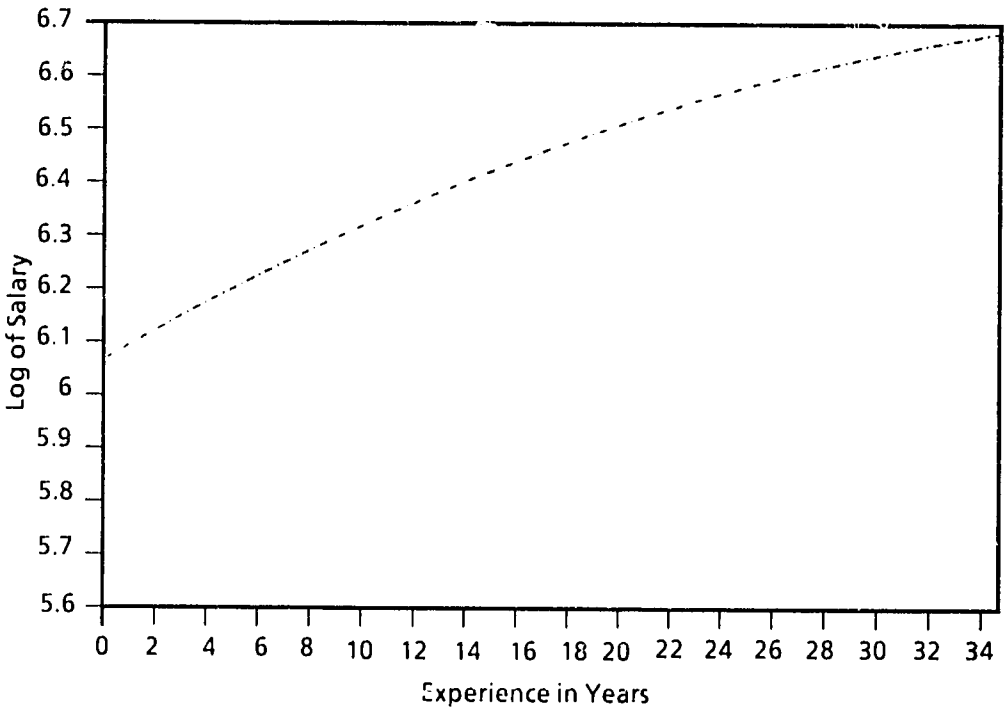


Figure 4b. Zimbabwe (experience-income profiles)

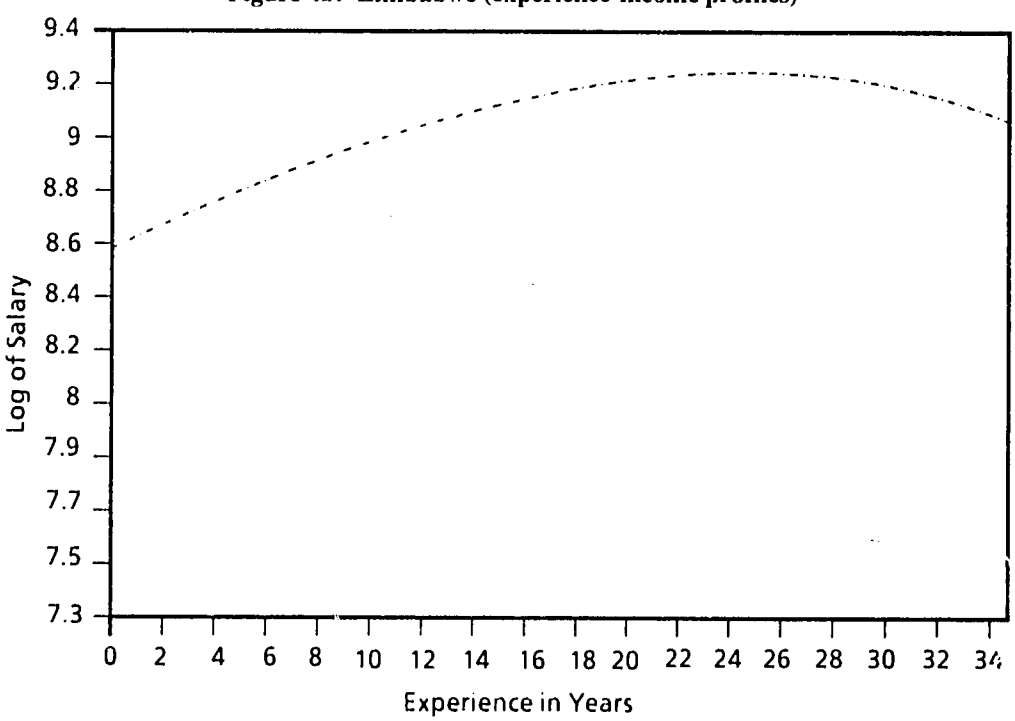


Figure 4c. Thailand (experience-income profiles)

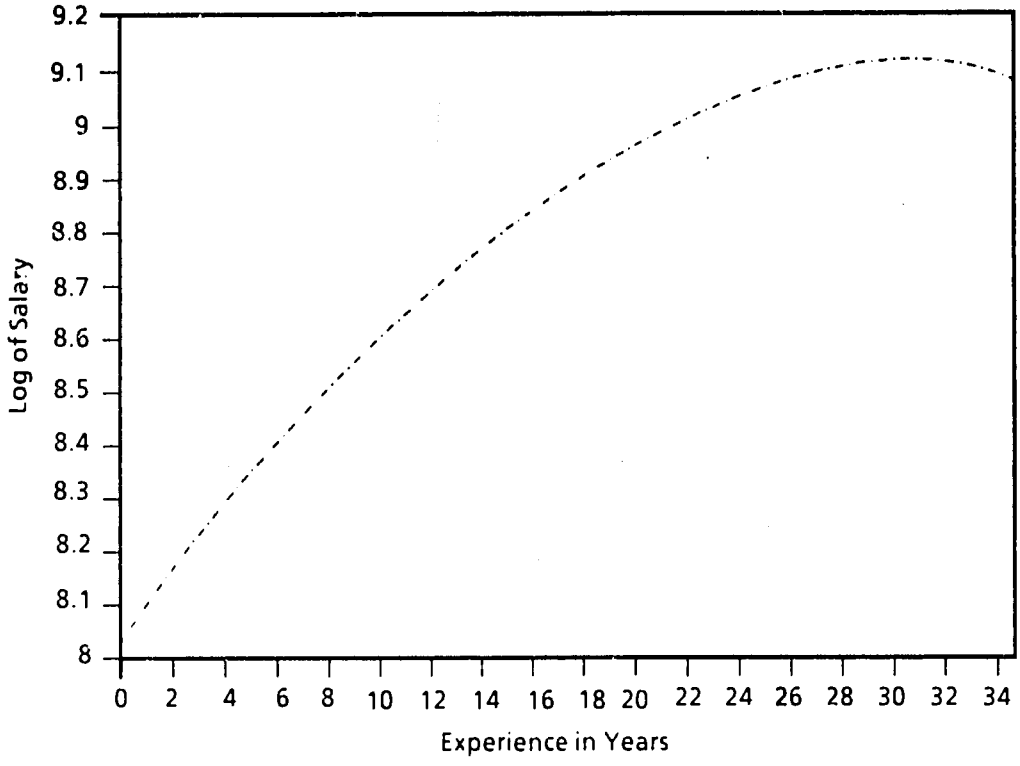


Figure 4d. Panama–Comparison of earnings profiles for key institutions versus CINAP scale, 1985

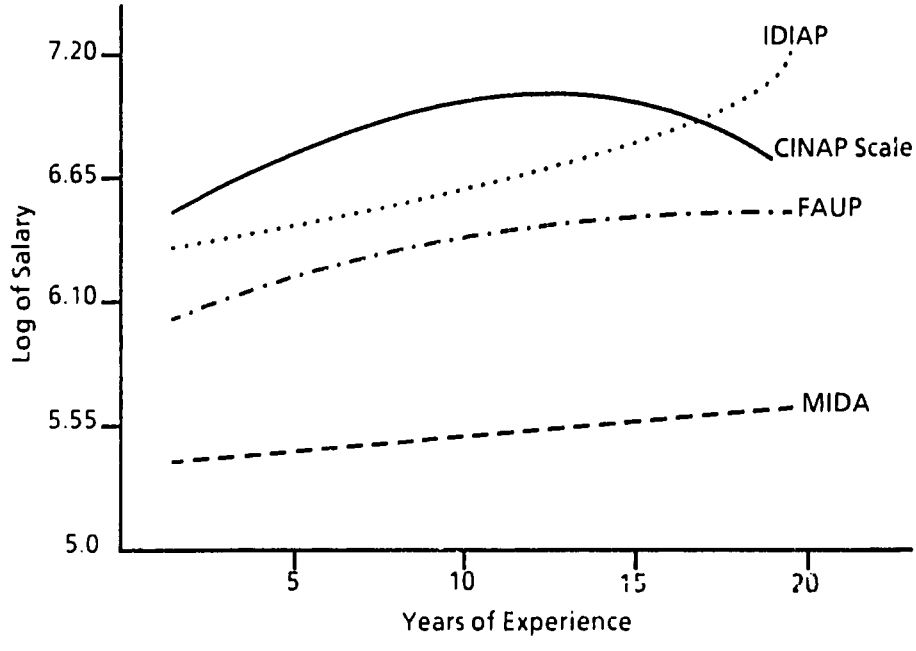


Table 1:
Earnings Functions from Four NARS

Variable	Dominican Republic	Zimbabwe	Thailand	Panama
Logarithm Salary	6.09 (108.6)*	8.56 (146.5)*	8.00 (390.1)*	6.22 (71.48)*
Experience	0.026 (1.97)*	0.056 (9.20)*	0.077 (24.84)*	0.015 (0.91)*
Experience Squared	-0.00026 (0.40)	-0.0012 (6.22)*	-0.0013 (11.19)*	0.00005 (0.80)
B.S.	-0.1218 (2.10)*	0.283 (7.06)*	–	
Engineer	–			–
Master's Degree	0.18 (1.09)	0.428 (8.90)*	0.045 (3.63)*	0.147 (3.13)*
PhD		0.635 (7.39)*	0.221 (5.21)*	0.076 (0.91)
Non-university	-0.08 (1.43)*	–		
Short Course	0.186 (3.09)*			0.0028 (0.28)
Director	0.534 (7.05)*			
Program Leader	0.036 (0.82)			
Female	-0.140 (2.89)*	0.0048 (0.10)	0.016 (1.49)	-0.14 (2.55)*
In Capital Location			0.048 (4.10)*	0.164 (3.75)*
R^2	0.67 n = 72	0.58 n = 174	0.77 n = 882	0.67 n = 84

* = Statistically significant coefficients.

- scientists in Bangkok earn 4.8% more than scientists with similar qualifications up-country, something of concern at a time when Thailand is building new centers in the interior which need to be staffed.

In the case of Panama, we report on scientists at IDIAP, the Panamanian Institute for Agricultural Research. From the earnings function we note:

- salaries rise in almost linear fashion at a slow rate;
- a Master's degree earns almost a 15% premium over an *ingeniero agronomo* and a PhD does not appear to earn any premium (the coefficient on the PhD variable is statistically insignificant);
- short courses do not contribute to higher salary (most staff had participated in several courses);
- women scientists earn 14% less than their male counterparts;
- scientists working in the capital earn 16% more than those in the interior.

The object of presenting these particular observations is to demonstrate that even the basic model can highlight potential problems in compensation policy. These problems may have to do with salary structure and race, sex, or regional differentials.

The model can also highlight interinstitutional differentials. Without reproducing the underlying equations involved, we present in Figure 4d the experience earnings profiles for *ingenieros agronomos* in Panama as estimated for the research institute (IDIAP), the Faculty of Agronomy (FAUP), the Ministry of Agricultural Development (MIDA), and the proposed scale negotiated by the agronomist's union (Colegio de Agronomos).

It is not hard from this diagram to see why the following apply:

- IDIAP is able to recruit the best scientists away from the other two organizations.
- The salary scale bargained by the agronomist's union would put heavy financial pressure on all hiring organizations.
- Since the scale would apply only to agronomists within the organizations, it would distort the internal wage structure of hiring organizations. For example, an agricultural economist trained first as an agronomist would benefit from the scale, but an agricultural economist trained first as an economist would not (even though they are performing the same work).

From the foregoing examples of earnings functions it is easy to see how a simple analytical tool can provide a clear visual as well as statistically rigorous method of important staff recruitment and retention issues.

It is also possible to relate the analysis to training policy. If an organized market exists for trained people outside of the public research system, it is not an efficient policy for government to bear the costs of training a person to the MSc or Phd in the expectation of recovering the cost later or through reduced salaries. Coercion as a means of retention does not make for productive scientists and it is impossible to make them stay. Governments (or their donors) end up with a revolving-door policy of endless training for replacement. In such cases it might be better to train fewer people but have more attractive earnings-experience profiles to retain them once trained. This is a question of both level and structure of salary.

Conclusion

The foregoing is intended as a demonstration of the usefulness of a simple tool, based on human capital theory, for analysis of very practical compensation and training policy issues. The approach is easy to apply, uses readily available administrative data, and can be done with statistical software available in every agricultural research institute. ISNAR looks forward to collaborating with national systems in the application of such techniques so that an accumulation of country experiences can lead to better understanding of the determinants of compensation of scientists.

