Report of a Workshop

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THE PLANNING AND MANAGEMENT OF AGRICULTURAL RESEARCH IN THE SOUTH PACIFIC

ADB, Asian Development Bank
ACIAR, Australian Centre for International Agricultural Research
CTA, Technical Centre for Agricultural and Rural Cooperation
IRETA, Institute for Research, Extension and Training in Agriculture
ISNAR, International Service for National Agricultural Research

ISNAR
International Service for National Agricultural Research

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

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

ISNAR has 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.

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5 to 16 October 1987
IRETA, Alafua, Western Samoa

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ACIAR, Australian Centre for International Agricultural Research
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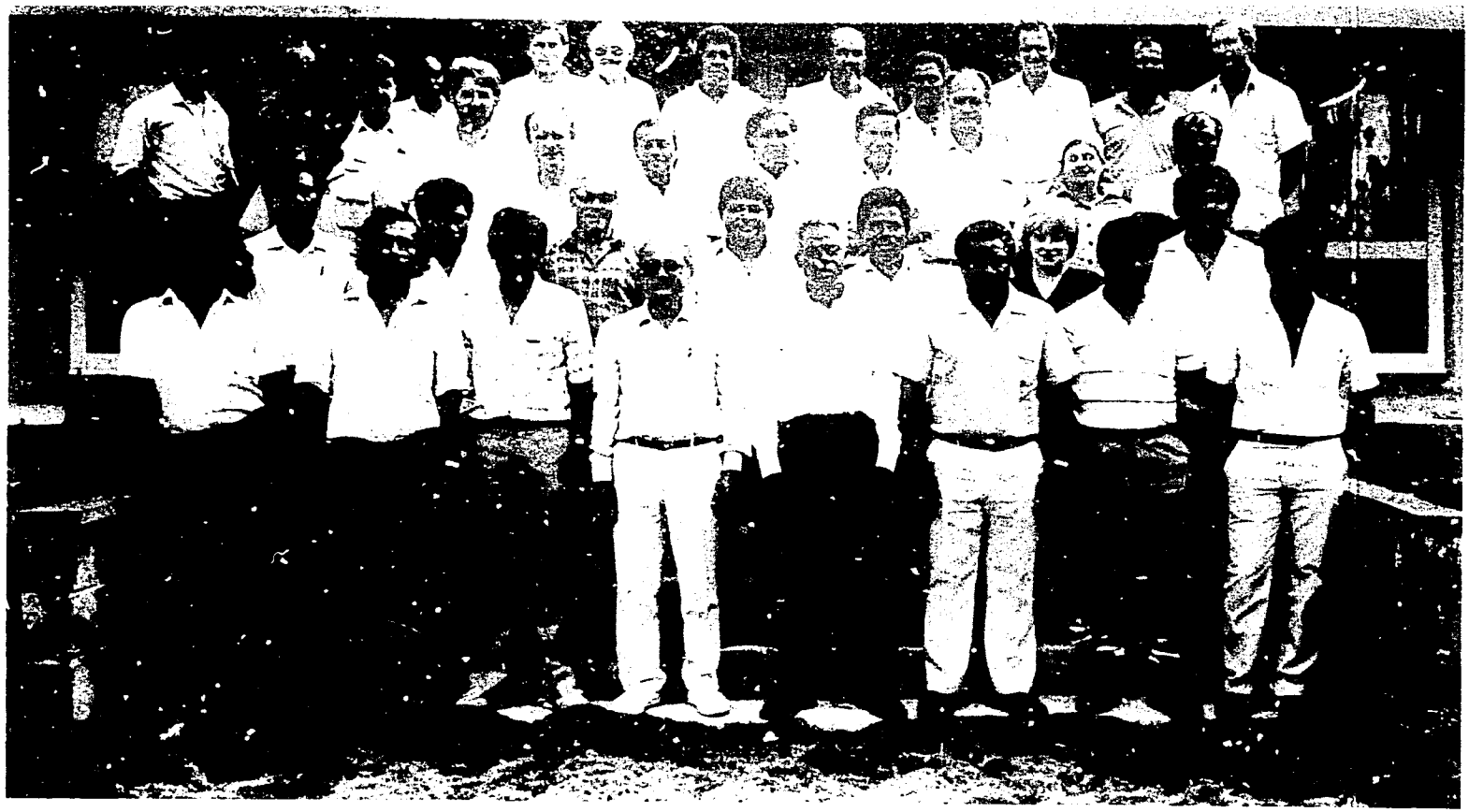

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PREFACE

The International Service for National Agricultural Research (ISNAR), in collaboration with the Institute of Research, Extension and Training in Agriculture (IRETA) of the University of the South Pacific (USP), held in October 1987 at Alafua, Western Samoa, a two-week workshop on the planning and management of agricultural research in the South Pacific.

The workshop was attended by 35 directors of agriculture and agricultural research managers from 11 countries in the South Pacific. In addition, staff members of IRETA and the School of Agriculture from the USP also participated.

The workshop provided an introduction for senior policy makers and practising research managers to key concepts and tools for strengthening the planning and management of agricultural research in the context of the South Pacific. It was designed to be an intensive learning experience based on a mixture of formal lectures, management case studies and exercises, and small working group discussions.

This report contains the papers and summaries of the main presentations made at the workshop. A wide range of topics are covered — from strategic planning and project design to human resource management issues, such as motivation and leadership. It is hoped, therefore, that these papers will provide useful reference material for agricultural research managers, both in the South Pacific and elsewhere.

The workshop would not have been possible without the generous financial support of the Asian Development Bank, the Technical Center for Agricultural and Rural Cooperation, and the Australian Centre for International Agricultural Reearch. ISNAR and IRETA wish to express their sincere thanks to these agencies for their assistance to this important workshop.

LIST OF ACRONYMS

AIDAB	Australian International Development Assistance Bureau
ADB	Asian Development Bank
ACIAR	Australian Centre for International Agricultural Research
ACP	African, Caribbean and Pacific Countries
CTA	Technical Center for Agricultural and Rural Cooperation
EEC	European Economic Community
IFPRI	International Food Policy Research Institute
IRETA	Institute of Research, Extension and Training in Agriculture
ISNAR	International Service for National Agricultural Research
SOA	School of Agriculture
SPRAD	South Pacific Regional Agricultural Development Project
USAID	United States Agency for International Development
USP	University of the South Pacific

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WELCOMING ADDRESS

Fuimaono Mimio
Minister of Agriculture, Forests and Fisheries, Western Samoa*

Representatives of international agencies, Pro-Vice-Chancellor Osbourn, delegates, distinguished guests, ladies and gentlemen:

With due respect, it is an honor and great privilege for me to be with you this lovely morning. It is our custom that we first give praise to our Almighty God for his loving blessings and care to us all.

On behalf of the Government of Western Samoa, I welcome you to our country, and to Alafua Campus, IRETA, the center for agricultural research and Development of the University of the South Pacific. As the Minister of Agriculture, Forests and Fisheries and an ardent farmer, I have a special interest in this meeting. Particularly, as I am told that the main objectives of this meeting are to improve understanding of the importance of research in agricultural development and to enhance the planning and management skills of research managers and agricultural policy-makers. More specifically, the workshop hopes to create more awareness of the important role of agricultural research amongst policy makers, and to impart more practical skills and techniques to research managers so that they can be better managers in planning, implementation, and monitoring and evaluating their work. Therefore the target groups are not only civil servants, researchers, managers, but politicians and policy-makers.

As a practicing farmer, and mindful of getting results that are practical in money terms, I would like research to be practical and relevant to the farmer's requirements. Very often in our region, we tend to be carried away with expensive research which the more developed countries are best able to do. The researchers themselves have their preferred field of research, which may often overshadow the priority needs of our countries. It is up to ourselves to identify those research priorities which our limited resources can afford. Sometimes, international funding institutions may come to our assistance, but again we should consider the long-term implications of such assistance into our economy. We should ask: Will the skill, if learned, lead to a further demand on development that we cannot afford with our limited resources? Will the new technique be appropriate and economical? We should be selective and limit our programs to our own requirements, and what we have the capacity to handle and pay for in the long term.

It is important that we train and educate our people in the region so that they can fend for themselves, so to speak. Research needs continuity and unless we have that continuity in our research, it may not be worth the money in the first place. So in our aim to promote the skills and techniques of our research managers, training would be of prime importance.

We should make use of the basic research done elsewhere and concentrate our resources on a few adaptive options. I believe that IRETA and other research institutes within the region are already collaborating with other international organizations such as ISNAR, ADB, CTA, and ACIAR.

I believe it is in our interest to strengthen the research institutions that we have already started, rather than setting up new institutions. Not only is it less expensive, but if we spread out our resources too thinly, we may end up with an over-watered coconut brew, a brew that may be generous in quantity but which has very little taste.

Ladies and gentlemen, it is in our interest to link up with international research institutions and to make use of

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* *Read on his behalf by Mr. Tupuola Tavita, Director of Agriculture.*

their findings, but at the same time let us be selective in our choices. We should be united in our views and steer our ship together rather than paddle our own canoe in this world of modern technology. I would like to wish you a successful meeting. We have many distinguished visitors and authorities on the subject of our meeting and I would like to congratulate ISNAR and IRETA for bringing them together, and for organizing this meeting.

Finally, I would like to wish all the delegates an enjoyable stay in Apia. May God bless you all and return you safely to your respective countries.

WELCOMING ADDRESS

Howard Elliott
Deputy Director General, Research and Training
International Service for National Agricultural Research

I would like to take this opportunity to thank the Director of Agriculture for the kind words of welcome on behalf of the Minister of Agriculture. I think his speech set the tone of the workshop for us, stressing the importance of agricultural research and training within the region, the necessity of having an appropriate agricultural research for the countries, continuity, clear priorities, and the need to strengthen what we have rather than dispersing efforts in a variety of new activities. If all politicians were able to express the needs of research with such clarity, the job of institution building for agricultural research would be that much easier!

As the Director mentioned, one of the objectives of this workshop is to bring together people responsible for agricultural development with those responsible for agricultural research so that the dialogue between research and development can be that much stronger.

This particular workshop is an important one for ISNAR because it brings together those people responsible for research and those responsible for development. At least in this first week we hope to have stimulated some discussion on how to make that dialogue more fruitful. During the second week, with people responsible for agricultural research, we hope to go into some of the more operational aspects of management of the research process and of research resources.

The workshop is also of great interest to ISNAR because of the breadth of participation of countries here from the region. This is the first time, I believe, that ISNAR has been able to get together with so many representatives of countries from the region, and where systems are small, the efficient way for ISNAR to try to work with those countries is perhaps through regional activities.

The workshop is also important to us because of the breadth of contributors. There are people from universities, from international research institutes; we have people from CARDI in the Caribbean, to bring a similar perspective of research in small island nations, people coming from the Commonwealth Development Corporation, the Commonwealth Agricultural Bureau, etc. So we have broad participation and I think our purpose here is to exchange views. This is not a one-way exchange of information from ISNAR towards a group of people, but we are drawing on each other and getting a broad exchange of ideas.

Finally, the workshop is important to us because we have managed to get a broad collaboration of donors, and this more than anything else is perhaps a good sign of how countries themselves can pull together around a clearly defined objective, the participation of a number of donors, each one contributing in the best way that that donor can. We have represented here the Asian Development Bank, the Technical Center for Agriculture and Rural Cooperation, which is an expression of the European Economic Community, the Australian Centre for International Agricultural Research, and then the Commonwealth Agricultural Bureau has also sent us a resource person. In short, we have a breadth in our participants and a wide range of donor representation. Each one is here because he wants to be here and he wants to share his experiences. Our task is to look at ways in which we can work together to improve agricultural research in the South Pacific, to improve the dialogue between research and development, and to improve the organization and management of agricultural research.

Without trying to abuse your time let me give you a brief word about ISNAR for those of you who have not had dealings with ISNAR before. As we know, agricultural research is increasingly important as new agricultural

developments become science-based. The Consultative Group on International Agricultural Research has met the food and the poverty problem in three ways, by (1) setting up a number of technological institutes which aim at meeting the technological problem; (2) setting up one policy research institute, IFPRI in Washington, which studies agricultural and food policies, and, more recently, (3) creating ISNAR to meet the institutional needs of agricultural research development.

The need for an ISNAR focuses attention on the central role of the national agricultural research system in the identification of research problems and the development of technologies to solve those problems. Breakthroughs, developments that are taking place in the international research centers, cannot be adequately capitalized upon unless there is strong national agricultural research to make those basic building blocks of development adapted and appropriate for national conditions. As an institute dedicated to helping national agricultural research, ISNAR was created as a service, and the word 'service' appears in its name consciously. Our task is not technical assistance, but institution-building. We work in partnership with national agricultural research institutes and the goal is to build a national capacity to plan, organize, and manage the research process.

ISNAR was set up as an international center so that it could be an independent source of assistance, advice, and counsel for national research free of political pressures. This means that ISNAR works with national agricultural research systems only at the request of the system, and in the belief that these systems sincerely wish to work with ISNAR. We do not come in as an external evaluator of a national research system to monitor or evaluate the progress of a system on behalf of some other agency as a control device. We are there as a service to national research. We will work in complementarity with other organizations, many of them represented here at the table, the FAO, and other international centers.

Our experience in the South Pacific has been short but fairly intensive. We have engaged in system reviews in Fiji, the Solomon Islands and Western Samoa, have done some follow-up planning with Fiji, and this workshop is a way of becoming involved in the region on a regional basis. I will have the opportunity to discuss ISNAR's work at a later time. But the workshop stresses some of the things that were indicated in those early reports that ISNAR has done in association with national systems: the need to improve research's dialogue with policy makers, the need for clear national research strategies, the desirability of improving management practices, and the desirability of strengthening linkages between research and extension and technology transfer institutions.

Therefore we are here with a common task and I would like to thank IRETA for sharing the task of organizing and sponsoring this seminar with us, thank them for the warm welcome that they gave to us, and all the arrangements they have made, and thank you all for joining us today.

WELCOMING ADDRESSES BY WORKSHOP SPONSORS

Nihal Amerasinghe

Senior Sector Planning Specialist
Agricultural Department (West),
Asian Development Bank

Pro Vice-Chancellor of USP, Heads of South Pacific Agriculture, distinguished delegates, ladies and gentlemen:

I am privileged to have the opportunity of addressing this opening session of the Workshop on the Planning and Management of Agricultural Research in the South Pacific. I am indeed honored to be here and would like to convey to you the greetings and cordial good wishes of my colleagues at the Bank. The ADB is happy to sponsor this important institution development workshop in the South Pacific in collaboration with CTA, ACIAR, ISNAR, and IRETA.

The importance of the agriculture sector in the South Pacific region is well known and has been highlighted in surveys and studies of the region by various agencies, including the Bank. Attention has been focused on the need, firstly, to increase national incomes through an expansion of agricultural exports; secondly, to enhance the productivity of crops that could lead to greater import substitution; thirdly, to diversify the agricultural production base to minimize the unfavorable impact of secular market fluctuations; and fourthly, to conserve the fragile ecosystems of the region. As we face these and other challenges of agricultural development, it is necessary for us to recognize that future development opportunities will have to be largely science-based rather than resource-based.

As we move from a resource-based strategy to a science-based strategy for agricultural development, the agricultural research managers of the region will be increasingly called upon to take a lead role. The Bank recognizes that in the short term it would not be possible to expand substantially the cadre of scientific manpower in the region because of budgetary constraints which would invariably preclude the attraction and retention of scientific personnel. In many of the South Pacific countries, the trained and skilled human resources servicing the agricultural sector are limited in numbers. It is also recognized that many managers of the national agricultural research systems of the region have not had formal training in management. It is our belief, therefore, that improving the management skills of agricultural research managers, will produce greater efficiency and effectiveness in the conduct of agricultural research across the region.

Agricultural research management is regarded as essentially a dynamic and expanding concept revolving around the needs of the beneficiary. In this regard, the rationale and objectives of research projects, the means or methods to attain stated objectives, and the resources to be utilized in achieving objectives have to be carefully assessed in the resource-scarce situations in which we operate. These basic elements of a research plan have also got to be bound together by a system of control, monitoring, communication, information, and memory functions. We would need to know, therefore, the current state of the art relating to these important service activities if we are to perform effectively and efficiently. The purpose of the workshop is to sharpen your understanding of these concepts and to give you an opportunity to acquire new knowledge and skills.

ISNAR, which is one of the 13 centers in the global network of agricultural research institutions under the CGIAR, was established in the Netherlands in 1980 and

is mandated to help the national agricultural research systems develop their capability to organize and manage agricultural research. ISNAR's first exposure to the region was the Bank-sponsored study of 'Agricultural Research Facilities and Requirements in the South Pacific' in 1981. ISNAR has since acquired considerable knowledge of the South Pacific region through its many studies of the national systems, and we believe ISNAR is eminently suited to conduct this workshop. The Bank also recognizes the important role of IRETA and the School of Agriculture of the University of the South Pacific in the region, in agricultural research, extension, and training. The Bank has assisted IRETA and the School of Agriculture through the financing of a tree crops agronomist to strengthen research in this important sub-sector and also more recently assisted in undertaking a study on forestry education needs of the region. We are pleased that IRETA is actively collaborating in this workshop, not only in the provision of its facilities but also by providing resource persons.

The Bank would like to see IRETA taking on greater responsibility for research management training in the region and we hope that this workshop would assist in building up its capability to undertake this task in the future.

In conclusion, I would like to wish you all a pleasant and useful two weeks of learning. In this regard, besides the formal learning opportunities we will have, this unique gathering of policy-makers and scientists will also provide for informal learning, especially a better appreciation of the problems and challenges that face us in agricultural research management in the South Pacific region. The Bank perceives this meeting as an initial step in strengthening agricultural research management in the region and we shall look forward to your evaluation of the training program and your recommendations for appropriate follow-up action. We also look forward to the publication of the proceedings of the workshop, which indeed would be a valuable reference manual for the region.

Mohan T. Narain

Agricultural and Rural Cooperation Technical Adviser, Technical Center for Agricultural and Rural Cooperation

Mr. Chairman, distinguished delegates, ladies and gentlemen:

It is both an honour and a privilege for me on behalf of CTA to thank you all for your presence at this workshop.

First of all I would like to say how sorry the Director is not to be able to attend the meeting this morning due to previous engagements; he has asked me to let you know that he is very happy to work in the Pacific region and that CTA would support all the activities that it can in the field in which it is interested.

When CTA was approached by ISNAR regarding the holding of this forum on the planning of agricultural research in the South Pacific, it responded positively to this request. CTA had no hesitation to meet the costs of participation of the representatives of the ACP member states from the Pacific. Now why the ACP states? To explain this I need to say a few words about the Technical Center for Agricultural and Rural Cooperation and its activities.

The Technical Center for Agricultural and Rural Cooperation was established in 1979 during the negotiations for the second Lomé Convention, to meet the needs of ACP states for acceding to scientific and technical information about new technologies, research findings and their application, and training opportunities in the field of agriculture and rural development.

The Lomé Convention now links the 12 EEC member states and 66 ACP states, 46 from Africa, 12 from the Carribean, and 8 from the Pacific. The convention contains several titles for cooperation, of which agricultural cooperation is one chapter. The main objectives of the center can be summarized as being of assistance to ACP states to attain a higher level of agricultural production and food self-sufficiency, while preserving the natural environment by developing their capacity to use and to master scientific and technical information required for the purpose. Now I am sure the effective diffusion of scientific and technical information to each of the 66 ACP states represents a great challenge in the view of the diversity and the nature of information needed. So far CTA has concentrated its efforts on satisfying the need to supply information to agricultural

planners, agricultural research workers, extension specialists, and those in charge of documentation centers.

They then ensure dissemination to the farmers through local organizations within the framework of the socioeconomic context and by means of audio-visuals or other means.

CTA itself is not a research organization which produces new knowledge or technologies, neither is it directly involved in project formulation and implementation. It works in close collaboration with individuals and organizations which have scientific and technical information concerning agricultural and rural development in order to facilitate the transmission of such information to those in positions of responsibility in ACP states. This is why CTA values the special working relations which it has established with ISNAR, IRETA, and others.

CTA has its headquarters in Ede-Wageningen in the Netherlands. It signed its first Memorandum of Understanding for Cooperation with ISNAR, also located in the Netherlands, in 1984 — the first year of its active life. Its first agreement with IRETA was in 1985. To assist in its activities in the Pacific region, it has, as from this year, established a regional branch office within IRETA so as to strengthen the joint efforts of the two institutions and the important task of facilitating the flow of information concerning agriculture and rural development.

CTA considers meetings and workshops such as this one an excellent opportunity to update the state of knowledge and, through interaction with some of the participants, help to improve the skills and knowledge base of the participants, and through them assist in the improvement of agricultural and food production in their countries. I am confident that all efforts have been undertaken by the organizers so that you may have interesting discussions and that you will find your two weeks spent here a worthwhile experience.

I wish you a successful meeting and I thank you very much.

Garth Atkinson

Australian Centre for International Agricultural Research

ACIAR would like to thank the Pro-Vice-Chancellor of USP and the Directors of Agriculture for the opportunity to participate in this workshop. Because we are a relatively new organization I'd like to explain very briefly our function and our role in this area.

The Australian Centre for International Agricultural Research was set up as a statutory body in 1981. The then Prime Minister, Mr. Hawke, saw that there was an opportunity for Australia to transmit and exchange with developing countries information concerning agricultural research. The ACIAR theme or catch-phrase is 'Partners in Research.' It sees itself as an initiator and a catalyst of research projects. It plays a mediator's role in bringing together research institutions in recipient countries and organizations in Australia. It was ACIAR's intention when it was set up that both countries, that is Australia and a recipient country, would receive mutual benefit from research projects. The program places heavy emphasis on an exchange of information between Australia and the other country, and exchanges of scientists between research institutions in both countries.

Although until recently ACIAR has been engaged in purely research-orientated projects, it acknowledges that in regions such as the Pacific technology transfer and development cannot be ignored. We are mindful of the considerable amount of work that has gone on in the past and the disheartening loss of achievement and results. Our role is becoming increasingly more orientated towards research and development and this is where we think we will play a more important role in the Pacific.

In the Pacific area we have been involved with several major programs. One is a coconut germplasm dissemination scheme. This program is also aimed at (i) the Kadan-Kadan disease, which we see as an important problem should there be a breakout in the area, and (ii) folliate decay disease in Vanuatu. We have a joint clam project. We have been involved in the transportation of fresh fruit and vegetables, and storage

in Papua New Guinea. We have been involved in the storage of plantain bananas. We are becoming involved in a banana breeding program in which we are looking at research and a tolerance and resistance of bananas to sigatoca, and over the last two-and-a-half years we have become involved in a regional program which is concerned with biological control of weeds and insect pests in the Pacific region.

WORKING TO STRENGTHEN NARS: ISNAR AND ITS STRATEGY

Howard Elliott
Deputy Director General
ISNAR

Introduction

When ISNAR was created it was given a broad mandate to strengthen national agricultural research systems (NARS). Its experience of working in partnership with NARS during its first six years has enabled it to formalize a strategy for system building in NARS. [1] The purpose of this paper is to present the framework for strengthening NARS that is found in that strategy, since it emerges from the experience of work with over 30 national systems.

The ISNAR Goal

In attempting to give content to its mandate, ISNAR has expressed its formal goal as follows:

> To assist developing countries to improve the effectiveness and the efficiency of their national agricultural research systems through enhanced capacity in the areas of agricultural research policy, organization, and management.

Although somewhat longer than the goal 'strengthening NARS,' this refinement lays out quite clearly several principles that determine how ISNAR approaches the task. First, ISNAR works in partnership with NARS which are engaged in their own system-building efforts; it cannot substitute for national efforts. Second, it is concerned with both the efficiency and effectiveness of a system. Efficiency relates to how well the system uses its resources to achieve outputs while effectiveness looks at whether the outputs of the system satisfy national goals. Third, ISNAR takes a systems-building approach which helps the country develop a capacity within the NARS for problem solving in the three related areas of policy, organization, and management.

Some System Concepts

Since ISNAR takes a systems approach, it is worth introducing some system concepts. Churchman defines a system as a 'set of parts coordinated to accomplish a set of goals.' He identifies five basic considerations that the scientist must keep in mind when thinking about the meaning of a system: [2]

1. The total system objectives and, more specifically, the performance measures of the whole system.
2. The system's environment: its fixed constraints.
3. The resources of the system.
4. The components of the system, their activities, goals and measures of performance.
5. The management of the system.

In terms of the management literature, ISNAR would generally be described as taking a systems and contingency approach [3]. It attempts to understand the interrelationship within and among organizations as well as the relationship between the individual organization and its environment. It attempts to understand how organizations operate under varying conditions and in specific circumstances and is ultimately directed towards suggesting organizational designs and managerial actions most appropriate for specific situations. In short, it says that while there is no one best way of organizing and managing research systems there is a way of approaching the question systematically. There is a middle ground between trying to promote a 'universal' model and saying that 'it all depends.'

Systems within Systems: ATMS or NARS?

ISNAR's primary task is to work with the national agricultural research system but there are many cases where applying the broader concept of the agricultural technology management system (ATMS) is appropriate [1]. The ATMS comprises all institutions, individuals, and their interdependent relationships, aimed at the generation, assessment, and diffusion of improved agricultural production and incomes. By 'agricultural technology management' we mean that the component parts of the system, individually or collectively, are able, by some management means, to deal with the constraints on the system. This could be either by adapting the system internally in response to the constraint or by attempting to remove the constraint through direct action. Improvement of the ATMS implies that the system is able to incorporate some of the constraints that were previously considered part of its environment. A NARS is more restricted in its coverage of relevant institutions and is more likely to accept the policy environment as fixed.

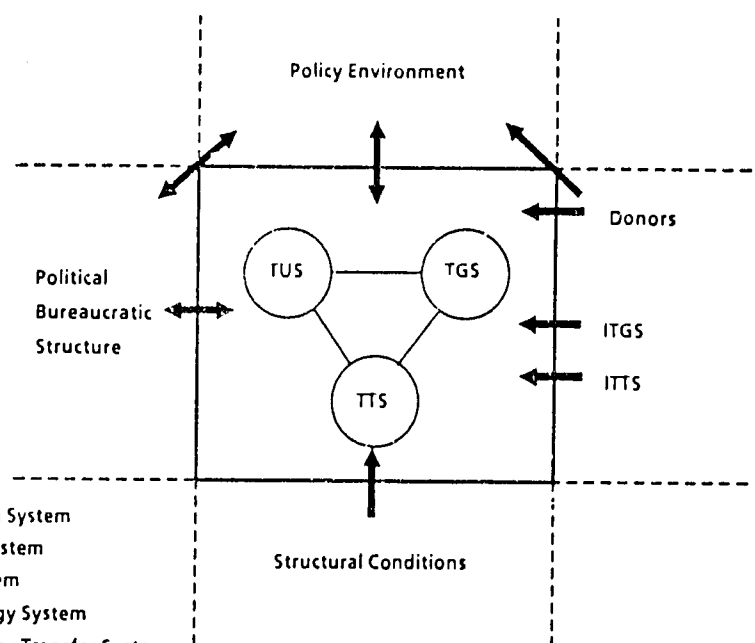
A generic ATMS is described in figure 1, which places the component parts of the system in relation to each other.