References

Elliott, H. and S. Kang. 1985. Analyzing Conditions of Service for Agricultural Researchers: An Experiment Using Earnings Functions. Working Paper No. 3. ISNAR, The Hague, Netherlands.

Elliott, H., R. Hertford, J. Lyman-Snow, and E. Trigo. 1985. Identifying Opportunities to Improve Agricultural Technology Management Systems in Latin America: A Methodology and Test Case. Rutgers University and ISNAR.

CONDITIONS OF SERVICE FOR AGRICULTURAL RESEARCH SCIENTISTS IN TUNZIT: WHAT ROOM FOR MANEUVER?

Paul Bennell

Introduction*

Mr. Jonas Itimbi, Director of Agricultural Sciences, scanned the skyline from his office on the sixth floor of the Federal Ministry of Science and Technology (FMST) of the Government of Tunzit. As usual, he had some difficult problems to deal with. Although the 14 agricultural research institutes in Tunzit were semiautonomous institutions with their own boards of governors, the FMST was responsible for the procurement and allocation of their recurrent and capital funds. Dr. Itimbi's most immediate task was to finalize research institute budgets for 1984. It was already December 1983, and he and his colleagues had been working on this since June.

Another perennial management issue that loomed large was that of the conditions of service of research personnel. Scientists, in particular, were becoming increasingly disgruntled about both the level of their salaries and fringe benefits and their overall career prospects. And this unhappiness was being vented by a well-organized senior staff association.

Mr. Itimbi recognized that there were a number of other arguments in favor of improving the conditions of service of scientists employed by the agricultural research institutes. In absolute terms, the value of scientists' incomes had declined considerably since the last major public-sector salary award in 1975. Scientists were also acutely aware of the better conditions of service enjoyed by professional staff in the universities. He could understand these feelings of research scientists who were equally well qualified and who felt that they undertook more relevant agricultural research than their counterparts in the faculties of agriculture and veterinary medicine.

The government was still strongly committed to the Green Revolution Programme which had been started in 1980 in order to reverse the decline of the agricultural sector in Tunzit. The agricultural research institutes were being asked to provide the technology necessary to achieve the targeted increases in agricultural production. But, given the lack of improvement in the conditions of service of research scientists, morale was generally low and there were reports of a large-scale exodus of scientists to the universities and the private sector.

There were, however, a number of important counterarguments for not making any significant alterations in conditions of service. As a senior civil servant, Mr. Itimbi was acutely aware of the stringent budgetary situation. Indeed, the government had just announced a tightening of its austerity program. And, since most professional groups employed in the public sector were demanding better conditions of service, what made research scientists so special? It seemed that nearly every profession was claiming that they were the most important occupation for the development of the nation.

The senior staff association had been involved in negotiations with the government at the end of 1982 and were becoming impatient for a decision. Mr. Itimbi

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**This management case was prepared for the International Service for National Agricultural Research (ISNAR). The case is based on information drawn from a wide variety of published and unpublished sources. Names and titles have been modified. Material contained herein is not to be quoted, cited, reproduced, or published in any form.*

knew that his minister and permanent secretary would be looking to him for his advice on this matter in the very near future.

The Tunzit Economy

The Tunzit economy was transformed by the discovery of petroleum during the 1960s. By 1980 over 90% of Tunzit export revenues were accounted for by petroleum products, and government derived over 75% of its revenues from petroleum-related taxation. However, in the early 1980s, the international oil market contracted sharply, with the result that oil export earnings fell dramatically.

While Tunzit experienced rapid economic growth in the early 1970s, with the advent of the oil crisis, there was an absolute decline in gross domestic product (GDP) between 1981 and 1983. Government revenues also fell dramatically, although total government expenditures remained roughly constant. In an attempt to curtail large increases in government borrowing and a rapid decline in foreign exchange reserves, increasingly severe austerity measures were introduced in 1982 and 1983. Most notable among these were the tightening of import controls and prices and income policy.

Despite the importance of oil, agriculture remained the main economic activity for a majority of the population. In 1981 the agricultural labor force was estimated at 15,602,000, or 52% of the total labor force. Over one-third of the land area of Tunzit is arable and was under permanent crops in 1980. A further 16% is forest and woodland.

Agricultural production declined at an average annual rate of 1.5% between 1970 to 1977 and per capita food production declined an average of 1.3% per annum from 1969/71 to 1975/77. Faced with this situation, the government launched a "green revolution" agricultural development strategy in 1980, with cereals production receiving the highest priority.

There was substantial inflation in Tunzit during the period 1975 to 1983. While the underlying cause was the rapid increase in economic activity, government policies tended to exacerbate inflationary pressures. The worst year was 1975 when the money supply increased by 75% and prices by 43%. The most important cause was a government decision to award large public-sector salary and wage increases recommended by the Public Sector Salary Review Commission Report in 1974. This price increase, coupled with a downturn in oil production, provoked a more cautious policy. The official rate of inflation in 1980 was 8.6% but the actual rate was widely estimated to be 25% to 30%. As a result of shortages induced by the government's austerity measures, the rate of inflation rose rapidly, by some estimates by over 100% in 1983.

The Agricultural Research System in Tunzit

As semiautonomous organizations, each of the agricultural research institutes in Tunzit was responsible to a board of governors, the members of which were appointed directly by the president (Table 1). The majority of board members were representatives from the agricultural industry, farmers and businessmen and politicans. Usually one or two members were chosen for their specialized knowledge of the particular area of research of the institute. The FMST also had a representative on each board.

All research institutes were entirely dependent on federal government funding, which was channelled through the FMST. Research institute directors submitted their proposed annual recurrent and capital budgets in June. For the first time, directors were requested by the FMST to resubmit their original 1983 budget proposals in order to take account of the stringent financial situation facing the country. They were told that the total research budget for 1983 would be no higher than in 1982. At some research institutes, their provisional recurrent expenditure estimates for 1983 were insufficient to meet anticipated emolument costs of existing staff and, for the majority, over 80% of recurrent expenditures had to be devoted to personnel costs.

Conditions of Service in the Civil Service

With the exception of three university-based institutes, personnel at the remaining 11 agricultural research institutes were subject to civil service conditions of service. Consequently, all personnel issues were monitored and had to be approved by the FMST and the Federal Ministry of Establishments. Such uniformity in the conditions of service did not exist during the 1960s, given the looser control and coordination of research institutions.

The conditions of service of civil servants and other public-sector employees had been reviewed by a number of ad hoc commissions. The most recent of

Table 1.
Number of Scientists, Technicians, and Total Employees Employed at Agricultural Research Institutes in Tunzit, 1977/78 and 1980/81

	Date originally established	Scientists		Senior Technicians		Junior Technicians		Total	
		77/78	80/81	77/78	80/81	77/78	80/81	77/78	80/81
CRIT	1944	43	49	47	98	1094	636	1616	1422
FRIT	1954	85	83	47	344*	183		843	1540
IAR	1922	104	129	53	904*	n.a.		1535	1967
IRETA	1969	37	44	89	32*	221		714	n.a.
LRIN	1964	7	17	23	29	77	64	211	243
NARI	1928	30	47	6	152*	40		177	461
NCRI	1899	159	127	100	500	n.a.	585	1946	1979
NHRI	1975	n.a.	34	n.a.	112*	n.a.		n.a.	395
NHCRI	1923	30	81	56	81	233		1214	1342
NVRI	1924	57	120	39	39**	80	396**	570	916
NIOMR	1975	33	46	14	20	166	155	378	348
NITR	1950	23	40	53	70*	n.a.	730	805	
NSPRI	1948	11	18	7	52*	41		198	201
RRIT	1975	24	30	5	45	16	283	343	517

* Combined total for senior and junior technicians.
** Includes administrative support staff.

these, the Public Sector Salary Review Commission conducted a detailed two-year investigation of both the grading and remuneration structures of all public-sector organizations in Tunzit. Job evaluations of over 10,000 jobs were undertaken and this eventually resulted in the introduction of a unified grading structure to cover all employees ranging from Grade Level (GL) 01 for cleaners and messengers to GL 17 for senior permanent secretaries. All agricultural research personnel were placed in this new grading structure, which by 1983 had remained virtually unchanged for the research scientist cadre (Table 2).

The Salary Review Report recommended large salary increases for all civil servants in order to make up for reductions in real incomes caused by inflation and to reduce differentials in private- and public-sector incomes. These increases were, in percentage terms, higher among the lower grades, so income differentials within the public sector also declined (Table 3). The cost of these recommendations, which were largely accepted by the government, was met by greatly increased revenue from petroleum taxes. Between 1975, when the new grading and salary structures were introduced, and 1983, there were only marginal increases in the salaries of senior staff (GL07 and above) which, in total, amounted to less than 5% during this eight-year period (Table 4).

Up to the grade of assistant chief research officer (GL13), all promotions were dealt with internally by senior management at those research institutes with civil service conditions of service. However all promotions were subject to vetting and approval by boards of governors. The most important criteria used in evaluating scientists for promotion were their publications (quantity, quality, and appropriateness in relation to national- and institute-level research priorities) and seniority (Table 5 and Figure 1). A BSc recruit entered as a research officer II on GL08 and would normally expect to progress to research officer I (GL09) after two years of satisfactory performance, and to senior research officer (GL10) after another two to three years. MSc and PhD recruits were placed at GL09 and GL10 levels, respectively. Promotions thereafter were considerably less automatic, depending increasingly on more stringent performance evaluations and the number of establishment positions for each grade approved by the Federal Ministry of Establishments (Table 6 and Figure 2).

For the positions of chief research officer (GL14) and assistant director (GL15), FMST issued guidelines to research institutes which stipulated that these posts must be advertised widely. Candidates were then interviewed by a committee drawn from the board of governors. Directors (GL16) were appointed by FMST in consultation with each board of governors.

Many research directors felt that there were relatively too few senior-level positions to allow sufficiently rapid career advancement for the majority of scientists. It was also argued that the situation had deteriorated since 1980 when the Public Service Commission imposed stringent conditions on approving increases in the number of established positions at senior levels. Thus, while the FMST had agreed in principle to create six more assistant director positions, this decision still had not been implemented by October 1983.

Table 2.
Titles and Corresponding Grades of Scientists in Civil Service and University-Based Research Institutes

Title	*Grade (GL)*	*Title*	*Grade (USS)*
Director	16	Professor	15
Assistant Director	15	Reader	14
Chief Research Officer	14	Principal Research Fellow	13
Ass. Chief Research Officer	13	Senior Research Fellow	12
Principal Research Officer	12	Research Fellow I	11
Senior Research Officer	10	Research Fellow II	9
Research Officer I	9		8
Research Officer II	8	Junior Research Fellow	7

Table 3.

Salary Differentials in the Tunzit Civil Service, 1960-1979

	1960	1965	1972	1979
Unskilled laborer	100	100	100	100
Messenger	138	106	113	111
Clerical assistant	241	152	154	127
Craftsman	263	188	168	157
Clerical officer	260	185	194	157
Chief clerk	741	517	413	265
Executive officer	969	629	517	344
Technical officer	943	613	512	344
Administrative officer	1232	706	661	433
Assistant superintendent of police	1216	790	653	433
Pharmacist	988	642	661	441
Education officer	1232	829	682	441
Engineer	1367	888	784	449
Architect	1367	888	784	449
Accountant	1367	888	784	449
Veterinary officer	1393	904	777	555
Medical officer	1607	1044	854	555
Senior assistant secretary	2451	1592	1020	673
Chief accountant	2351	1593	1389	1040
Consultant	2670	1783	1389	1040
Accountant-general	3144	2042	1766	1309
Director, public works	3593	2333	1766	1309
Adviser, education	3401	2208	1766	1309
Director, medical services	3593	2333	1766	1309
Permanent secretary	3144	2042	1736	1469

(Index, mean salary of unskilled laborer = 100)

Table 4. Civil Service and University Scheme of Service Salary Scale for Senior Staff, 1982

Civil Service	University	1 T	2 T	3 T	4 T	5 T	6 T	7 T	Incremental Rates USS
GL 07		2832	2952	3077	3452	3312	3432	3552	
	USS 6	4008	4176	4344	4512	4680	4848	5046	188
GL 08		3564	3744	3864	4014	4164	4314	4464	
	USS 7	5136	5316	5496	5676	5856	6936	6216	180
GL 09		4668	4830	4992	5154	5316	5476	5638	
	USS 8	6336	6528	6720	6912	7104	7296	7488	192
GL 10		5760	5922	6084	6246	6408	6570	6732	
	USS 9	7550	7632	7836	8040				204
GL 11		6744	6924	7104	7284				
	USS 10	8148	8388	8628	8868				240
GL 12		7404	7620	7836	8052				
	USS 11	9000	9360	9720	10080				360
GL 13		8064	8384	8704	9024				
	USS 12	10092	10512	10932	11352				420
GL 14		9168	9488	9888	10128				
	USS 13	11364	11940	12516	13092	13668	14244	14820	576
GL 15		10296	10812	11328					
	USS 14	12732	13392	14052	14712	15372			660
GL 16		11568	12144	12720					
	USS 15	14280	15000	15720					