These are

- the 'technology sector' with its subsectors (the technology-generating sector, the technology-transfer sector, and the technology-using sector);
- the politico-bureaucratic structure, composed of formal representatives of the government and decision-makers, and the channels through which interests of all groups in the system are made known to policy-makers;
- the 'external sector,' composed of donors, international technology-generating institutions, and multinational firms engaged in technology generation and transfer;
- the underlying 'structural conditions,' which include world markets for inputs and outputs, the resource base of the country, and the initial distribution of resources and power;
- the 'policy environment,' made up of all laws, regulations, customs, and practices which limit the way in which components of the technology sector behave.

Figure 1

Diagram 1: The Technology Management System



TGS - Technology Generating System
TTS - Technology Transfer System
TUS - Technology Using System
ITGS - International Technology System
ITTS - International Technology Transfer System

In small and dependent national systems, the importance of the external sector, the underlying structural conditions, and the policy environment may be relatively greater than in large systems and so justify the use of this broader concept of an AFMS.

Twelve Critical Factors

Through our collaboration with a broad range of NARS – 15 in Africa and well over 30 worldwide – we have found that strong and effective research systems depend on twelve critical factors. These twelve factors are interdependent. They can be classified in three broad areas: the policy environment of agricultural research, the organization of research systems, and management of agricultural research. They underline the three ways a system can be analyzed, the political, the structural, and the procedural. The twelve factors are summarized below:

The policy environment of agricultural research

- Interactions between national development policy and agricultural research
- Formulation of agricultural research policy: priority setting, resource allocation, and long-term planning.

Structure and organization of agricultural research

- Structure and organization of research systems.
- Linkages between NARS and policy-makers.
- Linkages between NARS, the technology transfer system, and users.
- Linkages between NARS and external sources of knowledge.

Management of agricultural research

- Program formulation and program budgeting.
- Monitoring and evaluation.
- Information management.
- Development and management of human resources
- Development and management of physical resources.
- Acquisition and management of financial resources.

It is clear that the three areas of 'policy,' 'organization,' and 'management' are interrelated. Any system-building strategy must take account of the way each type of factor promotes or constrains the development of effective and efficient research systems. A system-building strategy must identify and give priority attention to the binding constraint in the system. For example, it makes little sense to change the structure of the system if the inescapable problem is a policy one. Where the policy environment is favorable but the system is still ineffective, changes in the structure of the system may be required. However, it should also be recognized that strengthening of management mechanisms may provide a more efficient alternative to achieve the same goal.

Let me say a few words about each of the three broad areas. A more complete discussion of the individual themes can be found in the ISNAR Strategy Statement.

The Policy Environment of Agricultural Research

No one needs to be convinced of the importance of a favorable policy environment for agricultural research to play its role and have an impact on development. I would situate the policy issues at two levels: (1) how the NARS respond to policies that are fixed constraints (part of its environment) and (2) how system managers deal with policy issues that fall within their area of management responsibility.

In many countries research leaders accept the policy environment as fixed. This includes acceptance of pricing policies that distort the nature of production by farmers and therefore the demand for new technologies that they express to the research system. In several of its reports to South Pacific nations, ISNAR recommended that it be part of the goal mission of a NARS 'to deliver to government the information appropriate for the formulation of a national agricultural development plan.' It may be indicative that this was mentioned even before the task to 'provide producers reliable information for more profitable crop and livestock production' (Papua New Guinea).[21] Involvement of researchers in providing information on broader policy issues, however, competes with allocating resources to research per se and research leaders have a priority-setting issue here.

The more indicative concerns of the research manager must be focused on three things:

- Building national commitment to agricultural research.
- Developing national research strategies.
- Sound planning and priority setting.

First, a well-defined strategy and clear priorities are critical to building commitment. Without a clear strategy and sound priorities, it is difficult to build a commitment to research among policy-makers. A demonstrated capacity to do this type of planning is

often related to the capacity to carry out the plan. Ministries of finance and planning respond more favorably to plans with clear expected outputs than ones with proposals which only aggregate inputs. The task of convincing policy-makers of the need for research must be clearly given to a spokesperson for research with both the technical and personal status to interact directly with them. This is usually a task which cannot be delegated by the director of research.

Policy-makers must understand research so they can help to create a productive environment. A productive environment includes stability of funding, continuity of direction, and freedom for researchers to pursue approved long-term objectives. In return policy-makers should be able to expect from researchers responsiveness to national development objectives.

The second issue is to determine what kind of system a country can afford and how it arranges the division of labor with regional and international research institutions. This is a basic policy issue which is affected by the resource commitment of the national government and by the capacity of a system to manage such a relationship.

Finally, sound planning and priority setting is essential where donors fund a major part of the system. In the absence of such a well-articulated plan specifying national priorities, donors or international research can substitute regional or international priorities and the system ends up with an inappropriate use of its scarce resources.

The Structure and Organization of Agricultural Research

In looking at organizational factors, we are concerned with both the internal structure of research systems and with the organization of their external linkages. The structure of a research system is related to the mission it is expected to carry out. Since the mission of a system will change over time, structures may have to change, but a clear strategic plan should guide any proposal for structural change. It is easy to think of colonial systems which were organized to promote export crops and generate revenues for government in a period when the population was principally rural and food self-sufficiency was not a problem. With a change in mandate, structural change in the system may be necessary.

Within the system, how organizations are structured, the degree of centralization and decentralization of their management and their programs, whether programs and institutes are staffed along commodity, regional, or disciplinary lines are important questions related to the problems the system is trying to overcome. Where the focus has shifted from commodity concerns to problems of conservation or sustainability, a discipline or factor-based organization might be more appropriate than a commodity institute.

Problems of attaining critical mass are especially acute in small systems with diverse ecologies. The competing desires for representation in the main ecological zones and achievement of critical mass in one location is a question which faces every research manager. Where the question has been faced squarely, managers have usually opted for concentration of research efforts versus isolation and dispersion of staff.

In small systems it is most common for research to be found in divisions within ministries. This concentrates scarce talent and theoretically offers the advantage of close linkage to policy-makers and to official extension agencies. On the other hand, it sometimes introduces a level of bureaucracy that is not appropriate for research and usually ties salaries and promotion to civil service criteria. However, the oft-tried alternative, the semi-autonomous institute, has not always lived up to expectations. The hoped-for autonomy in salaries and promotion has not been realized because funding still comes from government sources. Moreover, autonomous institutes often become dependent on external sources of funding, become seen as externally oriented, and cut themselves off from their domestic political support. In short, in making recommendations the contingency approach says that there is no universal model and a country requires a system tailored to its particular situation.

It is especially important for small systems to maximize their effectiveness by forging scientific linkages at three levels:

- *national*: with universities and private research;
- *regional*: through networks and with more advanced partners,
- *international*: with IARCs, universities, donor agencies.

It is recognized, however, that the IARCs have relatively little activity in the region and that the idea of regional centers has been debated often. In this respect the CARDI experience should prove very interesting to

this workshop. Does the problem of linkage get addressed by structural or management means?

Management of Agricultural Research

In the list of twelve critical factors we have identified six essential management processes. The first three relate to the management of the research process itself: program formulation and program budgeting, monitoring and evaluation, and information management. They determine the quality and relevance of research programs and monitor the system's effectiveness and impact. The last three relate to developing and managing the system's resources: the human, physical, and financial resource base with which it works.

While we have been presenting the policy, structural, and management factors as separate, it is clear that the three aspects are interrelated. And interactions among management processes are important. For example, evaluation of activities without clear program objectives is meaningless, while clear objectives without evaluation may not be adhered to. Information systems are required for both processes. However, because different people and levels of decision-making have to be involved in these processes, they need to be examined both as individual processes and as part of a system.

The management of human resources is the single most important factor in research management. Since expenditures on human resources are the largest single element in research budgets, the allocation of resources is more a problem of allocating scientists than of allocating funds. The task of developing, retaining, and effectively utilizing a cadre of experienced scientists faces five serious challenges.

1. To build up adequate numbers of qualified staff to reach critical mass;
2. To upgrade the quality and experience of staff;
3. To retain qualified staff: reduce attrition, provide incentives, career prospects, and conditions of service;
4. To provide adequate operating funds for productive use of staff;
5. To create an environment conducive to productive work.

Over the course of the next two weeks we have papers dealing with the objective and quantifiable issues of planning human resources and setting conditions of service to make scientists productive. There are also several important sessions dealing with behavioral issues of leadership, forming productive teams, and creating the productive environment.

In the development and management of physical resources, the manager of a research system must provide appropriate infrastructure and equipment. In many cases this has involved a rationalization of structures inherited from colonial days, the creation of new infrastructure to meet new tasks, and a healthy dose of realism in planning infrastructure development. Realism involves ensuring the sustainability of the system from national resources when donor funding has been important, and maintaining a balance between capital expenditures, operating funds, and salary payments. Often the problem facing a system may be in an inappropriate factor mix rather than inadequate overall funding.

This leads to the first factor: the acquisition and management of financial resources. Recent analysis of data collected from research systems throughout the developing world shows that since the early 1980s there has been a decline in financial support per scientist. Scientists trained during the period of rapidly growing support (both national and international) for research are now facing a lack of those operating funds needed to be productive. Research systems face the problems of all governments and share in austerity measures. Year-to-year instability in funding, untimely disbursement, and difficulty in handling uneven influxes of donor funds appear to be serious problems for NARS. It is only partly fair to blame donors for instability caused by fluctuations in and incoherence of their support if the system itself has not taken some internal measures to deal with the problem. This is the responsibility of management. NARS have to explore internal mechanisms to live with such facts of life.

In summary, ISNAR finds that NARS face a broad range of issues and problems in the areas of research policy, organization, and management. These issues are complex and interrelated and, consequently, are best studied in a careful systems framework. In applying the systems approach, it helps to identify critical factors (ISNAR uses twelve but other taxonomies are possible) for system-building efforts. Depending on the particular country circumstance, any one factor can constitute the limiting constraint and this should be the factor which receives priority attention. Taken as a group, the twelve critical factors form a coherent framework for the analysis of any NARS, independent of its size, complexity, and stage of development. The result is an approach that is systematic in its application but leads to recommendations tailored to the individual system.

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RESOURCE COMMITMENTS TO AGRICULTURAL RESEARCH IN THE SOUTH PACIFIC: PRELIMINARY FINDINGS

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As an input to this workshop, ISNAR and IRETA thought it would be very useful to present a concise overview of resource commitments to agricultural research in the South Pacific. Since this information for more recent years was not readily available, I was contracted as a consultant to collect it using a combination of questionnaires and follow-up visits to the countries in the region.

For the purpose of comparison and discussion, the data available from the eleven countries of the South Pacific are summarized in tables 1-6.

In table 1, the research expenditure on crops and livestock is shown in national currency units of 10,000 dollars for each of the years from 1983 to 1985, and in table 2 this expenditure has been converted into US dollars to facilitate the comparison between countries. Only six of the eleven countries provided this information. Annual research expenditures for crops and soils are highest in Papua New Guinea (PNG) and Fiji. Both these countries have a multi-locational research program for crops and livestock in agro-climatic conditions that differ from one location to another. Solomon Islands, Cook Islands, Tonga, and Western Samoa have so far relied mainly on a main research station, which in each of the four countries has shown impressive development. This is a logical approach to the use of resources — mainly personnel and funds — that are available. The striking increase in expenditures in 1986 and 1987 in the Solomon Islands is entirely for crops. In fact, there appeared to be no provision for livestock research in these years. Out of a total research expenditure of 1.2m Solomon Islands dollars in 1986, capital investment amounted to 0.86m. Likewise in Western Samoa, research expenditures for all sectors were highest in 1986, with 0.88m Western Samoa dollars for non commodity research and crop protection, out of a total of 1.1m. Tonga had steady provision for research on one station, which even visibly shows impressive improvement. Among the smaller countries, Cook Islands showed steady aad impressive provision for research on one station, specializing in horticulture, with external aid. It would be necessary to separate capital and recurrent expenditures in each sector before any attempt is made to study the growth in research expenditures; the data that were provided, however, did not allow for this.

Research Expenditures

Comparisons between the research expenditures of six countries expressed in US dollars (table 2) indicate that, even making adjustment for inflation, there has been increasing provision for research in crops and livestock in the period 1983-1987. Papua New Guinea and Fiji stand out among others in the annual levels of this expenditure. The data for each country show far more provision for crops than for livestock; any deviation from this generalization as seen in these very few years appears to be connected more with livestock development than with research in Research and Development programs. With few exceptions, Cook Islands for instance in 1986, provision for forestry and fisheries research was not high. Research expenditures in Niue, Kiribati, Tuvalu, and Tokelau, all atoll countries, are small. These countries could benefit by an increase in expenditure and basic facilities for research. All four countries provided inadequate information in response to the questionnaire, and a follow-up is desirable.

For all the eleven countries, current annual expenditure on research in crops, livestock, forestry, and fisheries is assessed from data supplied for 1986 or 1987, as shown in table 3.