Table 5. Source of Publications in the Tunzit Agricultural Journal, 1970-1978

	Nonuniversity research institutes	University research institutes	University faculties	Others
Number	27	26	98	10
%	16.7	16.1	60.8	6.2

Figure 1. Median salaries of scientists according to years of experience in civil service and at university agricultural research institutes

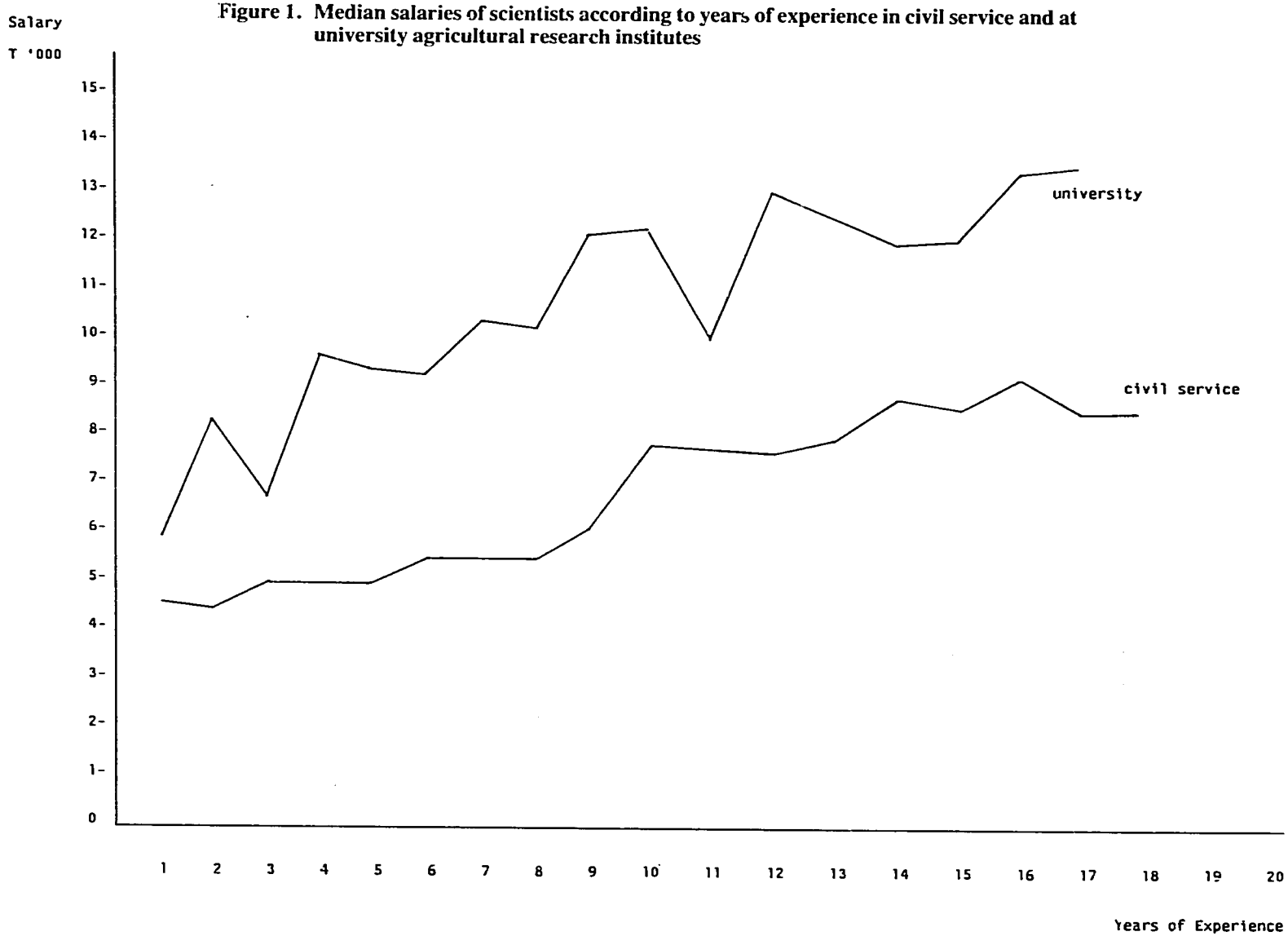

Table 6.
Percentage Distribution of Research Scientists with Nine to Twelve Years of Experience by Grade

Institution \ Grade	08	09	10	12	13	14	15	16
AERLS	0	0	11	22	0	66	0	0
FRIT	4	13	42	33	4	4	0	0
IRETA	0	0	30	30	0	30	10	0
NCRI	6	6	25	38	25	0	0	0
NIOMR	0	0	20	33	13	20	0	0
NITR	0	0	0	25	38	38	0	0

Figure 2. Percentage distribution of scientists according to grade in civil service and at university agricultural research institutes

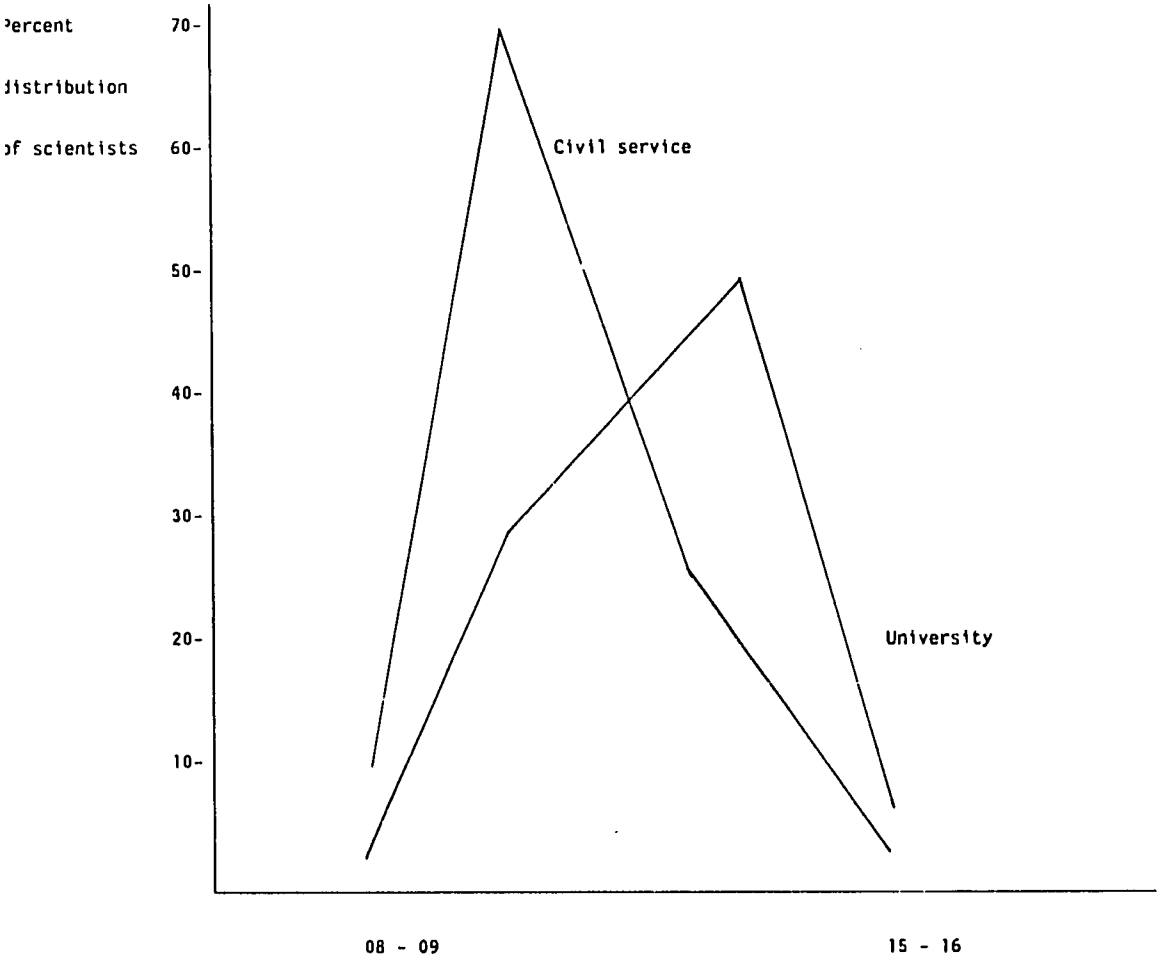

Table 7.
Requirements for the Promotion of Research Staff at Rabinala University

Promotion to:	*Requirements*
Research Fellow II	At least two years as a junior research fellow; MSc and substantial work towards a PhD. Evidence of capacity to undertake independent research.
Research Fellow I	At least three years as a research fellow II; PhD normally required.
Senior Research Fellow	At least two years as research fellow; above satisfactory performance.
Principal Research Fellow	Very good overall rating; original work of high quality essential; ability to inspire and guide other researchers highly desirable; administrative ability also necessary.
Reader and Research Professor	Very good overall rating throughout entire career; considerable research output and evidence of the experience and capacity to give effective overall leadership to all activities in the department; professor.

Conditions of Service in the Universities

Three of the 14 agricultural research institutes in Tunzit were formally affiliated to universities: The Institute of Agricultural Research, Extension and Training (IRETA) became part of the University of Benzil in 1972, and the Institute of Agricultural Research (IAR) with headquarters at Zaria was affiliated with Rabinala University in 1962, to be joined later by the National Animal Research Institute (NARI). Consequently, while they continued to be funded by the FMST, they were part of the administrative structure of the university to which they were affiliated and were subject to the same conditions of service as other members of university faculties.

Up until 1981, the grading and salary structures for university teachers and researchers were identical to those which prevailed in the civil service. In that year, university personnel began a concerted campaign for the establishment of separate conditions of service for the university sector. In 1982, the government accepted the recommendation of a commission of enquiry that the "uniqueness" of the university institution justified the introduction of a separate University System Scale (USS) (Table 4). The salary and wage bills at the four university-based research institutes increased by approximately 25-30% as a result of the implementation of USS. Their directors asked the FMST to provide the additional funds required to pay these increases, but the ministry had not done so by October 1983.

The rigor of the university evaluation system was alleged to be one of its most important characteristics. All advancements (both incremental within a single salary scale and promotions between them) were based strictly on merit. As with the other faculties, advancement in the four university- affiliated agricultural research institutes was on research output, which was measured primarily by an individual's publication record (Table 5 and Figure 1).

Each institute had an annual review committee where the curricula vitae of all scientists were examined. Conditions of promotion were clearly laid down (Table 7). Recommendations for promotion were made to the university's appointments and promotion committee and were given final approval by the university council. For promotions to reader and professorship levels, external assessors were appointed to assess the publications and teaching record of each candidate. The university research institutes did not have fixed establishments for each USS level nor were promotions supposed to be dependent on the availability of financial resources (Table 6 and Figure 2).

Table 8.
Major Indicators of the Staffing Situation for Research Scientists in Eight Research Institutes in Tunzit, October 1983

Name	Number of scientists	Qualifications			Years at the Institute					No.recruited 1983	No. resigned 1983
		BSc	MSc	PhD	0-5	6-10	11-15	16-20	20+		
NCRI	97	13	59	25	51	26	10	5	0	15(6)	10
FRIT	70	26	36	8	21	26	17	10	8	10	6
IAR	113	17	34	62	na	na	na	na	na	0(0)	6
IRETA*	39	0	10	29	10	10	10	5	4	0(0)	2
NARI	44	25		19	na	na	na	na	na	1(2)	1
NIOMP	56	52		4	28	21	3	2	2	7(0)	1
NITR	43	30		13	27	12	2	2	1	9(0)	1

( ) = non-Tunzitians, mainly from India.
*excludes training school staff.

The Staffing Situation in the Research Scientist Cadre

A survey of research scientists employed at eight research institutes was undertaken in 1983. Data were collected on appointments and resignations and on the experience and qualification profiles of research scientists (Table 8). A survey of employment and vacancies for professional personnel in Tunzit had also been undertaken in the late 1970s (Table 9).

During the early 1980s, the FMST received a number of memoranda from research institute directors concerning the employment of research scientists. They noted in particular the increasingly serious attrition of experienced and well-trained scientists, many of whom were leaving for better paid teaching and research jobs in the rapidly expanding tertiary education sector. Although attrition to the private sector was rare and falling because of the economic recession, scientists often compared their salaries with those being paid to middle and senior managers in private companies. Research institute directors pointed out that it was exteremely difficult to find scientists of the same caliber as replacements and some had been forced to recruit expatriates for the first time in over a decade. Most of these were recruited from India and, to a lesser extent, Egypt and Pakistan. They were paid an additional 10% of the Tunzit salary and their travel and relocation expenses were also met.

Faced with the serious financial squeeze, some research institute directors wanted to reduce the number of research scientists, in particular, those who were considered to be relatively unproductive. However, they were severely constrained by the government's insistence that no staff at any level should be retrenched. In fact, research institutes were under pressure to increase the recruitment of junior research scientists so as to prevent the emergence of any graduate unemployment.

The SSA and the Munzi Commission

The Senior Staff Association (SSA) of the Tunzit research institutes was a sector of the Union of Teaching Hospitals, Research Institutes and Associated Institutions (UTHRIAI). The UTHRIAI had been established as one of the 38 industrial unions recognized under the government-sponsored Trade Union Act of 1976. Prior to this, there had been no organization claiming to represent agricultural research scientists in Tunzit.