Table 1: *Research Expenditures on Crops and Livestock (Local Currency Units 10,000)*

	1983	1984	1985	1986	1987
Papua New Guinea (Kina)	322	475	540	319	428
Fiji (F$)+	194	200	226	274	426
Solomon (SI $)	22	27	72	121	129
Tonga (Paanga)	32	28	32	42	-
Western Samoa (WS $)	-	56	85	113	67
Cook Islands (NZ $)	21	17	17	17	19

+ excluding sugar cane research

Table 2: *Research Expenditures on Crops and Livestock (US$ 10,000)*

	1983	1984	1985	1986	1987
Papua New Guinea	358	528	600	354	476
Fiji	171	176	199	241	375
Solomon	11	14	36	61	65
Tonga	21	18	21	27	-
Western Samoa	-	26	39	52	31
Cook Islands	11	9	9	9	10

Table 3: *1986/87 Research Expenditures (Local Currency Units 10,000)**

	PNG Kina	Fiji F$	SI SI$	WS WS$	Tonga Paanga	Vanuatu Vatu
Crops	170	400	121	57	35	72
Livestock	149	79	7	7	6	
Forestry	73	87	9	1.3	3.4	
Fisheries	55	130	0.5	0.6		
Total	392	601	280	66	42	82
% from external sources	n/a	24	65	-	24	100

* except Vanuatu = 1,000,000 vatu

Table 4: *1986/87 Research Expenditures (US$ 10,000)*

	PNG Kina	Fiji F$	SI SI$	WS WS$	Tonga Paanga	Vanuatu Vatu
Crops	189	352	61	26	23	80
Livestock	165	70	3.2	5	7	
Forestry	81	59	4	0.6	4	18
Fisheries	48	65	0.2		1	
Total	435	529	130	30	28	92

Table 5: *Numbers of Persons Employed in Research in Agriculture, Forests, and Fisheries*

	PNG	Fiji	SI	WS	Ton	Van	CI	Niue	Kir	Tuv	Tok
SCIENTISTS											
Nationals											
Ph.D.		1					1				
M.S.	6	10	1	2	3		1				
B.S.	28	30	3	6	6		3	2	3		
Expatriates	16	10	9	8	12	12	7		4	1	1
Total Scientists	50	51	13	16	21	12	12	2	7	1	1
SUPPORT STAFF											
Diploma	29	143	4	5	11		3	3	4		4
Non diploma	67		23	6	15	17	8	1		1	1
OTHERS	270	31	46	4	60	62	15				6
Total	416	225	86	31	107	91	85	6	11	2	12
Ratio of Support Staff to Scientists	1.9	2.8	2.1	0.7	1.2	1.4	2.1	2.0	0.6	1.0	5.0

These data have been converted to US dollars in table 4. The expenditure shown is predominantly for crops, but it does not include expenditures on commodity research. The exceptions are for sugar cane research in Fiji and coconut, cocoa, and coffee research in Vanuatu. For Vanuatu this is, in fact, the major research expenditure, with no provision at all in the national budget for research on crops and livestock, external resources being used instead. In terms of US dollars, Fiji ranks first, PNG second, and Solomon Islands third for research expenditures in all sectors, including forestry and fisheries in 1986/87. Solomon Islands shows more provision for fisheries than for agriculture in this year. Research expenditure is seen to be much lower for livestock than for crops, except in PNG. In Niue, Kiribati, Tuvalu, and Tokelau, annual research expenditure for all sectors together is less than 100,000 US dollars in 1986/87. In two countries, Cook Islands and Tuvalu, research expenditure has not been separated for crops and livestock.

Table 6: *External Assistance to National Agricultural Research*

Donor Country or Organization	Types of Cooperation					
	Financial		Technical Assistance	Training In		
	Grants	Loans		Donor Country	Own Country	Other Country
OECD Countries						
Australia	XXXXX		XXXXX	XXXXX	XXX	X
Austria						
Belgium						
Canada	X			XX		X
Denmark						
Finland						
France	XXX		XXXX	X	X	
Germany Fed. Rep.	XX		XX	XX	XX	
Italy						
Japan	XX		X	X	X	
Netherlands	X		X	XXXX		
New Zealand	XXXXXXX		XXXXX	XXXXXX	XXX	X
Norway						
Sweden						
Switzerland						
United Kingdom	XX		XXX	X		
United States	XXX		XXXXX	XX	X	X
OTHER DONORS						
Argentina						
Brazil						
India	X		X	XX		

Table 6. *External Assistance to National Agricultural Research (continued)*

Donor Country or Organization	Types of Cooperation					
	Financial		Technical Assistance	Training In		
	Grants	Loans		Donor Country	Own Country	Other Country
Israel						
Korea (Rep)						
Taiwan	xx		xx	x		
ORGANIZATIONS						
African Dev. Bank						
Arab Fund for Econ. & Social Dev.						
Asian Dev. Bank	x	x				
EEC	xx	x				
FAO	xxx		xxx			x
Ford Foundation						
IDB						
IDRC	x			x		
IICA						
IFAD						
OPEC Fund						
Rockefeller Found.						
UNDP	xxx		x			x
World Bank	x	x				
OTHER DONORS (Not elsewhere specified)						
I. SPC	xx		x			x

Table 6 *(continued)*

Donor Country or Organization	Types of Cooperation					
	Financial		Technical Assistance	Training In		
	Grants	Loans		Donor Country	Own Country	Other Country
2. IBPGR	x		x			
3. CFTC	x	x	x			
4. IFS						

Research Personnel

Great variation between countries is found in the numbers of persons engaged in agricultural research as shown in table 5: from over 50 in PNG and Fiji to less than one full-time person for research in Tuvalu and Tokelau. Among nationals only two have qualified at the Ph.D. level, 23 at the Master's level, and 80 at the Bachelor's level. In total, 79 expatriate scientists are employed in the South Pacific. Vanuatu alone has no nationals in research and this relates to the absence of financial provision for research in the national budget of this country. Support staff are separated into those with and without a diploma qualification. Other employees are those who are in continuous employment even though they receive a daily wage, and are engaged in the range of operations that require more field than laboratory research.

The total number of persons used for research varies greatly between countries. The largest total number is in PNG and this may be related to the large number and area of research stations. Some countries, Western Samoa for instance, may not have included all field labor employed on research stations. Fiji shows a relatively high number of support staff, all commendably qualified at diploma level. The ratio of support staff to scientists is a useful research indicator and should be around 2. In Fiji, this ratio is 2.8, and in four other countries, including Niue and Cook Islands, it is around 2. In Tokelau the lack of scientists inflates this ratio to 5, a justifiable compensatory arrangement.
In the conduct of research, support staff are very important, and can save the scarce time of scientists in the research operation. On the job training of support staff, more particularly non-diploma persons, can improve their efficiency. An ideal ratio of 2 support staff for each scientist with 4 to 6 other employees is suggested as a good work team.

Countries and international organizations supporting national agricultural research are listed in Table 6.

Finally, it must be stressed that some countries have taken a policy decision to spend little or no money on research. This needs careful review.

Others, notably Fiji and PNG but also Solomon Islands, Tonga, Western Samoa, and commendably Cook Islands, are relying on research to support their development and extension programs. Until 1% to 2% of the agricultural gross domestic product is spent on research, provision for research should be regarded as inadequate.

THE SCOPE FOR IMPROVED MANAGEMENT IN THE SOUTH PACIFIC

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I. AN OVERVIEW OF THE DEVELOPMENT CHARACTERISTICS OF THE PACIFIC ISLAND NATIONS

Smallness

Of the several features that characterize the Pacific Island nations (PINS)[1], few inflict a broader impact on the direction and rate of development than that of 'smallness'. A number of studies have been carried out to investigate the implications of smallness on the various aspects of development. There is general agreement among these that a small country also has a small population, a limited resource base, and a small absolute national income (Fernando, 1986). Smallness itself, when applied as a quantifier to the range of measures that define the PINs, invites further delineation. Shand (1984), looking from three different perspectives of land area, population, and size of the economy, found that the PINs separate themselves into more or less fixed groupings which he categorised as small states (e.g. Fiji, Solomon Islands, Vanuatu); very small states (e.g. Kiribati, Tonga, Western Samoa); and micro states (e.g. Cook Islands, Niue, Tuvalu).

The implications of smallness are perhaps best summed up in his analysis, summarized below.[2]

(a) Small land area:

This gives rise to

- a narrow range of primary production;
- vulnerability to natural disasters, as well as fluctuations in external production and market factors;
- high per capita production costs and hence poor marketability owing to low output volumes;
- a limited choice of markets owing to low output volumes.

(b) Small population:

- limits production volumes;
- induces export- as well as import-dependence;
- provides little or no incentive for private sector participation in the service industry, thus placing pressure on government;
- often means a shortage of skilled or trained labor and a tendency to depend on expatriates.

(c) Economic smallness:

- the diseconomies of small-scale production tend to militate against industrialization;
- per capita investment costs on public sector infrastructure are often uneconomic;
- there is limited scope for raising internal revenue, causing a dependence on aid to meet basic social needs.

It is particularly important for the purpose of this forum to place emphasis on the aspect of 'smallness of land area.' This means that the amount of land available for agricultural use is already very limited. The constant demand for space of a growing population plus other competing pressures for alternative, nonagricultural use of land will mean that the practice of agriculture, for example, in terms of farming types, farming technologies, or land-use techniques must adjust accordingly. Research in agriculture needs to be geared

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[1] *For the purpose of this paper: Cook Islands, Fiji, Kiribati, Niue, Solomon Islands, Tuvalu, Tonga, Vanuatu, Western Samoa.*

[2] *See also: Fernando, 1986: p. 375.*

not only to economic or export production, but also to feed production and the increasing importance of the protection and preservation of the ecosystem.

Much the same findings have emerged from a study by Shaw (1982). Small countries are not smaller versions of larger ones. They perform all the policy functions of the larger states but under much more strain from inadequate resources and other factors directly attributable to 'smallness.' As a result

- There is a high per capita dependence on foreign trade, and this, combined with a narrow resource base, tends to create greater economic instability.

- Government ministers and employees tend to cover a wide variety of responsibilities for which they have inadequate or no training. 'At the same time, the load of foreign responsibilities is shared over fewer people so that travelling abroad or dealing with overseas official visitors and diplomats take up an inordinate amount of time.' High levels of foreign aid also means large amounts of time taken up with aid administration.

- Governments tend to look toward foreign investment and aid to overcome the narrow capital and skills base necessary for sophisticated project implementation. Projects are not tailored to local capacity, to be augmented where appropriate by imported skills and equipment. Evidently, 'The former are more visible, vote-catching and 'quick-acting' while the latter are slow to implement, require more local knowledge and skill, and yet, where successful, may be more pervasive.'

- Dependence on foreign investment and aid means that national development policy is never wholly an internal decision. Foreign investors with an annual turnover many times that of the small state wield considerable economic and political power. 'Too frequently, decisions which will affect small states are made in foreign boardrooms. . . . The investment policy of one or two transnationals may have a greater impact on a small state than that of much of its own bureaucracy.'

- The high accessibility of public officials renders ministers and bureaucrats vulnerable to influences by individuals both from within and outside their countries. In such a context, policy directions tend to be ad hoc, and the temptation to depart from planned long-term programs for 'quick-acting' projects becomes a major problem.

Territorial size, however, has taken on quite different proportions under the Exclusive Economic Zone (EEZ) international convention, and 'small' may no longer be an appropriate term to describe the PINs. The Pacific Island states have now extended their territorial limits to include areas of sea, many times (ranging from tens to thousands) the land area. The resources of the sea add substantially to the total economic potential. Nevertheless their successful exploitation will remain largely determined by such factors as the availability of capital, an appropriate skills base, or markets, which, as shown, are already constrained by smallness of population and economy.

Education

Smallness, however, has not always been dysfunctional. Because of it, literacy in the PINs has run at a very high rate for a developing region, particularly in the 'micro' and the 'very small' states, where it is in excess of 90%[3]. The lower rate for the larger 'small states'[4] can be attributed directly to the comparatively large land area and the ruggedness of the terrain, which combine to make it very difficult to bring basic education to the masses, particularly in countries where the population is already very thinly spread. For the PINs, smallness has made it more convenient to align education curricula with foreign examinations such as those of the U.K. and New Zealand, with consequent achievement of fairly high standards. But, like most other forms of foreign assistance, this has led to a dependence.

This dependence in education and intellectual development is perhaps the most serious of all problems confronting the PINs. In a sense, it has become a process of acculturation into seeing and doing things in ways often out of keeping with or hostile to the cultural environment. It has meant the removal of any opportunity for these countries to evolve for themselves a tradition of higher education and research. In regard to manpower planning and development, it has meant that those in the professional and skilled occupations, being mostly overseas-trained, are vulnerable not only to

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[3,4] Cook Islands, 91.8; Kiribati, 90.1; Tonga, 99.6; Western Samoa, 97.8; Fiji, 73 (1970); Solomon Islands, 9.0 (1970); (Fernando, 1986: p. 375).

cultural dislocation, but also to 'brain-drain.' The withdrawal of the foreign examinations has suddenly confronted a few education ministeries in the region with the realization that they have neither a national education philosophy to guide a relevant curriculum, nor the expertise and technical capability to plan and execute testing and evaluation on a national scale.

Political 'Smallness'

'Small' can also be an appropriate term to describe the modern political experience of the PINs, in the sense that most of them are only recently newly independent. Foreign policy in respect to other nations, or established political groupings of nations, is still being developed or explored. Internally, political institutions tend to run close to traditional patterns of community, loyalty, and affiliation. The ideals of democracy and democratic process sometimes give way to social obligation or communal expediency. In some instances, democratic process is bent and shaped to fit the sanction of tradition and culture. Already there has started to emerge a questioning of democracy itself as an appropriate basis of governance in very tradition-oriented societies.

Other Important Characteristics

Another major characteristic of the PINs which must be mentioned is the vast distances involved in communication and transport, both internal and external. Most PINs are archipelagic and the distances between islands (which average over 1500km in the Cook Islands and 3600km in Kiribati) add very severe limitations on effective centralized government and systems of public administration. The vast distance to export markets[5] in metropolitan countries means that the high transportation costs cut deeply into export earnings, and inflate the prices of imported goods.

Mention should also be made of the importance of the subsistence sector to the economies of some of the PINs. The limited contact with the cash economy of a large section of the population in countries such as Solomon Islands, Tonga, and Western Samoa, the unusually productive nature of the traditional rural sector, and strong preferences for traditional foodstuffs will continue to make subsistence production a significant factor of the economies of these countries (Fairbairn, 1985: p. 31). As the scope for boosting cash incomes in the PINs is limited in many cases, development policy may need to take a fresh look at the subsistence sector as a source of possible solutions.

[5] *Suva to: Auckland, 2300 km; Sydney, 3600 km; San Francisco, 8816 km; London, 20,554 km.*

2. MANAGEMENT ORGANIZATION AND DEVELOPMENT

Public Administration Systems

The PINs have invariably adopted systems of government and public administration inherited from former colonial rulers. At the time of attaining independence (which in the PINs contrasted markedly with the violent struggles in other parts of the world), there did not seem any need to change a system that was functioning normally. It seemed all that was needed was to install some local officers in posts vacated by departing colonial administrators, and perhaps change a title here and there. A provision of authority in the constitution and a derived enabling act of the legislature completed the process of giving the existing system a new look appropriate to the image of a new nation.

That, in general, sums up the background to the present day public service found in the PINs. Like independence, it was 'won' peacefully and without struggle. But, as is often the case, such seemingly cost-free achievement is not without its price.

Development Planning

Many Pacific Island states have now been politically independent for ten or more years. In the fashion of new nations before them in other parts of the Third World, they have embarked upon the practice of development planning as an instrument of progress and modernization. Many of them have now found that the promises and aspirations of better living standards and modern life styles which fired the fervor for independence have remained elusive. The search for an explanation has produced a plethora of theories which has added to the complexity of the development plan and caused many problems for the public administration system left to execute it.

The institutionalization of planning gave rise to an organization which quickly grew in importance and prestige within the public service. In nearly every Pacific Island state, a ministry or department has been created with responsibility for producing the national plan. Seen

as the center of government policy, the plan became the responsibility of either the prime minister or another senior minister. The idea of being able to have direct involvement with the formulation of the future directions of a nation, or direct access to the prime minister and other policy-makers, excited many an aspiring and ambitious public servant. Many opted for training in economics with a view to joining the planning office. As a vehicle for outside assistance, and possible influence, the plan and especially its preparation attracted considerable interest from foreign technical assistance agencies. Expatriates returned to public service, but this time (after independence) as development planning experts or advisors. The central planning office was now firmly established.

As the national plan evolved from the uncomplicated list-of-projects statement of the initial days to the lengthy but comprehensive surveys now found in many PINs, the organization of the machinery that produced it similarly grew both in size and complexity. Today in most PINs the production of the national development plan ostensibly involves an intricate network consisting of the central planning office and agencies which span both the public and the private sectors. In particular, every agency of the public service is expected to have some involvement with the plan, if not at the formulation stage, certainly in its execution.

The adoption of development planning and the accompanying organizational structure took place within the framework of a public administration system that had remained largely a transplant from the colonial administration. This system has continued to the present in the PINs.

Colonial Public Administration

Whatever the particular motivations or interests of each colonial power, colonies invariably served to strengthen their economy. They supplied the colonial power with raw materials and provided a ready market for its finished products. Mining, forestry, plantation agriculture, and commerce were typical areas of colonial interest. The colonial administration's central concern was to protect these interests by ensuring that there was political and social stability in the colony. The public administration system thus set up was characterised by three main functions, (i) the maintenance of law and order; (ii) the provision of basic civic amenities; and (iii) the collection of revenue to pay for the costs of administration. Very little or no development work was done. Some basic infrastructure (e.g. roads and jetties) was provided, but chiefly to facilitate the exploitation of natural resources.

A feature that has had a significant impact on the PINs is the leadership style of the colonial administration. Both to minimize costs and to encourage local acceptance of and respect for colonial rule, indigenous elites were taken into the administrative structure. However, they occupied lower ranks and did not take part in the administrative decision-making, which remained the prerogative of the colonial office in the 'motherland' and its proxy administrators in the colony. Later, at independence, it was to be these indigenous elites — 'chiefs' and 'big men' — who would step in and assume the roles left by their colonial masters, bringing about a kind of *de facto* marriage between public administration and traditional chiefs, with certain peculiar repercussions for some PINs today.

Administration of Development

The pursuit of socioeconomic development that has dominated national policy following independence would naturally call for a public administrative system that has the same focus in mind. Clearly the inherited system of the colonial era would be inadequate. In terms of functions, it would need to add to its responsibility for maintaining law and order, and collecting revenue, a capacity to devise the framework of government policies; to undertake the management and implementation of socioeconomic development; and to undertake the administration of industrial development (Omar, 1980). To what extent this has taken place in the PINs may be seen from a brief enquiry into the performance of the following aspects of the public administration system.

Strategic Planning

The commonality of development characteristics among the PINs is directly reflected in their planning goals. Universal goals are growth and increased living standards, equitable distribution of wealth, and self-reliance. A large majority share the goals of export diversification, employment generation, indigenization, industrialization or agriculture; preservation of culture and the environment, and increasing private foreign investment.

Planning goals need to be broken down into more specific objectives. However, development objectives become more meaningful when viewed in the context of problems and opportunities on the one hand, and the

derived strategies on the other. A number of PINs have used this approach in their plans: a problem or an opportunity is identified upon which a development objective will be based, which in turn will help shape the strategy to be used. Fernando (1986), analyzing the recent plans of three countries (Cook Islands, Vanuatu, Western Samoa) to discover how effectively the objectives and strategies have aligned with the problems or opportunities to be addressed, found general agreement with the observations made by other commentators on the subject. These identified several weaknesses, among which are

(a) Objectives and strategies represent symbolic statements of aspirations seeking the broadest degree of agreement from the people and aid donors. These lack specificity and become no more than platitudes.

(b) Governments in the PINs tend to have 'hidden agendas,' which they try to keep from their political opponents. Often, therefore, declared objectives and strategies differ widely from real policy aims.

(c) Objectives and strategies are sometimes utopian and too long-term. This tends to encourage policy making to emphasize highly politically visible projects and programs which bring short-term results to the political advantage of the governing party.

(d) Though plans commence with solemn recognition of social goals in the preface, little effective action is taken to achieve those goals in the plans. Objectives and strategies are often economistic, reflecting the bias of the planners, who tend to have backgrounds in economics (Fernando, 1986: p. 204).

(e) Plans continue to be overly concerned with macro-economic targets and modelling. This reflects the misplaced confidence that the economic trickle-down effect will lead to social good and happiness.

It is not hard to understand what underlies these weaknesses. Again 'smallness' plays a significant part, as does the nature of the 'carrier' public administration system. The closeness of a small community discourages forthrightness which may offend and encourages consensus-seeking and compromise in decision-making which tend to end up as mere paper statements. On the other hand, partisan politics, being in its infancy ('smallness' of experience), sees development projects as opportunities for scoring points against the opposition, for survival: 'hidden agendas' and ad hoc high-visibility short-term projects result. The reliance on aid for financing development inevitably means submission to the donor's perception of development.

The apparent freedom of the executive government or individual ministers to dictate diversion from agreed national plans, or to demand party-promotion projects at will, is symptomatic of the administrative philosophy that has carried over from the colonial administration and is being perpetuated, perhaps unconsciously, by the existing public administration structure. This authoritative leadership style of the colonial ruling tradition continued as the norm into post-independence government; the only difference being that the sahibs were now the local rajas, 'chiefs', and 'bigmen.' Several factors account for the consolidation of the new power base of this local elite, among which are

(1) Involvement with the colonial administration had enabled this local elite to acquire some of the culture and social values of the colonial master. They understood the value of 'modern' education for their offspring, who were despatched overseas and later returned to take up key positions in government and commerce.

(2) Public deference for authority, which went hand in hand with the native's conditioned esteem for the former master's culture, shifted automatically to the local elite. In government this found ready endorsement in the formalized hierarchical administrative structure where policy-making was the exclusive preserve of the apex, and decision flow was strictly top-down.

(3) The local elite, by virtue of its status in traditional society, assumed and claimed to represent the interests of indigenous society and culture in a non-indigenous system. Anything done by it, therefore, could be cloaked under a veil of indigenization. This combination in the persons of the local elite of ascribed public office authority and traditional rule has left the subordinate staff in public organizations doubly submissive, on the one hand by administrative rank, and on the other by obligation to tradition and cultural standards.

Public administration systems in the PINs have yet to recognize development as a multidisciplinary and intersectoral process. Public service labor policies tend to see the application of skills in strictly defined sectors, to the extent that planning is seen to be the preserve of economists, and the planning function strictly that of the

central planning office. Though networks have been set up (by the central planning office) in an attempt to provide for an integrated planning approach, these lie outside the purview of the authority for public service administration, and therefore get no support in relation to staffing or staff development. The planning process as a result becomes a very centralized affair. In this context development plans can be expected to be economistic and have a bias for a macro approach.

Macro-planning, however, has come under serious question because of the poor availability of national statistics and data upon which it depends. The admission in Tonga's DP3 that a major weakness 'lies in the lack of adequate and reliable data for the construction of a macro framework' represents the general status of national data collection in the PINs. Yet despite the questions, macro-planning has become established in the PINs. Dubsky (1986) reports that all development plans published in the early 1980s contain a reference to it, or a section devoted to a macro framework.

It is difficult to understand the wide acceptance of macro-planning in the PINs without linking it directly with the foreign experts engaged in planning. Two possible explanations offer themselves. Firstly, that its popular use derives directly from the presence of the foreign planning experts, most of whom tend to come from industrialized countries where economic growth orientation and macro modelling are standard. It is to be expected that their approach and technology will reflect their background, and given their position of influence, will soon become established in the thinking of those receiving the advice. There need not be anything wrong with this provided there is an appropriate counter response within the planning structure in terms of providing the necessary data base and the skills base required. Secondly, aid donors tend to encourage analysis of development in macro economic terms. When development projects are almost totally reliant on aid financing, the ability to present a case for development in a precise quantitative way has a clear advantage.

Implementation, Monitoring, and Evaluation

The following story told by a Vanuatu planner brings out a main problem that affects plan implementation in the PINs:

> '... On my island there was a project involving construction of a wharf, a British aid project. According to papers which we received in our office, the project had been completed. But it so happened that one of our officers travelled to this particular island and when he arrived there, he asked for the wharf. People in the area said: 'What wharf?' There was no wharf. He found out that the money had been spent on something else... '
> (Dubsky, 1986: p. 91)

The story clearly shows that the planners who prepared the wharf project had had no contact with the project when it was supposed to be implemented. This is indicative of an attitude that is fairly common among young planners in the Third World: that the planner's role ends when he has produced the plan. In this context there is a tendency to view plan implementation as a set of activities which are the responsibility not of planners, but of functional, technical, and administrative personnel (Conyers and Hills, 1984: p. 155). In the PINs this finds ready reinforcement in the organization of the planning machinery itself, where plan implementation is seen as the responsibility of line ministries, or departments, and the central planning office as in charge of control and general monitoring.

To avoid the fate of the wharf project, it is necessary for the planner to be linked in some way to the implementation process. The planner needs to consider how the plan will actually be implemented. In other words he needs to plan the implementation process. Normally this will involve identifying the various activities associated with a plan, preparing an activities time schedule, and mobilizing the resources (finance, staff, materials, and equipment). But for this to work, there needs to be a coordinating monitoring and evaluation mechanism to ensure that (i) the needed resources are provided; and (ii) the resources are actually converted into the goods or services intended by the plan.

The failure of a plan or project is due in many cases to poor coordination. In respect to manpower resources, the problem is aggravated by public service personnel policies made under the sanction of independent constitutional authority. These policies have failed to adjust to the concept of development and are a major barrier to successful planning and implementation. Often the implementing agencies lack the necessary manpower skills to undertake projects. Sometimes the conditions of employment provide no incentive for staff with the necessary skills to remain with the project. *The Kiribati Sixth National Development Plan, 1987-1991* recognizes many problems in a 'Public Administration system (that is) not suited to a young developing country. National conditions of service and salary scales

emphasise administrative functions rather than promoting professional (and technical) skills and productivity.'

The same constraints frustrate efforts at proper monitoring and evaluation. The gravity of the problem may be gauged from the following 'lament' extracted from the *Western Samoa's Fifth Development Plan, 1985-1987*:

> 'Both DP3 and DP4 stressed the need to establish a soundly based *'An Monitoring and Implementation System'* to ensure that development projects and programmes are implemented efficiently and on schedule ... However, to date, efforts to implement such a scheme have been abortive, with staff limitation being the chief constraint. The Treasury has recently introduced a system of quarterly reporting covering all development projects under implementation, but this applies only to financial as opposed to physical aspects. The absence of a fully integrated Plan Monitoring and Implementation System represents a crucial weakness in Samoa's development effort.'

Thus it is seen that without active coordinating of the planner's role in the implementation process, all monitoring is reduced to ritualistic paperwork that the Vanuatu planner was probably talking about. These put emphasis on ensuring that approved expenditure limits are not exceeded, the correct forms are filled in, and the signatories have the appropriate level of authority.

Financial Resource Management

The crucial role of government in fostering economic development in the PINs carries a concomitant responsibility for the effective mobilization of the financial resources required. This includes not only seeing to it that funds are available but that their allocation is done in a way to give proper support to the development plan, while providing for public services and government operations at the same time.

The limitations of size, low level of industrialization, and a relatively large non-cash subsistence sector restrict the sources of internal government revenue to taxation (on income and trade) as being the main one. Fairbairn (1985, p. 63) estimated that (apart from tax-haven Vanuatu) taxes constitute a proportion of national income ranging from over 20% to just under 50% in the PINs. This compares with 27% and 31% respectively for Australia and New Zealand, indicating that the PINs are not 'undertaxed or deficient in their tax effort' (ibid). In other words, there is little hope in looking to this source to meet further demands for government revenue. Foreign assistance, in the form of grants and concessionary loans are filling this gap. Table 6 gives an indication of the degree of 'dependence' on this source for financing government expenditure.