In August 1981, the civilian government appointed a Presidential Commission on Parastatals under the chairmanship of P.D. Munzi, with wide terms of reference to look at the operations of this group of institutions. The SSA submission to the Commission was over 110 pages in length. Part of this is excerpted below:

Introduction

The Research Institutes Senior Staff Association welcomes the setting up of the Presidential Commission

Table 9.

Employment and Vacancies of Personnel in Specific Occupations, April 1979

	Number	Vacancies	Total Estab. Positions	Vacancy Rate
Administrative Officers (public sector)	15815	8331	24146	34.5
Accountants and Auditors	3920	1727	5647	30.5
Economists	507	178	685	25.9
Statisticians	380	352	732	48.0
Lawyers	1096	773	2869	41.3
Architects	412	403	815	49.4
Civil Engineers	8069	9617	17686	54.3
Electrical Engineers	1567	930	2497	37.2
Mechanical Engineers	1170	587	1757	33.4
Chemists	99	68	167	40.7
Geologists	308	285	513	48.0
Biologists	62	45	107	42.0
Agronomists (incl. soil science + hort.)	197	116	313	37.0
Agricultural Engineers	132	99	231	42.8
Veterinarians	496	252	748	33.6
General Practitioners	1801	641	2442	26.2
Surgeons	251	129	380	33.9
Dentists	84	61	145	42.0

Table 10.

Schedule of Posts, Qualifications, and Experience Recommended by the Senior Staff Association to the Munzi Commission

Present Nomenclature	Proposed Nomenclature	Qualification/Experience
1. Director	Institute Director	Higher degree with at least 10 years postqualification experience in a reputable research institution with very considerable administrative experience
2. Assistant Director	Research Specialist Grade I	Higher degree plus at least 10 years of experience
3. Chief Research Officer	Research Specialist Grade II	Higher degree with at least eight years of postqualification experience in a reputable research institute
4. Assistant Chief Research Officer	Research Specialist Grade III	A higher degree with at least five years of postqualification research experience
5. Principal Research Officer	Research Specialist Grade IV	A higher degree plus at least three years of postqualification research experience
6. Senior Research Officer	Junior Research Specialist I	A PhD or MSc with at least two years of postqualification experience or a minimum years after junior research scientist grade II
7. Research Officer I	Junior Research Specialist II	Master's degree by MSc examination plus experience or 2nd class and two years of experience
8. Research Officer II	Research Assistant	A minimum of 2nd class Hons. degree

Table 11.

Recommended Salary Scales for Staff of Tunzit Research Institutes Submitted by the Senior Staff Association (Tulits)

Grade	*Increments*						
Director	22,161						
R.S. I	21,054						
R.S. II	19,946	20,660					
R.S. III	17,008	17,629	18,250				
R.S. IV	14,298	14,799	15,300	15,801			
R.S. V	11,229	11,672	12,115	12,558	13,001		
R.S. VI	9,947	9,767	10,127	10,487	10,847	11,207	
R.S. VII	7,193	7,481	7,769	8,057	11.207	8,633	8,921
R.S. VIII	5,670	5,850	6,030	6,210	6,370	6,580	6,750

on Parastatals. It is hoped that the findings and recommendations of the Commission will go a long way to satisfy the yearnings and aspirations of the staff of Research Institutes in Tunzit.

It is pertinent to mention that the federal government efforts to make the Green Revolution a success is a very laudable one. Indeed, for a very long time, agriculture was the mainstay of the Tunzit economy, and it occupies a position of great importance in the national economy. This position has been maintained because of the research works carried out by the Research Institutes. However it is imperative to emphasize that up till now, the research institutes have no conditions of service which could guide the career of staff and previous attempts to draw up one have always been overtaken by events.

Chapter 1. Preamble

Therefore, research institutes are a step ahead of these other institutions because they are more significant to the social and economic development of the nation. As such, research institutes' staff need to be treated as "specialists" within the Public Service of Tunzit. They cannot get this treatment if they are still being remunerated within the unified grading system of the Public Service.

For the research institutes to compete effectively in the labor market, and to prevent any frustration due to infrastructural deficiencies and low productivity due to brain drain from the institutes, remuneration of the workers must in no way be inferior to those in the universities.

This submission also made a number of recommendations concerning both the organization and conditions of service for agricultural research institutes. The most important of these were:

scientists and other research personnel would be developed (Tables 10 and 11).

4. There would be improved fringe benefits.

A second submission was made by the Committee of Directors of Research Institutes (CODRI). CODRI was established in June 1981 and it was originally planned to hold two meetings each year. As with the SSA, there had never been an organization of research directors prior to this.

The Munzi Commission Report was published in October 1981. It recommended that parastatal organizations with "autonomous employer status" should be free to establish their own grading and salary systems. However, it argued that the highest salary paid in each organization (i.e., that of the director or managing director) should be set by the government.

The commission recommended that the university teaching hospitals and the research institutes should enjoy "autonomous employer status" and that the staff of these institutions "should enjoy essentially the same conditions of service as those applicable to university staff."

The government expressed its views on the Munzi Commission Report in a white paper published in May 1982. It accepted the commission's recommendations concerning the need for parastatals with "autonomous employer status" to undertake their own job evaluation exercises and establish appropriate salary and wage structures. However, the government considered the proposed top salaries of directors as too high and stated that these would be determined by special negotiating panels for each category of parastatals. The UTHRIAI waited for their panel to be convened. By September 1982, nothing had happened and, in an attempt therefore to put pressure on the government, a large majority of union members went on strike for approximately two weeks. Another strike took place on 10 November 1983, but this time the negotiating panel was convened after only one day under the chairmanship of the Director of Budget. After four meetings, an agreement was signed between the representatives of the UTHRIAI and the government. A summary of this agreement is included below:

1. Establishment of advisory councils.

It was agreed that the panel should recommend to the government that two advisory panels should be set up: one for the teaching hospitals and the other for research institutes. The advisory panel will comprise representatives of chairmen of the institutions, the chief executives, and representatives of registered and recognized associations/unions. Such an advisory panel will have the following functions: (a) advisory and recommending policies and targets for the development plans and budgets for the institutions and (b) ensuring uniformity of conditions of service.

2. Salary range for chief executives.

It was agreed that the basic salary for the chief executive of a teaching hospital or a research institute should not be less than a professor. It was further agreed that these chief executives should be entitled to allowances equivalent to the allowances generally allowed deans of universities.

3. Housing allowance.

It was agreed that the housing allowances of all officers from grade levels 07 and above should be raised to 25% of salary.

What Room For Maneuver?

Dr. Itimbi met with his advisors at FMST in order to discuss with them the future condition of service policies and procedures. "I have now had the opportunity to review the situation. It's a long and complicated story, and, as we all know, very controversial. We must proceed, therefore, very cautiously by systematically evaluating all the factors which have collectively determined the career and salary structures at the research institutes. All too often in the past, recommendations have been made which have been based on exaggerated statements. We must also recognize that, given the serious financial situation facing the country, the scope for improving the conditions of service for research personnel is limited. It is important therefore, to distinguish clearly between recommendations concerned with increases in salary and other fringe benefits, and alterations to grading and promotion procedures, and then to spell out the cost implications."

SESSION 8

SPECIAL EXPERIENCES

HUMAN RESOURCE ORGANISATION AND DEVELOPMENT IN ON-FARM CLIENT-ORIENTED RESEARCH: SELECTED ISSUES AND LESSONS

Jim Bingen, Susan Poats and David Kaimowitz*

Jim Bingen, from Michigan State University, presented a paper on the human resource issues raised in the management of what ISNAR calls *on-farm client-oriented research* (OFCOR). The paper was co authored by Dr. Susan Poats, who was not present at the seminar.

OFCOR is a research approach designed to help research meet the needs of specific clients, most commonly resource-poor farmers. It complements–and is dependent upon–experiment station research. It involves a client-oriented philosophy, a specific research approach and methods, and a series of operational activities carried out at the farm level. These activities range from diagnosis and ranking of problems through the design, development, adaptation, and evaluation of appropriate technological solutions. Farmers are directly involved at various stages in the process. The designation *OFCOR* has been used instead of *farming systems research* (FSR) because the latter has come to have very different meanings for different people.

In talking about the human resource management issues raised by OFCOR, Dr. Bingen drew from an empirical research study carried out by ISNAR in nine countries that have had sufficient time to experiment with and develop diverse organizational arrangements and management systems for implementing OFCOR. The study was directed by Dr. Deborah Merrill-Sands and carried out with support from the government of Italy and the Rockefeller Foundation.

The talk was divided into two parts. The first part covered a descriptive presentation of the key findings from the case studies, and the second concentrated on specific lessons for research managers. Three central issues were covered in both parts: the recruitment of scientists, staff management, and staff development or training. Although these issues were presented separately, Dr. Bingen stressed that they are closely related. The institutional arrangements used to organize OFCOR in a country and the particular scientific labor market conditions are aspects that affect all three issues.

Recruitment of Scientists

It is useful to examine the recruitment process in terms of supply and demand for scientists. The key issue with respect to demand is how much effective control OFCOR administrators are left with in selecting their staff under the "project mode" of many OFCOR programs and existing government hiring regulations and procedures. It was also clear from the case studies that human resource programing and planning is commonly absent.

At least three cases (Zambia, Zimbabwe, and Panam did have explicit criteria for the staff they recruited for OFCOR. In other cases it was difficult to say whether any such criteria existed.

On the supply side, there was evidence in a few cases (Zambia and Ecuador) that recruits were interested in working in OFCOR because of the perceived opportunities for training and subsequent career advancement, or economic incentives tied to foreign-funded projects. OFCOR managers themselves have sought to affect the supply of usable recruits either by giving new recruits special training in OFCOR or by actively developing relationships with universities (such

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* *Prepared by David Kaimowitz, based on a presentation by Jim Bingen.*

as in Zambia and Zimbabwe) in order to identify and capture their best graduates, particularly those with special interests or skills for working in OFCOR.

Staff Management

Under this heading Dr. Bingen discussed OFCOR staffing characteristics, the role and use of foreign scientists, and program leadership. Overall, the case studies found that an average of 17% of scientific staff and 18% of technicians were assigned to OFCOR programs. In general, there was little difference in training between the scientists working in OFCOR and those working in other programs in the NARS. Latin America represents something of an exception. In the three Latin American countries studied (Guatemala, Ecuador, and Panam there was a heavy reliance in OFCOR programs on BSc-level scientists.

Contrary to expectations, OFCOR scientists are not significantly less experienced than the average in the NARS studied. On average OFCOR scientists had 6.5 years of experience compared to 7 years in the NARS as a whole. Significant differences were found, however, in three African cases where foreign scientists had about twice as much average experience as national scientists (10.2 versus 4.9 years).

The cases also showed that the basic agronomic disciplines are dominant in both OFCOR programs and the NARS in general. Social sciences, animal production, and other research disciplines are all underrepresented in terms of staff composition. This was particularly true of the Latin American cases.

Several factors seem to influence the staff composition of OFCOR programs. These include the research traditions and/or experiences of the different countries, the presence of a social science or agricultural economics unit within the NARS, and the different influences of donors and/or the IARCs.

The cases also seem to show a range of different ways in which social science and other nonagronomic disciplinary skills are incorporated into OFCOR. These include multidisciplinary teams (Senegal), the use of these specialists in an advisory role (Zambia), and/or secondment (Indonesia). Foreign scientists have also been used to provide these services, especially in the early years of OFCOR programs (Panam, Guatemala).

Very few women work in OFCOR programs. There were none in Ecuador, Guatemala, Panam, and Nepal. Women represented only 2% of professionals in Senegal and Bangladesh, 9% in Zambia, and 11% in Zimbabwe. Nevertheless, where they are employed, women researchers have provided unique contributions on gender-related issues (Bangladesh). Dr. Bingen raised the issue of whether OFCOR programs can afford *not* to have female scientists.

Foreign scientists present a number of particular problems. OFCOR managers are usually forced to select foreign scientists on the basis of their curricula vitae. They may even have only a minimal role in the selection process altogether.

It is not at all clear that OFCOR programs rely more heavily on foreign scientists than other NARS programs. On average, 86% of OFCOR scientists are nationals.

But the cases do point out the critical role foreign scientists have played in various OFCOR programs. In four countries (Zambia, Zimbabwe, Guatemala, and Ecuador) foreign scientists have provided significant leadership, especially in the early phases of the program. Foreign scientists have also been used as short-term consultants, substitute scientists, collaborators, and advisors.

The use of foreign scientists was found to pose several problems. Foreign scientists may be more responsive to their own external funding agencies. Cases were identified where the foreign scientists lacked the necessary regional experience, language, and OFCOR skills. Funding agency policies that designate separate vehicles and supplies for foreign scientists occasionally create conflicts and inefficiencies. Foreign scientists sometimes come to countries and leave without training national counterparts, and their sudden departures may have an adverse effect on the operation of the program.

Another problem identified was how to make the best use of scarce, senior, experienced staff. Senior scientists tend to concentrate at headquarters or major stations, while technicians and junior scientists are out in the field running on-farm programs and trials. One reason for this is the difficulty in getting senior scientists to accept moving to remote areas. This difficulty is compounded by the lack of adequate incentives in many systems for moving to such areas.