Public Budgeting

The very limited availability of financial resources places great importance on the budgeting process for their best utilization. In this connection, the location of the budgeting function in relation to the planning function can be a major factor in determining the quantity and the quality of the financial support for development programs.

Historically, the responsibility for the budget was the main function of the treasury, the emphasis being strictly on control. Public agencies had specific tasks allocated to them and the treasury's main concern was to keep them to those tasks by a very tight control of the budget. Hence the line-item system of budgeting, which is geared specially for this purpose, became the standard. The attainment of independence, and particularly the accompanying adoption of the Westminister parliamentary model for the legislature, which institutionalized a constitutional, legal, and regulatory framework for the budget, has had the effect of consolidating an approach to budgeting that has been shown to be non conducive to the notion of development.

Two factors account for this. Firstly, the parliamentary aura now surrounding the budget has transformed it from a mere statement of public revenue and expenditure to a formal pronouncement of government policy. Consequently the position of minister responsible for the budget — the finance minister — has become a position of considerable power and influence in terms of shaping government policy. (Party leadership and unusual coalition of political parties have been decided on a trade-off or compromise centered around the finance portfolio.) The finance minister is therefore in a very strong position to influence the allocation of the budget. Secondly, the pervasive power of control over others that treasury officials have acquired through the budget is something that is not easily let go of. This position is defended by reference to instances of financial irregularities and improprieties, as well as exceeding limits of authorized expenditure. The control orientation has led to the dominant influence of accountants and accounting control techniques in the treasury in some PINs. Here the main emphasis is to

reduce the level of inputs and thereby cut expenditure; no regard is given to the possibility of extracting increases in outputs and benefits from a given level of inputs (Fernando, 1986: p. 278). In addition the power to influence the allocation of budgetary resources is shared by treasury officials through their direct involvement in the budget preparation. Their interests as public servants in struggles for higher salaries and other advantages will receive some focus in the budget. Similarly they will tend to have a bias for the treasury organization over other public agencies in the allocation of resources.

From the foregoing there seems to be strong arguments for placing the function of development planning and that of budgeting within the same ministry. This is now being done in some PINs. In these countries moves have been initiated to reform the budgetary system and process by incorporating systems such as planning programming – budgeting, zero-base budgeting, etc., that are more supportive of the development planning concept. In other PINs the capital or development budget is separated from the operational or recurrent budget and transferred to the central planning office. A problem here is the fact that capital projects invariably result in introducing new demands for recurrent costs which have to be borne by the recurrent budget. If not properly coordinated this can result in the support of new project outputs at the expense of ongoing needs, or the embarrassing abandonment of completed projects. Because aid donors are normally interested in supporting development projects, this separation between the recurrent and the development budget tends to encourage a view that the development budget, and hence all development has to be financed by aid. With this has developed an unfortunate attitude that development is only possible with the intervention of foreign assistance.

Human Resource Management

The literature on the experience of development efforts in the PINs is rife with references to constraints attributed, directly or indirectly, to deficiencies in the quantity and quality of the effective manpower. In the field of research and extension in agriculture, excellent coverage is provided in the report by Oram, Beal, and Kern (1987). The report identifies deficiencies in the attitudes as well as the knowledge and skill of the research and extension personnel, and makes suggestions about ways of redressing them.

Granted the importance of upgrading the specialized capability of the researcher or extension officer, success in inducing the desired change is determined largely by the receptivity of the farmer. The same applies to any other sector of development. By and large, the process of developing the economy of the PINs takes place in an environment that might best be regarded as indifferent in terms of human capacity to accept or absorb desired change. Therefore, while efforts are being made to upgrade the quality of the change agents at the micro- or sectoral level, it is important that steps should also be taken to try to raise the level of awareness and appreciation by the target population of these efforts and of the general concept of development at the national level.

To appreciate the last point made we have to remember that the communities of the PINs have no tradition of higher education and research. In fact this is a region where the environment for postliterate learning and self-education is very limited if it exists at all, where oral tradition was until recent times (and still is in some places) the mode for recording a people's history and heritage, and where cultural mores suppress individualism. The absence of a higher education and research tradition has meant that, for these communities, the concept of development and modernization is on the whole a foreign import. And it will remain foreign and ineffectual until there has been created an atmosphere conducive to its understanding and appreciation.

For most Pacific island nations, the basic facilitators of such an atmosphere are generally lacking: no university or institution for continuing education, no press; there is a dearth of appropriate information, and often the language of developmental information is not in the vernacular. The diseconomies of scale inherent in the physical geography of these countries will ensure that, for many of them, this state of affairs will continue indefinitely.

3. ISSUES IN MANAGEMENT AND DEVELOPMENT

The foregoing section has set out to investigate the appropriateness of the inherited system of public administration as a vehicle for the process of development and modernization in the PINs. In the process it has also attempted to look behind some of the more visible evidence for a clearer perception of the issues involved. It has long been understood that colonial administration was not designed to promote economic development directly. Therefore the organization arrangements, labor systems, and administrative processes left behind were unsuited to

mobilizing and speeding up development (Fernando, 1986: p. 295). The fact that this model of administration has continued to be followed in the PINs must be a matter for serious and concerned deliberation.

It appears from the evidence that has been considered that the scope for management development in the PINs is being greatly constrained at the 'global' or macro level by certain attitudinal and behavioral factors. These are compliance, dependence and indifference. Conditioned compliance, deriving from a position of subservience during colonial times and now reinforced by a state of aid-dependent underdevelopment, would appear to account for the unquestioning tolerance given to unsuitable practices and procedures, as already pointed out. Deliberate exploitation of culture and traditional status by the local elite for self-centered motives adds reinforcement. The parochialism of government departments and strict adherence to archaic rules and regulations are symptoms of power politicking in emulation of the colonial administrators. All these represent major problems to be faced in any move to reform the public administration system, which has to be a precondition for effecting management change and development.

Dependence is self-reinforcing. Aid breeds demands for more aid. Local input into the development budget is allowed to diminish. Accordingly, local responsibility for the successful implementation of development programs will also diminish. Foreign experts tend to encourage the recruiting of more experts. Meanwhile, local staff are neglected and become disenchanted with their work. The net result is likely to be a project or program, totally or almost totally aid-funded and located in a largely indifferent environment. The issue for management development is how to effect a better attitude in respect to aid-dependent development.

An issue that is often raised, but has not been directly referred to in this paper so far, is the question of how the practice of management and culture relate to one another in the PINs. The question is more usually presented in terms of how culture affects or influences management practice, in a manner to suggest that it should do so in a negative way. To say that this is a curious question to ask will no doubt surprise many, but it shows how much our thinking has been conditioned to believe that culture, at least of the Pacific Island communities, is a barrier to good management practice. The corollary is even more presumptuous: that management as practiced in western industrialized countries ('western management') is the only correct approach to managing development in the PINs. Since 'western management' is integrally identified with western culture, one might be led to think that the promotion of management in the PINs was a means of western acculturation.

The question which the PINs must address is whether they can have the benefits of development and modernization without giving up their cultures to westernization.

4. SOME SUGGESTIONS FOR A SOLUTION

In trying to analyze an approach towards improving the performance of management in the PINs, this paper has followed the argument that, because of the hierarchical structure of the organization of government, a defect at a higher level will have a multiplier effect all the way down the lower levels of the hierarchy. Any defect detected must therefore be traced to the originating level and dealt with there. The argument that has been developed in this presentation is that the deficiencies in management practice at the sectoral or micro level stem from having an inappropriate public administration system at the macro level. The following are some suggestions towards finding a solution:

(a) To Administer or to Manage?

The term 'administration' refers to the act of carrying out orders, edicts, or decrees determined elsewhere in a regulated and formalistic manner. The actor has no input into the content of the matter to be administered. 'Management' on the other hand, provides for the intervention of the actor in terms of his knowledge, skill, and experience in determining the outcome of whatever is being managed. The 'public administration system' provides a service for the execution and implementation of the business of government. That business, in the context of the PINs, is predominantly to manage the process of development and modernization. The 'public administration system' therefore should be built upon a theme: 'to manage' rather than 'to administer' — 'Public Management' rather than 'Public Administration.'

(b) Organization of the Public Management System

This will need careful research and study. Essentially the system should promote government policy for development, be less formalistic and more dynamic. The notion of an independent public

service may no longer be relevant in an environment where there are increasing calls for an inter-disciplinary and integrated approach at policy formulation and problem solving. The notion of a 'central guidance cluster' as a model for the organization of the public management system should be carefully investigated.

(c) Attitudinal Change towards Aid

If foreign aid becomes the only hope for a means of effecting change and development, it will not help to have to contend with an aid-dependency complex. People's attitudes must change so that they value 'aid' as their own hard and duly earned property. The rhetoric of colonialism may be a thing of the past, but the reality of its legacies is something that should never be forgotten.

(d) Research and Extension

Any good intention will be reduced to waste if the intended target is unprepared or unable to comprehend the intention. Approaches and methodologies of development devised outside the region may not fit comfortably within the cultures of the Pacific societies. Research and extension approaches must not attempt to alienate Pacific societies indiscriminately from their values and traditions. Continuing education and public awareness programs must be given high priority in any attempt to bring the benefits of research and extension to bear on the development efforts of the community.

(e) Management and Culture

The culture of modern management practice is founded on the traditions and values of developed, industrialized, generally capitalistic society. To a large extent it tends to conflict with the values and practices of socialistic, communal Pacific Island societies. The PINs need to be aware that unquestioning acceptance of change and development may well lead to their annihilation as a cultural entity. They have the choice of molding a mode of managing their development to suit their environment or facing the prospect of total alienation from it.

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WHAT IS SPECIAL ABOUT AGRICULTURAL RESEARCH MANAGEMENT IN GENERAL AND IN THE SOUTH PACIFIC CONTEXT?

Paul Bennell
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P. Bennell spent two sessions discussing with participants two fundamental questions:

1. What is special about agricultural research management?

2. What is special about agricultural research management in the South Pacific?

These questions have to be carefully answered so that the functions and skill requirements for research managers in the region can be clearly and precisely specified and, where necessary, special training provided.

Effective research requires that the following seven critical interrelated processes are undertaken:

1. Translating priority problem areas into relevant, researchable questions and feasible projects.

2. Mobilizing and effectively utilizing the needed financial resources.

3. Developing and maintaining a physical infrastructure.

4. Developing and maintaining a critical mass of well-qualified scientific personnel.

5. Taking advantage of all scientific capabilities at the national and international levels.

6. Assuring the flow of information between research and extension workers, farmers, policy-makers, and the public.

7. Monitoring and evaluating program implementation.

There are six corresponding management functions: planning and programming; monitoring and evaluation; management of financial resources; management of physical resources; management of human resource; and communication and information. Each of these is alleged to have characteristic requirements which are special or unique to research institutions.

In the first session, the following topics were dealt with:

(i) *Planning and programming of research.* Even in small research systems or organizations the planning and programming of research is a highly complex activity involving the elaboration of research priorities and objectives and corresponding allocations of resources across disciplines, commodity and factor programs, and numerous geographical locations. Research products are often intangible (i.e. disembodied technology), often with long gestation periods and high levels of risk and uncertainty.

ii) *Human resources management.* Are there any distinctive attributes of agricultural research personnel? The extreme, archetypal view of the research scientist is of someone who is somewhat eccentric, egotistical, and a loner. Less extreme views still regard researchers as particularly valuing the following aspects of their profession: autonomy of institutions, freedom of work, creativity, originality, and intellectual honesty. The implications for the personnel management of research scientists are (1) conflicts between individual and organizational goals are likely to arise, especially in 'mission-oriented' research institutions; (2) control by management should be limited as much as possible in order to allow the necessary scientific autonomy. In general,

this means that a participatory, collegial style of management should be adopted. (3) It may be particularly difficult to get researchers to work collaboratively together, especially in formally constituted research teams.

(iii) *Research managers.* Research managers themselves are not usually professional managers with specialized training. In general, it is the most able and/or experienced researcher who is promoted into a senior management position but this does not necessarily mean that they have the motivation or the aptitude to undertake their managerial assignments effectively. Other alleged deficiencies of research managers are that they are often poor delegators and that they continue to be too wrapped up in the technical aspects of their job and thus too little concerned with the personal needs of their staff and their own interpersonal skills.

(iv) *Communication management.* The communication and information of research organizations are, it is commonly alleged, highly intensive. Effective 'linkage' relationships must be maintained with overseas research institutions, technology transfer and other agricultural institutions, and other training institutions, universities, politicians, policy makers, and farmers. It has been found that there are relatively very small numbers of individuals in research organizations who play key, but nonetheless, informal roles in facilitating the research organization's communications with the outside world. They act therefore as information 'gatekeepers.'

On the second question, what is special about agricultural research management in the South Pacific, a clear distinction was made between the developing country and very small island contexts. The following topics were discussed:

(i) *Size.* The fundamental problem facing agricultural research in small, geographically isolated states is the acute imbalance between research needs and research capacity. Research needs are considerable, especially when a wide range of agricultural commodities can or could be grown, as is typically the case. However, available resources for agricultural research, even in the most favourable policy environment, will never be large enough to justify a major agricultural research effort.

(ii) *Research planning and programming.* These are even more important in small countries given the very limited resources that are likely to be available. Establishing control and continuity over the planning process is often particularly difficult with high levels of donor involvement. The need for regional or international research activities also considerably complicates research planning.

(iii) *Human resources management.* Small islands tend to have personalized administrations strongly marked by local cultural attitudes towards, *inter alia*, authority, leadership, cooperation/conflict resolution, communication, achievement, and motivation. The impact of isolation and small size on job satisfaction, staff morale, long-term career progression, and, more generally, the type of researcher required is central to the human resources management function for agricultural research in small island countries.

(iv) *Financial resources management.* As in other developing countries, agricultural research organizations in the South Pacific suffer from inadequate operating budgets coupled with erratic, unpredictable release of funds. This seriously undermines the effectiveness of the overall research effort. There is a general lack of professional accounting expertise.

(v) *Communication and information.* This is particularly critical in the small island context given the greater reliance on overseas organizations and the very close links with technology transfer activities.

THE FUTURE ROLE OF AGRICULTURAL RESEARCH IN THE SOUTH PACIFIC

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In 1979 the Asian Development Bank's first South Pacific Agricultural Survey provided an overview of the state of agriculture in the Pacific Islands (Ward and Proctor, 1980). Although not all island states were members of the Bank (and thus some countries, e.g. Tuvalu and Vanuatu, were not included) I believe that the coverage in the study was reasonably thorough. As it was the first such survey conducted by the Bank (or indeed any agency) for the Pacific Islands, a considerable amount of information was included on the context in which farming occurs in this region. This paper also puts emphasis on contextual topics, firstly because a number of the matters which might be included under the paper's title are considered elsewhere in this volume. Secondly, in the last eight years there have been important changes in some of the conditions under which agriculture is practiced. Thirdly, new research material is now available which suggests that some assumptions often made about the social and cultural context of Pacific Island agriculture and agricultural research are, quite simply, wrong.

The main points made by the South Pacific Agricultural Survey report in relation to research need to be included:

- lack of access to technical and commercial information, with the exception of Fiji and Papua New Guinea;
- emphasis given locally to adaptive research but without sufficient basic research, or the facilities to do it;
- little appreciation among decision-makers of the very high potential benefits which might accrue from basic genetic research on root crops;
- lack of maintenance of important plant collections (and loss of some);
- little attempt to adapt research to the environment and agronomic practices which subsistence farmers often used – such as utilization of steep slopes and gardens with mixed species and mixed varieties;
- abandonment of research on (and the practice of) soil conservation;
- limited work on plant pathology;
- limited work on post-harvest technology.

The report argued that 'a strong case exists for the establishment of an international (crop) research institution ... to carry out basic research on plants of major importance to agriculture in this particular environment' (Ward and Proctor, 1980: p. 452). It was argued that individually, or even collectively, the Pacific Island states could not fund such an institution from their own resources and that an internationally funded institution was necessary, which 'would offer a high level of technical, scientific service to the region.' Preservation of germplasm, work on genetics, plant physiology, pathology, and chemistry, the study and improvement on multispecies and multivariety agricultural systems, and so on would be undertaken. National departments would be provided with information and materials to carry out the adaptive and extension work. A regional quarantine station was also needed.

The key point stressed in the report was that modern agriculture must rest on the findings of high-quality research in the fields of plant genetics and pathology, farm systems, economics, and marketing. The role of research is to provide the base on which development

can be encouraged and extension carried out. Without such a sound research base, the practitioners in agriculture are reduced to making minor changes — no fundamental improvements will be possible. And in the Pacific Islands this will be fatal for the agricultural sector.

Our proposal for an international research institution obviously did not come to fruition in the form proposed. I still feel that is unfortunate. However, the absence of an institute of the type envisaged has been partly compensated for by the development of new institutions or the maintenance or expansion of existing ones (national and international) to undertake some of the work envisaged. In the first place, the University of the South Pacific Faculty of Agriculture and the Institute for Research, Extension and Training in Agriculture (IRETA) at Alafua now have considerably greater research capacity than eight years ago. The Australian Council for International Agricultural Research (ACIAR) has provided access to facilities and skills through collaborative arrangements. Aid programs, such as the USAID-sponsored South Pacific Region Agricultural Development Project have made professional resources available. The Institut de Recherche pour les Huiles et Oleagineaux (IRHO) research station in Vanuatu has become a 'facility of global significance' for work on coconuts (Foale, 1987: p. 7). Some national institutions in the region (for example, in Solomon Islands and Fiji) have been able to do important work in plant pathology and have improved facilities for work on tissue culture. It might therefore be argued that a major regional institution was not necessary.

In my view, however, the resources available are still insufficient. There is a case for a general review of regional needs, to identify the key requirements, select priorities, and assess the extent to which the existing institutions can meet medium-term needs. A significant increase in their resources will be needed to meet the shortfall. The aim should be to get a considerable increment in the resources being devoted to basic research of benefit to the region, to reduce the present duplication, and to ensure that the research is applied to top-priority problems. Unfortunately there may still remain too much of a parochial attitude in the region. Certainly this was noted in 1987 by an FEC consultant, who went on to say that there had been a 'complete lack of response in all countries to the invitation that suggestions be made for regional schemes.' The only proposals came from IRETA, IRD, SPC, and IRHO (Yates, 1987: p. 29). There is a need (as there was before IRRI was established) for high-level independent advice on what might be possible and where the biggest returns are likely to be.

Research Needs

It is clear that great scope exists for research on germplasm collections and the genetics of a number of important Pacific Island crops. The work now being done on taro, for example, is a start. But the case of the Pacific Island banana industry is a good example of the need. In 1958, Western Samoa exported about 30,000 tonnes of bananas worth $2,000,000 to New Zealand; in 1986 none. In today's New Zealand dollars, the 1958 exports would be worth about $16,000,000. The collapse was due primarily to bunchy top and black leaf streak, though transport problems also contributed. For other former main producers (Cook Islands, Fiji, Tonga, Niue), black leaf streak, bunchy top, nematodes, weevil borer, and scab-moth are major problems (Fullerton, 1987). Control by pesticides is expensive and, in the smallholder system, difficult to organize and hard to apply with safety. On the marketing side, the Pacific Island varieties of banana are now seen as less attractive than the varieties imported from Ecuador or the Philippines.

Unless alternative varieties can be introduced and disease resistance improved it seems unlikely that the Pacific Island industry will ever recover (e.g. Foure, 1987). Bananas could be Samoa's second or third most valuable export again but, as the experience of Tanumalula plantation shows, not without prior research and continued research support. The same is true for other Pacific Island countries. One year ago ACIAR, in conjunction with the International Network for the Improvement of Banana and Plantain (INIBAP), held an international workshop in Cairns, Australia on *Banana and Plantain Breeding Strategies* (Persley and De Langhe, 1987). The participants came from every continent — but no speaker came from the Pacific Islands (unless New Zealand is included in 'Pacific Islands'). The proceedings are very informative. The priority research areas identified are precisely those the Pacific Islands need, but there is no significant Pacific Island presence in the field. If major advances are made elsewhere, one may ask where the region will be equipped to deal with the quarantine and other difficulties involved in the safe exchange of germplasm. The coconut industry is somewhat better served, but the appearance of cadang cadang in the Solomon Islands may herald a major challenge. The Western Samoa cocoa industry has been in difficulties for years. In Papua New Guinea one may ask how well equipped

were the country's basic research resources to deal with the appearance of coffee rust in 1986? I venture to suggest that the only major crop in the Pacific Islands which is really well served with a basic research input is sugar cane in Fiji, and that is essentially a private sector operation concentrated in one country. My conclusion is that despite the excellent work now being done at Alafua and the other centers, neither the crop nor the country coverage is anywhere near sufficient.

In general terms the point made above also applies to work on root crops. Although some are exported, most of the production is for home consumption, and I think it necessary to comment on the context in which root crops are now grown in the Pacific Islands as this should influence future research directions. However, the possible use of root crops as industrial crops should not be overlooked. For example, can the special properties of taro starch be exploited? Can post-harvest techniques improve keeping qualities, transportability, or marketing qualities?

The importance of the subsistence sector in Pacific Island agriculture is accepted by everyone, although we should not ignore the exceptions, such as Nauru, Majuro, or Tahiti and those areas where the nonfarm economy dominates. Much of the case for increased research on root crops stems from the role and nature of the subsistence sector. First, in many island areas labour rather than land is the factor which is in short supply. Planners often assume the opposite. Root crops under various systems of shifting cultivation give high returns per unit of labor input even if returns to total area, including fallow, may be low. If expansion of cash cropping is to go hand in hand with maintaining subsistence output, research on plant varieties and on farming systems will be vital but will need to take account of the need to maintain, or indeed increase, the returns per unit of labor input. If attempts are made solely (or primarily) to meet the parallel need to increase production per unit of land, I fear the effort may be counterproductive. In the eastern Pacific, the alternatives of emigration (temporary or permanent) and public service or aid-related employment place agricultural labor, even for subsistence, on the edge of acceptability, and higher labor demands relative to output will make the problem worse.

Secondly, production for household consumption is still organized in ways closely related to the core of traditional society, beliefs, and customs. It is the basis of, and in some cases provides the real legitimacy for, traditional systems of authority. Thus policies which seek to introduce new agricultural systems may meet resistance or simply be ignored as socially unacceptable. Alternatively, new technology or new farming systems may be adopted, and have been adopted, without recognition that this will in fact destroy the basis of customary authority and bring major sociopolitical changes. This situation argues for a strong sociological component in any farm systems research. It also suggests that a close examination should be made of existing systems with an eye to modification rather than replacement. Although a considerable number of agricultural systems have been described, the necessary detail and identification of key elements (such as planting sequences, varietal choice, soil preparation techniques) is often lacking. Given the great variety in Pacific Island cropping systems, this is a serious gap. Thirdly, it must be recognized that there is often a gap between what is assumed to go in village agriculture, and what actually happens. This is true even within the island countries themselves, in part because the flow of information from bottom to top is weak against a gradient of status and political power.

It is commonly assumed that traditional Pacific Island agricultural systems are variants of shifting cultivation, or swidden, systems. At a time when land shortages and the need to shorten fallow periods are increasingly evident, it would be instructive to examine in detail those indigenous systems which entailed permanent or near permanent cropping systems. These include complex planting sequences and intercultivation systems: the use of composting techniques in the Enga Province of the PNG highlands or on Tikopia; the creation, mulching, and maintenance of taro beds in swampland from the southern Cook Islands right across through the lower Rewa River Delta of Fiji to Frederik Hendrik Island in southern Iraian Jaya; the irrigated taro terrace of new Caledonia, Vanuatu, Rarotonga, Fiji, and elsewhere. The process of disintensification of agriculture, which has occurred throughout the Pacific Islands in this century, has often been overlooked. What we see today is often an impoverished version of traditional subsistence systems. The more complex elements would be worth intensive study to assess their applicability or adaptability in today's conditions. They may have much more relevance and acceptability than new crops and new cultivation practices. We now have evidence that the highlands of Papua New Guinea had complex agricultural systems earlier than those known in any other part of the world. Perhaps we should look more closely in our own region for old techniques which could be used anew.

In a great deal of the writing of consultants, agricultural researchers, and academics, the general failure of

Pacific Island smallholders to increase, or even maintain, levels of cash crop production is blamed on the so-called 'traditional' land tenure systems. Other causes often cited are the supposedly limited cash requirements of islanders stemming from 'subsistence affluence,' the 'backward sloping supply curve,' or target production attitudes. Others include the disincentives inherent in communal village life with its supposedly widespread redistribution of income through customary obligations. Although there has been, and indeed still is, some sound basis for such ideas, they are no longer sufficient or even major explanations of the lagging performance of smallholder farming in many areas. There is not time to argue this in detail but the evidence includes work in Fiji showing that individualization of land tenure in Fijian villages has progressed rapidly — both through use of formal leaseholds, and the exploitation of traditional mechanisms to keep land securely in individual or household hands for long periods (Ward, 1986). It includes the recent work of O'Meara in Western Samoa, which shows that in a number of villages (both remote and accessible) two systems of tenure now operate with the new or modified system now dominant (e.g. in the villages of Malie, Vaega, and Neiafu). In the modified system land is in fact held and inherited on an individual basis regardless of the *matai* title. In Vaega nearly two-thirds of the village's plots are held by individuals and are considered to be directly inheritable by children (O'Meara, 1986: p. 126-129). In Vanuatau, Rodman (1984) has pointed to individualisation of communal land and many examples have been noted in Papua New Guinea. Tonga, of course, individualized its land tenure long ago. The traditional ways are still the ideal, but the realities are very different and it is difficult to argue that insecurity of tenure is a major problem.

Similarly dramatic changes have taken place in the way labour is mobilized — now less and less through kinship groups and more and more for wages or on nonkinship lines. Returns from farming are now distributed more narrowly within the community. Communal obligations are observed less frequently at the expense of commercial imperatives.

The argument that the villagers' need for cash is limited, and hence agricultural output for cash is low, rings hollow in the face of the popularity of urban or rural nonfarm wage jobs, or migration to New Zealand, the USA, or Australia.

Explanations for poor performance need to be found elsewhere. There is growing evidence that the key problem in recent years — except where plant disease (as in the banana industry) has been the main difficulty — lies in the economics of smallholder production. At the level of returns received, many growers in Polynesia have concluded that cash crop farming is simply not worth the effort put into it.

There is no need to stress that world market prices have been low in recent years. If political arrangements such as the Lome Convention or the Stabex scheme were to fail, Pacific Island agriculture and economies would be devastated. Thus political alliances to maintain such favorable arrangements may be more important than improved agricultural technology. But at the level of the village producer even these assisted prices give very low returns. O'Meara has provided very interesting data for Western Samoa. In 1983, compared with a national minimum daily wage of $WS4.00, also paid in the village for casual labor, copra production returned on average only $WS 2.17 per day of labor (O'Meara, unpub.). He calculated the value of the marginal product of labor in copra production to be $WS 1.78, less than half the local wage rate. People obviously do want the money — and if they cannot find any other source, they will grow coconuts and produce copra. But this is a last resort, used to earn what is obviously essential and little more. There is very little incentive to go beyond that minimum. I believe that a lot more detailed research is needed at the microeconomic level to clarify what is considered worthwhile and what is not, and how growers react to price changes. Too often we have pushed products which simply are not financially attractive in terms of labor inputs. Products of research which require increased labour inputs may not be accepted unless the increment in output is large. The ACIAR-supported Smallholder Farming Systems project of the University of New England will provide valuable data in this field but is only a start (Hardaker and Fleming, 1986).