In general, problem-solving research is more administration-intensive than disciplinary research. The same applies to multidisciplinary programs. Empirically, it was observed that leadership in the cases studied tended initially to be in the hands of social

scientists, but over time was passed to plant or animal scientists.

Staff Training or Development

Of the eight cases for which there was information, slightly more than half of the OFCOR programs had specialized training in on-farm methods. Such training involved the provision of socioeconomic skills to agronomists and/or of FSR skills in general. Generally, this training was done more in relation to a "project push" than with an overall human resource development plan or program. There has also been a tendency to overlook on-the-job, refresher training.

A few OFCOR programs do have apprenticeship programs for new recruits. Senegal used a "memoire period" for this purpose, but this was found to be overly formalistic. The Curso de Producción Agrécola (CAPA) program, in Guatemala, however, does appear to be rather successful. This program has trained all new agronomists in applied technical methods. One aspect of it is that all agronomists are given their own individual plot where they must apply the techniques they have learned. This apprenticeship approach has fostered a shared research approach in Guatemala. This led Dr. Bingen to raise the issue of whether OFCOR programs can afford not to have CAPA-type training.

Long-term training raises other issues. There is little evidence that the long-term training being provided is inappropriate. There are often problems with the timing of the training, however, since having staff coming in and out of terms in critical moments can be disruptive. There is also a problem with attrition among people who return from training.

Training for research technicians is important, but often overlooked. IRRI offers some of this. Zimbabwe and Senegal also had some technician training. Overall, however, the training of technicians has been deficient in most cases.

Lessons for Managers

Dr. Bingen identified three major lessons for OFCOR managers concerning recruitment. First, more needs to be done by OFCOR programs to work with the educational institutions from which they recruit in order to condition the recruits they receive. This may involve introducing OFCOR training in the curriculum, or increasing faculty and student participation in research programming, planning, and implementation or other types of joint activities. Second, recruitment must become an integral part of human resource planning. Third, since most recruits are junior, special program measures are required to socialize them into their assignments. One possibility for this is to pair them up with more senior scientists.

There is a need for OFCOR programs to develop identifiable career paths. The current "task force" approach to OFCOR hinders the development of such career paths.

More must be done to assure the contribution of female scientists and social scientists. Indeed, OFCOR programs cannot afford to continue to have such poor participation from these groups.

Multidisciplinary, and not just interdisciplinary, research is required. This demands specific research methods, some examples of which include the "group trek" used in Nepal and the better-known techniques of rapid rural appraisal. Leadership must come from researchers who understand and are committed to multidisciplinary work.

More generally there is a need for leadership from individuals who are highly committed to OFCOR. There are definite trade-offs in this respect involved in the use of foreign scientists as leaders. Frequent reorganization and management changes make both effective leadership and team building much more difficult.

Foreign scientists should only be employed to fill approved positions. Efforts should be made so that their work overlaps heavily with that of national counterparts. For consultants to be useful, they have to be experienced and to respond to clearly defined program needs. Special attention might be given to making more use of Third World scientists from other countries in this work.

Special attention must go to getting more senior and experienced scientists in OFCOR programs. One possible option would be to use scientists in an advisory or backstopping role. Another possibility, logistics permitting, would be to commute back and forth from a centrally located station to the field.

Finally, Dr. Bingen stressed the need to use networks that provide scientists with the opportunity for scientific exchange through an in-service training mechanism.

INTERGROUP RELATIONS BETWEEN AGRICULTURAL RESEARCH AND EXTENSION

Paul Bennell and David Kaimowitz*

A paper by Paul Bennell called "Intergroup Relations between Agricultural Research and Extension" was presented by David Kaimowitz. The focus was on how researchers interact with their extension counterparts and what research managers can do to handle the difficult problems caused by poor interaction between the two groups.

Dr. Kaimowitz noted that neither research nor extension can fulfill its responsibilities without the other. This requires strong collaboration, good communication, and the motivation and skills for interaction.

Unfortunately, such collaborative relations between researchers and extension are relatively rare. Nor, however, is there usually open conflict between the two groups. Hostile avoidance and indifference seem to be most common type of interaction.

Competition

A primary reason for poor relations is competition over preferred policies, resources, operational control, and credit and blame. (The definition of resources used here is relatively broad and includes power and responsibility, status, and rewards and recognition, as well as financial and human resources.)

Competition is likely to be greater between groups where (1) at least one of the groups is unhappy with its available resources, (2) there is a perception that there is a fixed quantity of resources to be divided up, and (3) there has recently been a major shift in the share of resources going to one of the two groups.

Often competition does not break into open conflict because policymakers do not allow it to do so. Hostile avoidance occurs instead. A common symptom of such hostile avoidance is that the groups try to become less dependent on each other by taking over the other's functions (researchers doing extension work and vice versa). If there is really no meaningful pressure for cooperation, it may not take much competition to produce hostile avoidance between researchers and extension workers.

Part of the competition between researchers and extension agents tends to center around the use of academic qualifications and length of training as a justification for researchers to have higher status and benefits. Whereas researchers are always considered professionals, extension field personnel in many places are only paraprofessionals and have lower status and incomes.

These differences in training, status, and income between the two groups are partly a result of their different historical origins. In addition, the idea exists that research is more complicated and thus requires more advanced training. Extension's association with low-status farmers and the need for extension agents to live in rural areas with few amenities has also contributed to its low status. Because of extension's low status, researchers tend to adopt a superior, patronizing attitude towards extension agents. The poor image of extension also makes it difficult for extension services to recruit and retain quality extension staff.
To try to overcome their low status and low income, extension workers have tried to improve their position by becoming more professional. This involves taking on more responsibility for activities such as information integration, making recommendations, and adaptive research.

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* *Prepared by David Kaimowitz, based on a paper prepared by Paul Bennell.*

Researchers have responded to extension's attempts to become more professional in a variety of ways. These include (1) accepting the trend and building closer links with extension, (2) turning over adaptive research activities to extension and concentrating instead on (higher status) applied research activities, (3) allowing extension field agents to participate in research trials but only as manual labor and informants, not as full participants, and (4) fighting with the extension services over who has or should have the mandate for the activities listed above. Only the first of these four responses is likely to permit a positive working relationship between researchers and extension agents.

Besides competing over objective differences in resources, power, etc., researchers and extension workers also compete over their group identities, that is, over how each group views itself and is viewed by the other. Each group fashions its own group identity by comparing itself as favorably and distinctively as possible with the other group. The result of this subjective process of group comparison is stereotyping and the development of "ingroup"/"outgroup" relations. When this happens, the differences between the individuals in the two groups are exaggerated and the differences between individuals within each group are minimized. This problem is worse where there are already large status differences or conflicts over resources between the two groups or where group members are strongly committed to their own groups.

Other Aspects of the Relation between the Two Groups

While competition between researchers and extension workers may explain many of the problems in the relations between the two groups, other aspects are also important. Three key issues in this regard are differences in orientation and work style, concerns related to competence, and the level of contact between the two groups.

Differences in orientation and work style tend to reinforce problems of competition. Researchers are said to be more oriented towards the general scientific community, while extension workers focus more on their specific employer. Researchers have a longer time horizon. They want to be absolutely sure about their recommendations, no matter how long they take to create them. Extension workers on the other hand often prefer to use the best answer available at a given moment, even if it may need to be modified in the future. Researchers are also said to value theory more than practical experience.

For the linkages between research and extension to be effective, both groups must be competent and must be perceived as such by the other groups. They must also be competent in performing linkage activities. High levels of frustration are associated with unsuccessful activities, which quickly leads to a deterioration in relations.

Lack of contact is another reason for poor relations. This may occur due to the physical distance between research and extension, a lack of operational mechanisms to bring them together, and high staff turnovers which make it difficult to form long-standing and solid informal relationships.

There are a number of different ways contact between the two groups can be increased. These include placing the two groups' offices closer together, setting up regular meetings or joint activities, and seconding personnel from one group to another. Greater contact is only likely to improve relations, however, if the behavior each group observes in the other tends to break down their preconceived negative notions. Contact may worsen the situation if people don't like what they see when they get together.

What Can Be Done to Improve Relations?

The key to improving the relationship between researchers and extension workers is the establishment of shared goals. These goals must be things that are important to both groups and which neither group can achieve without the other. Usually a general commitment to agricultural development is not sufficient.

The basis for these shared goals must be a shared concern by *both* groups with the transfer of technology to producers. In addition, the group's day-to-day operations must be more dependent on each other. One way to ensure this is to set up work teams that include members of both groups. There must also be clear, verifiable, and enforced linkage objectives. Other preconditions for developing shared goals are (1) extension's complaints about status and/or rewards must be addressed; research should view extension's professional aspirations positively. (2) Shared goals must be made insufficiently compatible with the goals of the individuals in the different institutions. And (3) shared goals must be given sufficient weight in performance appraisal and reward.

Management has a key role to play in the creation of shared goals. Policymakers, research managers, and

extension managers must all be committed to them. These groups must also work to create organizational cultures in their respective institutions where these goals are highly valued. Donors can sometimes promote shared goals by using joint funding as an incentive for cooperation. Nevertheless, donor involvement in this area also has great potential for negative results and must be handled with caution.

HUMAN RESOURCE MANAGEMENT IN EMBRAPA (BRAZILIAN CORPORATION FOR AGRICULTURAL RESEARCH): AN OVERVIEW

Tarcizio R. Quirino

Approaching Human Resource Management Experiences at NARS

The tasks of human resource management for agricultural research are affected by the strategy, operation, and structure of the NARS as well as by its need to cope with an environment that may range from friendly to hostile and move from one point to another within this continuum.

A "no-formula" approach to human resource management would imply that each case is unique and management should decide on a case-by-case basis. A prescriptive approach would take the opposite view–that there are "right" and "wrong" ways for doing things and these are to be taken into consideration in as uniform a way as possible.

A third theoretical perspective, as well as some international experience, suggests that there is no universal formula for dealing with human resources. On the other hand, there are aspects of the organization such as technology, size, organizational experience, and environment that limit the possible alternatives for effective management by excluding some of them and making others more appropriate for a specific case. Identifying such contingencies and relating them to appropriate choices of action for similar cases is desirable for the study of management of human resources in agricultural research. It is also of both theoretical and applied relevance.

The present presentation draws on the experience of a NARS (Brazil) and attempts to highlight what contingencies had the greatest influence on each of the five basic aspects of human resource management for agricultural research at EMBRAPA, the leading organization of the NARS (Bennell and Zuidema, 1988).

Institution building was the long-term goal expressed by those at the managerial level. An institution-building approach is a series of actions which culminate in creating an institution and providing it with the means for fulfilling its objectives in a continuous and persistent manner. Short-term goals were focused on client satisfaction, defined by improved profitability for the farmers. As the process of building an institution went on, internal and external characteristics changed and the organizations or parts thereof went through phases. Therefore, decisions on human resources were made contingent upon the phase the organization was in, and success varied.

The following section of this document will provide some background material for understanding the situation and its effects on human resource management. The next section will analyze each one of the five central management tasks for human resources as they occurred at an agricultural research organization, namely, EMBRAPA. Differences in the contingencies and the adaptations made at the management level are the focus. The section on institutionalizing reflection, is an overview of one organizational arrangement that had a positive impact in making management more aware of the opportunities and pitfalls of managing from a contingent-approach frame of reference. Finally, conclusions are offered to summarize the material and to indicate possible solutions.

EMBRAPA and the Brazilian Agricultural Research System

The present model of the Brazilian National Agricultural Research System (NARS) was organized in 1973 in order to meet the growing need for food and other agricultural products generated by the country's urbanization and industrial growth. Moreover,

exhaustion of the import-substitution model of economic development required new solutions for sustained growth. Brazil's natural endowments point to a system where agriculture should play a central role. Technology must be mastered and integrated into such a system so that sustained growth may be obtained.

To prepare for the official creation of the new model of agricultural research, a task force was appointed by the central government to study the previously existing system, to determine the country's needs, and to analyze international experiences. The task force included experienced agricultural researchers along with economists and sociologists.

The old system was based on publicly funded and maintained regional institutions in which researchers had a lot of freedom for pursuing work on diverse, but not complementary, themes. This was all loosely coordinated by the central government through the National Department of Agricultural Research (DNPEA), a division of the Ministry of Agriculture. A few states had their own institutes or programs and had been able to produce first-rate research for their own needs, while other national priorities weren't contemplated by anybody. Coordination with extension services was another issue, but this will not be pursued here. Analysis indicated the need to create a cooperative system of agricultural research in order to overcome the problems of the existing one. The new system was designed to represent a middle-of-the-road solution for the problem of centralization and coordination.

The Brazilian Corporation for Agricultural Research (EMBRAPA) was created as the head of the system, with EMBRATER (Brazilian Enterprise for Diffusion of Agricultural Technology) as its twin sister at the federal level. Both are affiliated with the Ministry of Agriculture, though their juridical status of public enterprises permits much more freedom about all managerial aspects than any other possible arrangement. State institutions, mostly organized as public enterprises, received the mandate for adapting research to local conditions and supplying knowledge that could be applied to specific demands at that level. Coordination with university agricultural departments, private research, and existing federal- and state-funded research agencies working with a few important export crops such as cocoa, sugarcane, natural rubber, and coffee completed the system. A participative, although centralized, planning process was designed to avoid duplication of effort and lack of complementarity. This was intended to be a concentrated system in contrast to the previous, diffuse system.

No doubt the strong centralization power in the hands of the military government at the time was one of the factors that helped change the system. The strong meritocratic orientation of the task force prevented this from becoming an unfortunate liability for the new organization and its members.

The system is presently functioning with 44 research centers under EMBRAPA's direct jurisdiction and 16 state enterprises or integrated research programs. Universities, institutes, and private research centers are a part of the NARS insofar as they take a role in the process of planning research priorities and are totally or partially funded for doing their own research on agreed-upon priority themes. They benefit from all sorts of EMBRAPA services as well, such as access to libraries and stored information systems, use of germplasm banks, participation in training programs, and auditing procedures.

Efforts by the central government to contain the public deficit are leading to some changes in the system configuration. The specialized institutes for research on export crops are supposed to become a part of EMBRAPA's structure in the near future. Moreover, EMBRATER's diffuse system is to become the sole responsibility of the states. It is still unclear how diffusion will be coordinated within the research system and among the states themselves.

The new constitution, which was declared last October 7, contributes strongly to these changes, since it requires much greater participation from the states to the budget than used to be the case. EMBRAPA's coordination over the whole system has tended to become more technical and less budgetary. Its influence has declined in the more advanced, rich states as well as in those states where agricultural research is not first priority. It is expected to increase in the frontier states that depend on new technology for expanding and fortifying modern agriculture. EMBRAPA needs to find new ways for exercising its policy of balancing local interests and weighing them against a framework of long-range national development.

Human Resource Management in EMBRAPA: An Institution-Building Approach

The overall strategy for institution building in the long

term in EMBRAPA was set by an operational arrangement that highlighted human resource training. At the time there were very few PhDs or the equivalent among the agricultural researchers in the country. Realizing that having well-educated researchers is essential to an efficient NARS, the first thing the Board of Directors did was to establish a large training program with emphasis on postgraduate training. The training division was the first to be implemented at the Department of Human Resources (DHR). The other functions were deeply influenced by this strategy, as we shall see.

Planning

When EMBRAPA was created, there was no formal plan for human resource management.

EMBRAPA replaced an existing agricultural research network. The earlier mandate of research centers was completely restructured, with new locations added to the existing ones and a specific focus on products or resources clearly assigned to each of them. During this reorganization, the experience and location of the old institutes and expertise of the research staff of the old system were taken into consideration.

The resulting structure is composed of product centers and resource centers at the national level, supplemented by service centers (soils, basic seeds, genetic resources) and by small subregional units located in the states (UEPAEs) or territories (UEPATs) where, for one reason or another, no state system can be immediately organized.

This general organizational plan substituted for a formal plan for decisions about human resources. Moreover, the DHR was expected to create the following structural characteristics: namely, researchers should put an emphasis on applied research and should work in interdisciplinary teams, and programs should focus on products, not on disciplines. This loose method of planning was very efficient as a device for institution building because it allowed the DHR to take advantage of opportunities as they appeared in a poor human resource market.

Personnel were divided into three groups: researchers, support personnel, and administrators. The numbers of employees required in each category were decided upon according to the type of commodity they would be researching.

This first phase took about six years. At that time, an attempt at developing a master plan for EMBRAPA was made, but it was never put into effect and the human resource portion of the plan was generally ignored.

Since the beginning, EMBRAPA's program has been largely determined by political and funding considerations, with little backing given to human resource availability. Because of this, it is impossible to plan ahead for staff needs and many researchers are seriously overloaded with work. As a trade-off, EMBRAPA built a public image of being hard working and client-oriented, at the service of agricultural interests. Institution building has overcome any considerations of planning or orderly management.

In April 1988, EMBRAPA's first master plan was put into effect. Covering the period through 1992, two sections are supposed to take care of human resource planning–a section on macro-policies and another on specific goals.

Intentionally, there is still little formalization as far as human resource structure is concerned. However, there are clear criteria for making decisions and these tend to be focused on institution building. The trend is from loose to more precise human resource planning. Relationships with the organizational environment as well as strategic institution-building considerations have in a certain measure inhibited the use of conventional methods of quantitative planning for human resources in EMBRAPA. Explicitly formalized, qualitative decision-making criteria have been used instead.

As the organization becomes better established, the need for more precise planning methods grows. As the human resource market becomes more sophisticated and abundant at the supply side, demand must be precisely identified by the research organization.

Staffing

Making incremental decisions is a tactic that allows decisions to be taken step by step. Despite disadvantages such as uncertainty of outcome, it has the one big advantage of allowing for adaptation to the environment and to changing political and market situations. It is particularly important as an institution-building strategy, especially when mitigated by a strong general sense of purpose.

The development of job descriptions and promotion and salary guidelines was basically made step by step as each research center was restructured. It wasn't until later that general systematization was undertaken.

All staff from the previous system were allowed to apply for employment in EMBRAPA. The basic selection process relied on interviews and curriculum examinations to select those who would be hired. If hired, individuals started at a higher salary than they had been receiving, but they were required to give up their tenure. They also had to accept posting at any research center in the country and/or postgraduate training, either domestically or abroad.

Despite these requirements, most of the researchers in the old system did apply for employment in EMBRAPA. However, many of them felt they had no choice, and the whole process left an atmosphere of tension and discontent, and even active opposition to the new system.

On the other hand, the majority of employees came from outside the old system. Many of them were from the academic and diffusion sectors and many were new graduates. This group was glad to have the opportunity to join the new system and they were excited about the new ideals it stood for. Central positions were given to the few senior researchers there were in the country at that time. Practically no expatriates were included in this first phase.

Academic performance was the main hiring consideration for employees entering the system for the first time. There was a great deal of freedom in hiring at this time, and any individual who appeared to have the potential of contributing to EMBRAPA could be invited to join the staff. Fortunately, the hiring team possessed a good deal of foresight and used their administrative freedom well for building the institution we all know.

Seventy-nine percent of EMBRAPA's principal staff was hired during this first six-year period. Then, because of the world economic crisis and the country's attempts to control the national deficit, there was a significant change in hiring policy. On the one hand, by EMBRAPA's initiative, a law was enacted that required a public selection process for all new employees. Exceptions were those who already held a PhD degree and had 10 years of experience on the one hand, and laborers on the other. One of the main objectives of this move was to avoid political pressures in hiring new employees. This new process requires the DHR to define positions and recruit and deploy staff in an orderly way and in harmony with the policy of manpower development. On the other hand, by initiative of the executive branch, a ban on hiring any employees was decreed shortly thereafter.

In order to get around this ban, hundreds of "temporary" employees have been quietly hired to meet increasing contractual obligations. These employees come under a number of disparate legal situations, and there are no clear-cut solutions to the problem. At this time, this parallel staff makes up about 30% of the total 8,800 EMBRAPA employees. This is clearly an untenable situation, and it is widely agreed that this group must somehow be legally integrated into the normal employment structure. Unfortunately, this is an area with considerable political undertones, and it is not likely that it will be resolved soon.

Normal hiring can take place only after public selection, which is usually open only for the lowest positions of each career line. The newer centers in outlying areas are largely understaffed and are most subject to the public selection process. Because of the expense and length of the procedure, there is a tendency to wait for staffing needs at different centers to accumulate and then to fill them all together by holding two or three selections a year.

Periods of ban and let-go have been alternating ever since. The result is an erratic hiring policy dominated by factors external to the organization.

Taking an encompassing view, these different stages in the selection procedure have corresponded to phases in the evolution of EMBRAPA. At first, with the large numbers of applicants from the old system, painstaking screening was done to prevent the hiring of less competent and less motivated individuals. During the following stage, selection was made by the directors and those directly responsible for developing the new programs. At that time, the Department of Human Resources was little more than an instrument for formalizing the selections of the administrators. At the next stage, the selection team had very little to do for a while as they didn't have much influence during most of the process of hiring parallel staff.

The most recent developments in the hiring process have revitalized the selection team. They would like to see an efficient, well-organized, professionally run selection process under the command of the Department of Human Resources. However, legal and political considerations are basic concerns, and they cannot risk developing inappropriate procedures. At this stage integration with organizational planning and with development and compensation procedures has been achieved and is taken for granted.

Development

By 1970, there were few individuals in Brazil with postgraduate degrees. The courses taught at the postgraduate level at Brazilian universities were few and had been created less than 10 years earlier. Agriculture was not largely represented among them.

The government decided not to hire individuals from the international pool for the following reasons: expatriates tend not to settle in a country but remain for only limited periods; nationals are already familiar with the country, language, and culture; hiring nationals had strong domestic support and political appeal that could be capitalized on in favor of implementing changes.

There were many problems with this decision. One was that the few experienced researchers in the country had to be divided among the universities and the research centers. Postgraduate programs had to be expanded and fortified, and research facilities had to be modernized and enlarged.

A training program was developed that sent young researchers to domestic universities for master's degrees. These programs were also given additional funds to support the increased demand on their research and teaching resources. More experienced researchers from both EMBRAPA and the universities were sent abroad to obtain PhD or MS degrees in subjects on which there was no domestic expertise.

International donations and loans from recognized sources, such as AID, World Bank, and Interamerican Bank, were instrumental in this program. A three-month course was designed to give researchers a general orientation on the logic of science, scientific writing, statistics, and the newest plant breeding techniques. At the same time they were given an indoctrination in the new organization.

These training programs formed the basis of DHR development activities. The postgraduate training program provides a strong base for scientific research. Short-term training, such as short courses, seminars, international trips, and on-the-job training update and refresh this base. Researchers are encouraged to attend courses and scientific meetings. Support and administrative personnel receive lower priority for that.

Presently, 50% of all researchers with postgraduate diplomas were trained in EMBRAPA's own program. Research conducted in 1981 in four host countries (USA, UK, France, and Spain) with 68 advisors of 126 of EMBRAPA's postgraduate program participants indicated that 34% of them were described as "exceptional" students (upper quarter) and another 38% as "good" (Quirino and Ramagem, 1985). Attrition rates are systematically low (less than 5%) and completion rates are high (more than 80%). Part of the success of EMBRAPA's training program springs from its integration into the reward system. Any researcher who earns a degree is automatically promoted to a higher career level, and these promotions cannot be achieved without acquiring an advanced degree. Short-term training does not lead directly to economic rewards, but participation in short-term courses and seminars, etc., is viewed very favorably by the administration and by peers. There is a trend towards avoiding human capital decay.

At the present time, the training system is being reevaluated in this light, with more emphasis being given to training in specific disciplines. Training programs for laboratory and field technicians are also being developed. State enterprises have priority for basic postgraduate training, however.

Attention is also being focused on internal mobility, especially for administrative and support personnel. The external labor market is tighter than it was, and with the rigid public selection process in force for hiring, hiring and promoting from within is essential. It can also serve to strengthen the institution and contribute to keeping good employees in the system and to reinforcing meritocratic principles.

Compensation

When EMBRAPA was first created, public-sector jobs offered a combination of salary and a variety of fringe benefits. However, the fringe benefits were difficult to administer, and EMBRAPA chose to shift to larger salaries without all the benefits. There was almost no challenging competition for researchers in the job market, but the aim in establishing EMBRAPA's salary plan was to make it an attractive career choice for the

best students in the agricultural sciences. Other employees were also paid top market level in order to attract the best workers and to keep salaries in line with other employment segments.

Care had to be taken not to deplete the research staff at the universities and state institutes; many of these researchers were hired at the better salaries offered through the EMBRAPA system. They were then allowed to continue at their old jobs, since the universities and state institutions were tied up in the old public-service system and couldn't pay the higher salaries.

Changes in the political and economic environment of the country took a toll on this system of higher salaries. Salary is more visible than fringe benefits, and the first reduction made by the government when cutting the public deficit included NARS salaries. Tight controls on fringe benefits have since been instituted. Salaries are periodically updated according to the purchasing power index, but bringing NARS salaries into line with other categories has been the result of a difficult bargaining process, which is time consuming and diverts managerial time from more relevant duties.

Although salary levels in EMBRAPA do not have the comparatively favorable position they had at first, they are still relatively high. Unfortunately, the relative loss may have a negative effect in the long run for attracting some of the best candidates for agricultural research.

There is a trend towards introducing new fringe benefits and restoring some of the old ones. These cover such things as dental care, subsidized meals, free transportation, health insurance, sabbatical and special leave, and supplemental retirement programs. Experience is rewarded by means of a supplementary financial benefit.

Evaluation

There have been repeated attempts at setting up an evaluation system, but there has been no satisfactory outcome. Initially, EMBRAPA adapted recognized international evaluation techniques to its own system. The results of the evaluation were supposed to be the basis for promotions.

A few years later, the DHR discontinued the evaluation process because it felt that it was doing more harm than good. Many researchers felt that their efforts were not given full consideration and that a lot of personal bias was interfering with the process. The forms included psychological criteria, particularly personality characteristics, that were inappropriate. There was excessive reliance on academically oriented outputs that researchers in more applied fields felt was unfair. Many supervisors failed to fill out the evaluation forms, while others failed to take responsibility for the evaluations they had made. Basically, the atmosphere surrounding the whole evaluation process was very negative and was bad for morale.

A few years later another scheme was tried, but it also failed. This one tried to make the evaluation process separate from promotions and raises. Instead, it emphasized planning for the next year and then following up on the planning rather than judging performance, per se. The employee was to be evaluated on the anniversary month of employment to avoid turning the process into a collective act. The employee and the supervisor would both fill out an evaluation and then would meet to discuss both forms. This process failed because it was not properly implemented–there were insufficient personnel, there was no training, and there was poor control.

At the present, a committee system is being used. Part of the committee is nominated by the department or center and part is elected by each employee category. Performance evaluations are directly tied to promotions, which are decided by the committee. Only 3% to 4% of the annual personnel budget is allocated for promotions, so the committee has a difficult task. Each committee is free to set its own rules. The DHR only suggests a list of performance aspects that may be taken into account. A typical case could be described as follows. The process begins by examining lists for promotions submitted to the committee by each manager at all levels and including his/her subordinates. Each manager is free to apply the suggested criteria. The committee's main job is to issue the final list within the preset budget limits. Negotiations inside and outside the committee are the usual procedure for approaching consensus. There are indications (a drop in discontent among employees, an increase in praise for this system) that it is working reasonably well. But there are tentative plans for a more comprehensive system. Experiences at the local level are being examined and analyzed and may contribute to the development of a new system.

EMBRAPA's overall experience with evaluations has

had its ups and downs, without any sense of direction. A survey has shown that the employees want to be evaluated after all. However, past experience does not encourage optimism and the present system is admittedly tentative and experimental.

Institutionalizing Reflection on Human Resources

It is generally accepted that human capital is the most important asset of a research organization; however, it is not always managed on a first-priority basis. The fact that the first act of EMBRAPA's newly inaugurated first directorate was to set up a training program is significant–this symbolized EMPBRAPA's intention to give top priority to human capital. A study about the economic results of such an investment indicates that the rate of return is at least 22% a year (Avila et al., 1985), which in itself is unusually high. This compares very favorably with other types of investments.

Managing human resources in a proper way is neither automatic nor obvious. Situations vary, resources are usually scarce, and decisions need to be made about priorities. Despite the advancements of the last 20 years, knowledge on the matter is lacking and there is a lot of folk wisdom and myth around that are accepted as fact. There is a need for continuous fresh reflection on human resources, specially when the organization depends primarily on the quality and performance of its human capital. These needs were faced by EMBRAPA in a creative way.

EMBRAPA's DHR has set up a small group of two to five specialists who act as a think tank and internal-consultancy working task force. This group forms an integral part of DHR's head office. It provides DHR with a scientific basis for DHR actions. The group attempts to integrate an understanding of the environment, objectives, and strategies of the organization with the tenets of sociology, psychology, social psychology, economics, and administrative science.

This group could be referred to as a central advisory and technical support group or assessorship. It acts as a resource for DHR and the NARS as a whole. The way it is set up gives it professional, not bureaucratic, authority, so its influence is based on convincing evidence.

The group has focused primarily on training, compensation, and evaluation. Training has been examined from the level of postgraduate programs and their economic impact on agriculture to what makes an effective training program. Compensation has been looked at in both its monetary and symbolic forms. And evaluation has been examined from the aspect of human resources to organizations, both quantitatively and qualitatively. Analyzing the results of changes that were initiated as the result of previous studies is also part of the group's program.

The role this group has played in the organization is perceived as being extremely positive. Group members are frequently invited to participate in important working groups, including the master plan, and are recruited for positions in top management. They are also constantly requested to give courses and to participate in conferences and symposia.

This group's primary responsibility is to apply science to the management of human resources, and it has done this effectively. It has also helped preserve the best aspects of the organization and has contributed to the overall perspective of the organization's future and mission. The group is currently working on a series of books on its studies on the administration of human resources.

Conclusions

EMBRAPA's experience indicates that the evolutionary stages in the development of a NARS have the greatest effect on human resource management. The size of the organization can also have an effect, but it is not an important variable in this case.

Not each of the tasks is equally influenced. Human resource planning in EMBRAPA has been conducted in a variety of ways, ranging from loose objectives, centered on the organization to more precise objectives, centered on structure. It didn't reach the usually required precision and clarity. At first, criteria for recruiting, such as academic competence and scientific experience, substituted for formal planning. Later on, external factors prevented full adherence to formal plans. However, the trend towards formalization is there. Staffing was first influenced by the conditions of an inherited working force, then by the restrictions of the human resource market place. Incremental decisions and interaction with development were the usual solutions for coping with these conditions. Later on, there were external pressures that necessitated the creation of legal barriers, and these were established to protect organizational efficiency and effectiveness. Staffing was affected the most strongly by all this and unbearable

imbalances were created. Solutions are still pending.

Development followed the reverse path, that is, from a clearly central position to one that is becoming less important. However, training content and objectives are currently being reexamined. Training could become more central and receive first priority again if the external constraints over financial resources would ease.

Compensation has been affected by external influences the most. Its trend is downward as well. Fortunately, there are indications that it is leveling off for now. If this doesn't happen, turnover may bring about the need for more hiring and development and make any prospects of saving on salary illusory in the long run.

Finally, evaluation represents the most erratic of the five human resource management tasks. Despite that, the trend seems to be toward improving the process, as it is the desire of both employees and management.

This overview didn't include organizational behavior factors. They seem to be deeply influenced by the evolutionary phases and by external constraints and influences as well. Furthermore, each of the management tasks has an impact on organizational behavior and vice versa. The effects of quality of work life (a form of compensation) on motivation, and therefore on organizational performance, is an example well documented elsewhere (Quirino and Xavier, 1987). The effects of leadership on each phase of human resource management is another factor that is clearly evident at many of the stages of EMBRAPA's experience.

References

Avila, Antonio Flavio Dias, Jairo Eduardo Borges-Andrade, Luiz José Maria Irias, and Tarcizio Rego Quirino. 1985. Formation of Human Capital and Returns on Investment in Manpower Training by EMBRAPA. EMBRAPA/DID, Brasilia.

Bennell, Paul and Larry Zuidema. 1988. Human Resource Management for Agricultural Research: Overview and Issues. ISNAR, Working Paper no. 15, The Hague, Netherlands.

Quirino, Tarcizio Rego and Sergio P. Ramagem. 1985. The Academic Advisor and the Foreign Graduate Student. International Education (Fall): 37-46.

Quirino, Tarcizio Rego and Odiva Silva Xavier. 1986. Qualidade de vida no trabalho e desempenho de organizações de pesquisa. Anais do XII Simpósio Nacional de Pesquisa em Administração de Ciência e Tecnologia. São Paulo.

SESSION 9

DISCUSSIONS

SESSION 10

SKILLS DEVELOPMENT

COMPUTER TOOLS FOR HUMAN RESOURCE MANAGEMENT

Krystyna Stave

Purpose and Structure

The purpose of this session was to explain and illustrate the advantages of using microcomputer tools in human resource management and to give participants an opportunity to work through examples of several types of microcomputer software for managing information.

The session consisted of a 20-minute lecture on the advantages of using microcomputers to manage information for decision making, a brief introduction to spreadsheet and data-base software, and two one-hour exercises in which participants actually used spreadsheet and data-base software. The lecture and exercises built on the theme of the workshop, which was that good information is essential to managing human resources efficiently and effectively.

Figures 1 and 2 were used to establish a common definition and terminology of spreadsheets and data bases. The definitions led into a discussion of how data bases and spreadsheets can be used by managers to improve information used for decision making. Two simple exercises were then used to illustrate the specific application of data bases and spreadsheets to human resource management.

The exercises had been set up before the session began, one using a commercial data-base program and the other using a commercial spreadsheet program. Participants worked on these exercises in groups of two, using the exercises to explore the use of each type of software tool in managing information. Each group used one microcomputer.

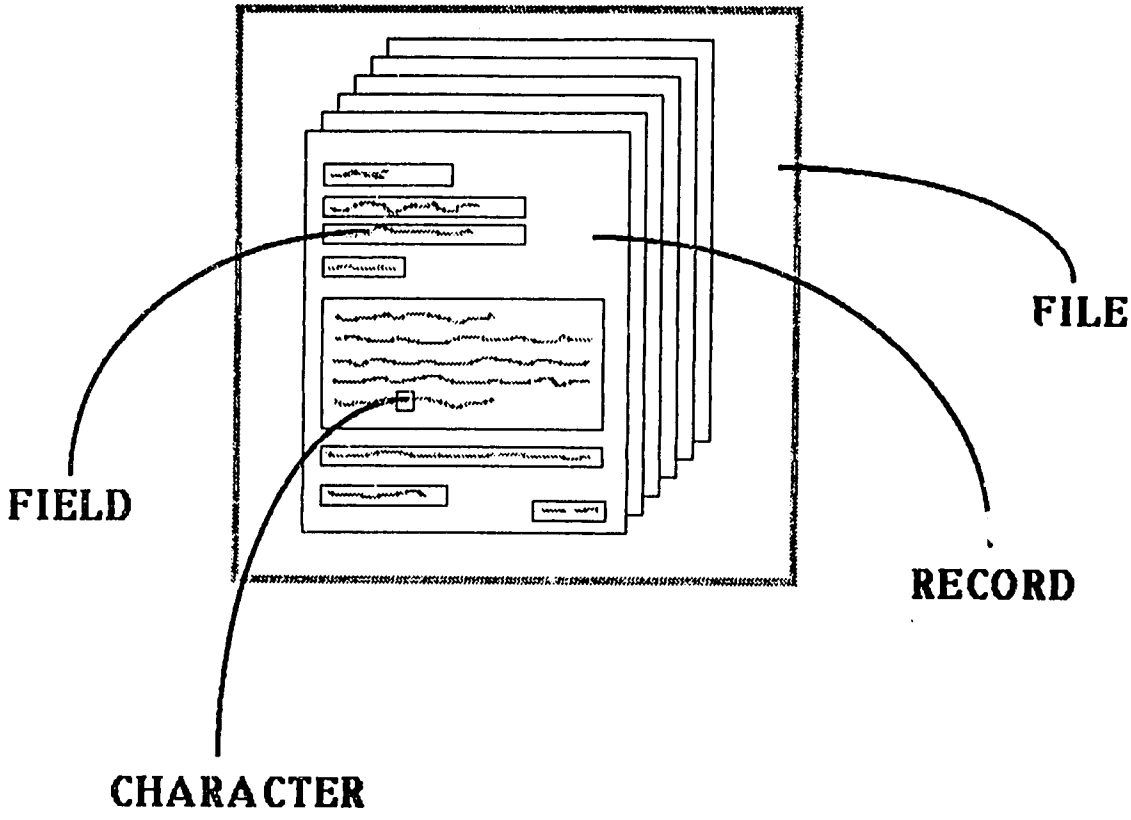
A demonstration version of the ARIS computer program as presented earlier in the week was also available for participants to view.

Summary of Presentation

Accurate, appropriate, and readily available information is a basic requirement for good human resource management. Computer tools can improve the range of information that is collected, stored, and processed. They can increase the accuracy, accessibility, and amount of information that is available to the human resource manager for decision making. Computer-based tools do not make decisions or set priorities, but they do facilitate better management of information on which decisions are based.

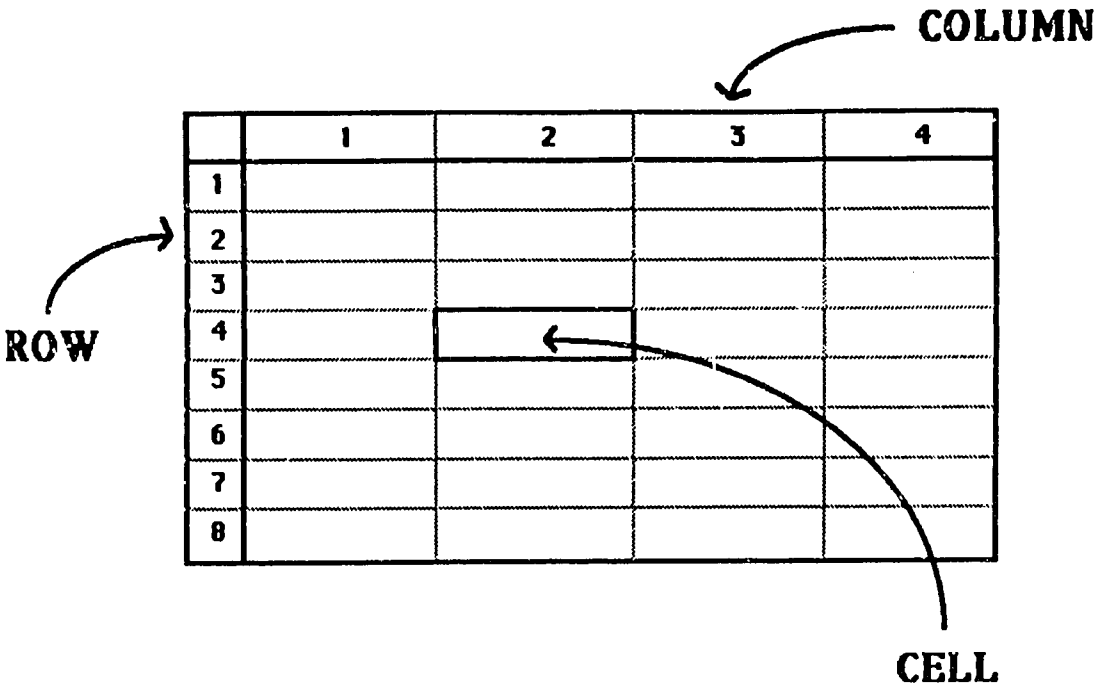
Two types of computer tools for managing information are particularly well suited for human resource management tasks. These are data-base management and spreadsheet analysis programs. Data-base management programs allow the manager to store, retrieve, and summarize information in a data base, or set of organized and related information. Spreadsheet programs allow the manager to maintain information in the form of an electronic worksheet. The worksheet can be used for manipulating numerical information, for "what-if" analysis and forecasting.

Figure 1. Data base



A database is a collection of systematically organized information. The whole collection is called the database FILE. Each separate "page" of information in the file is called a RECORD. All records in the file contain the same categories of information, called FIELDS. Within the fields, information is stored by CHARACTER. One example of a database is a catalog of books in a library. The entire catalog is the database file. The catalog contains a separate record for each book. Every record, or card, contains the title of the book, the author, the publisher, a brief description of the book, and a reference to where the book can be found.
The information contained in a database file is organized in the same format for each record in that file.

Figure 2. Spreadsheet



A spreadsheet, or electronic worksheet, is a tool for organizing, manipulating, and analyzing data. The spreadsheet is set up as a grid of ROWS and COLUMNS. Each piece of information in the spreadsheet is stored in a CELL, a space one row high and one column wide. A cell can contain letters, numbers, or mathematical formulas.

Spreadsheets can help you analyze any data that can be displayed in a row and column format. By using formulas to describe interrelationships among individual pieces of data, you can test the effects of changing data. Electronic spreadsheets are used for "what-if" analysis, forecasting, and statistical analysis.

"The spreadsheet is a visual environment where you can perform mathematical, algebraic, and logical operations and see the results of those operations immediately."

- Woody Liswood, Whole Earth Software Catalog

SUMMARY AND EVALUATION

WORKSHOP REPORT

Paramjit Sachdeva, Paul Marcotte, and Bonnie Folger*

In the final session of the workshop, participants reflected on their experience at the workshop, commented on the materials used, and suggested follow-up action by ISNAR. They also assessed each session and presentation, and the workshop as a whole.

A brief summary of the feedback and recommendations is given below. Table 1 lists the NARS participants; Table 2 lists the materials used.

Feedback from workshop participants was very positive. On a scale of 1 (poor) to 5 (excellent), the workshop was rated 4.3. The materials were individually rated for content and usefulness, and received an average score of 4.1. Although the scores varied by topic area/theme, the range was not wide.

We also received detailed comments on the relevance of materials, and on the advisory, research and training services required from ISNAR in the future. This qualitative feedback on each topic is summarized in Table 3.

Overall, workshop participants confirmed the general thrust of ISNAR's research and materials development efforts in HRM. The NARS managers suggested that we continue work on human resource information systems, performance appraisal case studies and measures, human resource questionnaires (and their application to organizational behavior issues), earnings functions approaches and analysis, and the global data base on human resources in NARS.

The case studies on recruitment, training, compensation, and performance appraisal were considered appropriate as training materials, and ISNAR's lessons of experience and the synthesis papers on HRM topics were considered useful for senior managers in NARS. Participants suggested that we suitably adapt these materials for use in regional and national workshops on human resource management.

Workshop participants also provided suggestions for improvement in a number of areas. The data-based tools will now be further tested with data from the field. The materials on recruitment planning, compensation, and appraisal will be validated against successful and not-so-successful experiences in the NARS. For the package as a whole, we will complement conceptual frameworks with problem-solving tools and approaches, and will develop and test these in close collaboration with NARS managers.

The NARS managers' feedback has been very useful for ISNAR's HRM Working Group. On behalf of ISNAR, we wish to record our thanks to the NARS participants for their contributions to the successful workshop. We now look forward to continued collaboration with NARS leaders in following up issues of mutual interest to ISNAR and individual countries.

**HRM working group chairperson, workshop coordinator, and assistant coordinator, respectively.*

Table 1.

NARS Participants at HRM Workshop

AFRICA

Dr. Lucas P. Gakale
Director of Research,
Ministry of Agriculture
Private Bag 0033
Gaborone, **Botswana**

Daniel Ouedraogo
Head Research Resources Div.
I.N.E.R.A.
P.O. Box 7192
Ouagadougou, **Burkina Faso**

Dr. Ndiaga Mbaye
Deputy Director General
Institut Sénégalais de
Recherches Agricoles (ISRA)
Boite Postale 3120
Dakar, **Senegal**

Dr. James B. Matata
Assistant Director of Manpower,
Planning and Development
Kenya Agricultural Research Institute
KARI Headquarters, P.O. Box 57811
Nairobi, **Kenya**

Dr. Dennis M. Wanchinga
Manpower & Training Officer
Southern African Centre for
Cooperation in Agricultural
Research (SACCAR)
P.O. Box 00108
Gaborone, Botswana

Dr. A.M. Yassin
Director of Training and Publication
Agricultural Research Corporation
P.O. Box 126
Wad Medani, Sudan

Dr. Robert Kikopa
Director
Department of Research and Training
Ministry of Agriculture
Livestock Development
Box 9071
Dar-es Salaam, **Tanzania**

Professor Onyembe Pene Mbutu Lolema
Président – Délégué Général
I.N.E.R.A.
B.P. 2037
1 *Kinshasa*, **Zaire**

Mr. Oneas T. Mufandaedza
Assistant Director
Division of Livestock and Pastures
Department of Research and Specialist
Services
Ministry of Agriculture
P.O. Box 8108, Causeway
Harare, **Zimbabwe**

ASIA

Dr. K.V. Raman
Director
Ministry of Agriculture
Research Management
Rajendranagar
Hyderabad, 500 030, **India**

Mrs. Sumarsini
Agency for Agricultural Research
and Development
P.O. Box 103/KBY PM
Jakarta 12520, **Indonesia**

Dr. Cynthia R. Mamon
Director, MISD
Philippines Council for Agriculture, Forestry
& Natural Resources Research Development
Los Baños,
Laguna 4030, **Philippines**

Dr. H.M.E. Herath
Deputy Director (Research)
Department of Agriculture
P.O. Box 47
Sarasavi Mawatha
Peredeniya, **Sri Lanka**

Ms. Nguyen Thanh Thuy
Deputy Head
Research Management Department
Institute of Agricultural Technology
of South Vietnam
121 Nguyen Binh Khiem Str.
District 1, *HoChiMinh City*
Vietnam

LATIN AMERICA

Licenciada Liliana Vaccaro
Directora Nacional Asistente de
Organizacion y Recursos Humanos
Instituto Nacional de Technologia
Agropecuaria (INTA)
Rivadavia 1439
1033 *Buenos Aires*, **Argentina**

Emilio Madrid
Executive President
Instituto de Investigaciones
Agropecuarias (INIA)
P.O. Box 439/3
Santiago, **Chile**

Dr. Jaime Tola Cevallos
Research Director
I.N.I.A.P.
Ministerio de Agricultura y Ganaderia
Casilla 2600
Quito, **Ecuador**

Ing. Mario Allegri
Director de la Estación Experimental
"La Estanzuela"
C.I.A.A.B.
La Estanzuela
Colonia, **Uruguay**

OBSERVERS

L.R. Przekop
Head of Training
I.C.A.R.D.A.
P.O. Box 5466
Aleppo, **Syria**

Dr. James Bingen
Institute of
International Agriculture
Michigan State University
324 Agricultural Hall
East Lansing, *Michigan* 48824, **USA**

Table 2.

Human Resource Management Materials Used in the Workshop

	Authors
Overview Papers	
• Human Resource Management for Agricultural Research: Overview and Issues	**Bennell/Zuidema**
• Recent Evidence on Resource Commitments to Agricultural Research	**Elliott/Roseboom**
• Human Resource Management for National Agricultural Research: ISNAR's Experience and Lessons	**Sachdeva**
• Management Issues in the Collection and Use of Information on Research Personnel	**Mook**
• Some Aspects of Training in National Agricultural Research Systems (NARS)	**Abe**
• Performance Review and Development in Agricultural Research Organizations	**Bennell**
• Organizational Behavior Factors: A Brief Synopsis of Leadership, Motivation, and Conflict Management	**Marcotte**
• Compensation Schemes for Agricultural Researchers	**Bennell**
• Analyzing Compensation Issues Using Earnings Functions	**Elliot**
Presentation Notes	
• Recruitment and Career Planning: Notes	**Mook**
• Agricultural Researcher Performance: What Factors Influence Researcher Performance	**Zuidema**
• Intergroup Relations between Agricultural Research and Extension	**Kaimowitz**
• Human Resource Management in On-Farm Client-Oriented Research: Selected Issues and Lessons	**Bingen**
Case Studies	
• Human Resource Planning for National Agricultural Research: A Management Exercise Based on Data from Thailand	**Mook**
• The Management of a Regional Training Project: The SACCAR/ISNAR Southern African Agricultural Research Training Project	**Abe**
• Annual Performance Appraisal at the National Institute of Agricultural Research	**Bennell**
• Identifying Human Resource Capabilities and Constraints in National Agricultural Research Systems: A Test Methodology: Case Study, Ecuador	**Marcotte**
• Conditions of Service for Agricultural Research Scientists in Tunzit: What Room for Maneuver?	**Bennell**
• Human Resource Management in EMBRAPA (Brazilian Corporation for Agricultural Research)	**Quirino**
Diagnostic Tools	
• ARIS: An Agricultural Researcher Information System for Human Resource Management	**Zuidema**
• Human Resource Survey (Questionnaire)	**Marcotte**
Exercises	
• Small Group Exercise on Human Resource Information Systems	**Zuidema**
• Using Microcomputers to Manage Human Resource Information	**Stave**

Table 3. Feedback and Recommendations on HRM Topics/Themes

Topic/Theme	*Feedback*	*Recommendations*
1. HRM Overview	– Very useful global data; will help in policy discussions. – Systems framework for HRM is appropriate and relevant. – ISNAR's lessons of experience provide useful guidelines for NARS.	– Further develop and disseminate global data and analysis. – Use framework and synthesis paper for increasing senior managers' sensitivity to key issues in HRM.
2. Information Systems for HRM	– ISNAR's emphasis on human resource information systems (HRIS) is very welcome. NARS will benefit greatly. – ARIS methodology and software are appropriate for planning and diagnosis of HRM requirements. – These tools need to be adapted for NARS at different levels of computer literacy.	– Continue to develop HRIS/ARIS. – Adapt and test the MIS tools in different country contexts, using field data. – HRIS/ARIS must have the ability to be adapted to specific national conditions.
3. Recruitment and Career Planning	– ISNAR has good materials for training. – Recruitment planning is linked with strategic planning for the NARS. – More emphasis is needed on selection methods and job descriptions. – Career planning is difficult to do in most NARS.	– Further develop case studies on: selection methods, link between recruitment planning and salary structures, and career planning in NARS. – Undertake comparative analysis of planning techniques and career structures being used in different countries.
4. Training	– Most NARS need guidance (and guidelines) on training. ISNAR has made a good start. – Regional country examples are interesting. – Training needs vary from country to country and generalizations of approach and content are not possible. – A special emphasis is needed on training in francophone Africa.	– Give high priority to development of training materials. – Emphasize approaches/techniques/checklists for training needs assessment. – Provide guidelines for design and delivery of management training programs/workshops. – Undertake regional and national level training. – Research on "training" (as a topic) is not appropriate.

Table 3. (continued)

Topic/Theme	*Feedback*	*Recommendations*
5. Performance Appraisal	– ISNAR has good training materials on performance appraisal and criteria. – The (new) PRD approach is useful, but might be difficult to implement if the link between performance and rewards is weak. – In most NARS, salary structures do not allow much flexibility in rewarding high performers. – NARS managers need to review performance systems and salary structures together.	– Further develop case studies illustrating the benefits and difficulties of implementing different performance appraisal schemes. – Further develop the assessment instruments, criteria, and measures for appraising scientists, and test their application in NARS.
6. Compensation	– Most NARS need to review their compensation policies–and ISNAR's work in this area will be very helpful. – The earnings function approach provides a good starting point, but has to be adapted to the local context, especially in nonmarket economies. – Changes in compensation policies are difficult because of financial constraints in developing countries. – ISNAR's analysis could help in policy dialogue with governments.	– Further develop and test the earnings function approach, especially its data needs, limitations, and how these can be overcome. – Examine nonfinancial compensation policies appropriate for NARS. – Develop case studies of successful compensation schemes and of simple techniques for analysis of compensation issues.
7. Performance Improvement/ Organizational Behavior	– The human recource inventory (questionnaire) is a useful diagnostic tool for planning. – Since financial incentives are less feasible in NARS, other motivational tools have to be emphasized.	– Further develop and adapt the questionnaire. – Develop case studies of team work in NARS.
8. Special Experiences	– HRM aspects of special project experiences (such as OFCOR and research-extension) are useful for research managers.	– Share special project experiences with NARS, as case examples. – Emphasize the practical aspects of various approaches.