Land Research

In stressing the importance of scarcity of labor, I do not underestimate the increasing problem of land shortages. In Viti Levu, Fiji, the 20 years 1958-1978 saw the proportion of the island which was in use rise from 10.4% to 34.7%. With 67% of the island having slopes of over 18° and being largely unsuited to agriculture, there is obviously very little high-quality land now available for new farm development (Ward, 1985). The same is true in most of Polynesia. Intensification is obviously necessary. The clearance of forestland for agriculture or pastoral farming has proceeded apace in many areas.

Aerial photographs allow this process to be mapped in some countries, including Western Samoa. In southwest Upolu the process can be illustrated in the village of

Sa'anapu, starting with cleared area in 1942, the land cleared between 1942 and 1956, and between 1956 and 1970. By 1970 the cleared land reached an elevation of almost 400 meters and the uncleared forest, still being felled for food gardens, covered soils which were classified as 'shallow stony soils' of restricted use which 'should be placed in forest reserve.' (Wright, 1963)

Among developing countries, several of the Pacific Island states are extraordinarily well provided with environmental surveys — soils and land use in particular. Fiji and Western Samoa are probably the most fortunate. But it is nevertheless true that for effective regional planning and agricultural planning the material is not well coordinated. One important research task would be to put these data into a form in which they could be readily used for agricultural development planning. At present there is a tendency to ignore the data available or to replicate surveys needlessly.

It is also necessary to point out that not all the resource surveys, and particularly their attempts at land classification, are suitable for local conditions. When 70% of the population of Chimbu Province, PNG, is successfully depending on sweet potatoes grown on slopes of over 20° (Bleeker, Kerg and McAlpine, 1984) which would normally be considered 'unsuitable for cropping,' the need for caution in accepting existing surveys is obvious. This suggests another field for further investigation. Perhaps much of the farming system research done for sweet potatoes and other root crops should be carried out quite deliberately on steep slopes to ensure relevance for the likely farmers. Obviously this does not apply in countries such as Tonga, but parallel comments can be made about any farm system research directed at other difficult environments such as those of the atoll countries. In the latter the needs are for much more research on soil improvement (including the identification of techniques used elsewhere in the region) and for ways of enriching the range of fruit and nut trees used — including high-value specialty products for elite markets, for example, heart of palm or products derived from pandanus fruit.

Agroforestry

Pacific Island subsistence agricultural systems were usually integrated agroforestry systems. The importance of tree products — fibre, food, and materials — has tended to be overlooked in our 'agricultural' research. Given the particular and difficult environments of steep slopes and difficult soils in the islands, it is time that much more attention was paid to the tree side of the system. There is considerable scope for agroforestry systems in the smallholder scale in both subsistence and commercial components. The range of foodstuffs from trees drawn from the local area has been reduced, in part, by the directions taken in agricultural extension. This trend should be reversed by a deliberate research and policy effort.

A final question is, who will do the research? Much of the basic research will have to be done initially by nonnationals but this should be only a temporary solution. There is a need for strong research training in both natural and social sciences and for the establishment of good national or regional career structures for Pacific Islanders staffing their own high-quality, high-level regional research institutions.

Summary

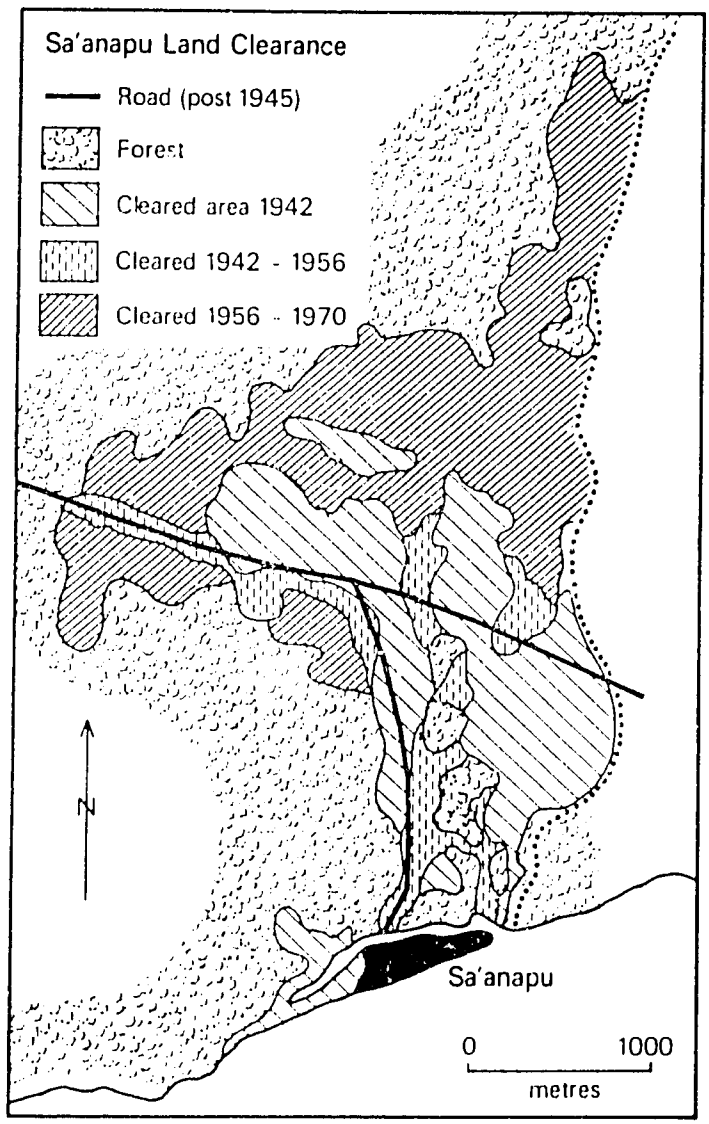
In both commercial and subsistence sectors there is a need for a much larger input in basic research — otherwise the adaptive research and the extension services will have nothing with which to work. The current lack is resources — equipment, buildings, and skilled personnel. The handfuls of people working on atoll agricultural problems, or on germplasm collections, tissue culture, or plant pathology are far too small. Investment in research can have a very high, favorable cost-benefit ratio, provided that the right fundamental problems are attacked and training of research and extension staff goes along in step.

The orientation of much of the research needs to take account of the fact that, in contrast to the situation in many developing countries, labor for agriculture is in short supply. This must influence the direction of the work on farming systems.

The assumptions of social and tenurial constraints on agricultural production need to be revised and more work done on the microeconomics of smallholder farming and on the sociology of the rural Pacific.

The basic environmental information needed for rural planning is available in some countries but needs to be brought together in practical format. In other countries the data are still not available and baseline studies are needed, directed to practical application.

Marketing is not well handled in a number of countries, and existing marketing boards and other structures and policies need review. Some would argue that certain boards seem to exist for their own benefit rather than for


Sa'anapu Land Clearance
Road (post 1945)
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Cleared area 1942
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Cleared 1956 - 1970
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that of the producers. If the Pacific Islands are to be successful in penetrating the luxury markets of Japan, Europe, or North America, marketing, presentation, reliability, and quality are the keys. A great deal of work is necessary to get this right.

If resources for basic research are to be increased, they should be concentrated in one institution, with a high level of technical input in both natural science and social science. This would ensure the coordination of research endeavors and would facilitate quick dissemination of results to the region. I would now favor building on the bases available at Alafua with a network of national centers equipped to take the results and apply them in the local context.

Lastly, the agricultural sector must be seen in all its links to the local and national economy and society. For example, it is necessary to ensure that access to urban facilities is improved in parallel with rural programs the modern farmer needs this access just as much as the town worker. Far too much planning is done in the Pacific without consideration of the regional and social impact of projects and of the linkages between the primary, secondary, and tertiary sectors. Far too little research is being done to provide much hope that the serious difficulties of the Pacific's most important sector will be solved.

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UNDERSTANDING AND INFLUENCING THE POLICY ENVIRONMENT

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INTRODUCTION

I was asked to prepare a paper which would stimulate some reflection on what research managers can do to deal with the policy environment. I am putting forward some ideas with some hesitation since most NARS leaders have traditionally treated the policy environment as something that is fixed. I would like to treat the subject in three steps.

1. place the problem within the framework of the agricultural technology management system (ATMS);

2. discuss two tools which have been used at ISNAR for analyzing the ATMS: a functional analysis of the system (responsibility charting) and a policy analysis;

3. discuss some of the contributions that economic analysis can play in improving the policy environment.

With this introduction, it is hoped that we can have a fruitful exchange of ideas on what research managers can do to improve the policy environment and what is the appropriate collaboration that an organization such as ISNAR can provide.

A THREE-LEVEL ANALYSIS AND ITS ASSOCIATED TOOLS

The ATMS approach was developed first for use in Latin America, where the public sector had a pervasive impact on both the supply of and demand for agricultural technology. In many cases, however, the private sector has been emerging as an important force. In spite of this investment some systems have not been very productive. There arose competing theories of the evolution of technical change in Latin American agriculture, and this led to our three-stage analysis which could deal with all the issues they raised. These theories included

(a) induced innovation, which explained the development of inappropriate technology by incorrect market signals;

(b) structuralists, who emphasized the role of land distribution in producing biased technical change;

(c) political economists, stressing the role of special interest groups;

(d) monetarists, emphasizing incorrect exchange rates and pegged interest rates in inflationary situations;

(e) technological determinists, describing the role of external organizations and the international transfer of technology;

(f) institutionalists, focusing on management weaknesses within the research system.

All of these approaches emphasize different factors which affect the nature and quantity of improved technologies, both supplied by the agricultural research system and demanded by users of those technologies.

On the supply of technology side, the model looks at the system's research resources, component units, internal management, and its attempts to influence its environment. On the demand for technology side, the model postulates that the nature of technology that users of different classes request of the system is conditioned by a number of structural conditions and policy constraints that limit the range of options open to farmers. Some of these constraints, through improved technology management, may be changed.

The ATMS approach involves three levels of analysis which are logically linked to one another and iterative in their contribution to identifying opportunities to improve the system. It begins holistically but focuses rapidly on the key points of intervention, (a) at the system level, (b) at the institutional level, (c) at the commodity level. Information generated at each succeeding level is used to confirm hypotheses advanced at higher levels and will be available in the formulation of strategies for improvement in the technology management system.

Stage 1: The System-Level Analysis

The Stage 1 analysis is the most aggregative level and generates the information and hypotheses about the influence of key environmental variables, primarily the structural constraints and policy environment. It fully describes the system and its evolution. It includes the following tools and products:

Functional Analysis. Responsibility charts for key organizations in the ATMS providing a complete mapping of the system's structure and management mechanisms.

Events Analysis. Analysis of major policy, institutional, and technological events in the recent history of the system, providing a chronology of the system and interrelationship between policy, institutional, and technological events.

Policy Analysis. An assessment of key policies which affect the overall level of economic activity in the system, relative prices of factors and outputs and direct investments in the agricultural sector.

Stage 2: Institutional Analysis

The institutional analysis focuses only on the few key organizations within the system concerned with technology generation for agriculture. As a component of the ATMS, each organization can be approached (as a subsystem) in terms of its mandate, objectives, resources, and management of both its internal functions and outward linkages to its environment. In many ways, an ISNAR review of a national agricultural research institute concentrates on this level of analysis. The key functions the analysis looks at are

- problem identification;
- priority setting;
- obtaining adequate financial support;
- attracting and retaining human resources;
- developing and managing infrastructure;
- programming and executing research;
- managing linkages with the technological environment;
- monitoring and evaluating research;
- communicating results to clients and policy-makers.

It is at this level that we begin to look at the management issues that are basically under the control of the director of an institute (including the way he or she manages relationships with the broader ATMS).

Stage 3: Technology Performance Analysis: Case Studies and the Interventions Opportunity Matrix

This third level of analysis brings us to the disaggregated level of the individual commodity and an attempt to assess the impact of technology management activities related to one crop. A number of case studies on carefully selected commodities are carried out using an integrating framework which we called the 'Interventions Opportunity Matrix' (IOM). At its simplest, this is a checklist of factors which positively influence or constrain the path of technological change at the level of the individual commodity. In its more complex form, one can attempt to quantify the variables.

It is at the level of the individual commodity that hypotheses about the adequacy of resources, management, or the impact of external factors are confirmed or disproved. It is, for example, quite conceivable that a system which in the aggregate is underfinanced and understaffed may manage to give stable funding and allocate its best scientists continuously to its most important commodity, in which it is achieving an impact.

For each selected commodity, covering the principal food, export, and industrial crops, a number of technological events are studied in detail. The impact on production is estimated and each factor is assessed as having contributed positively or negatively to the production impact.

Looking across the range of technological innovations and commodities, one can see the extent to which research resources, management, farm level constraints, structural conditions, and the policy environment have been constraints on or contributors to success in generating and diffusing improved technology.

THE STAGE 1 (SYSTEM-LEVEL) ANALYSIS AND STRATEGIC PLANNING

In this paper we now concentrate on the role of the Stage 1 analysis in generating hypotheses about system-level constraints and in providing the information required to assess alternative proposals for improving the overall agricultural technology management system.

The strategic planning process involves three steps:

1. an assessment of the present scenario and its critical problems;
2. the generation of a range of alternative solutions from which a preferred scenario is chosen;
3. the establishment of the action program and choice among the strategic options for implementation.

In many cases, the strategic planning process is faulty because action-oriented managers jump from the problem to action without considering the range of alternative scenarios. The tools developed in the ATMS approach lend themselves well to steps 1 and 2 of the process and consequently help ensure that a range of alternatives is considered before choosing the preferred scenario. In this case, we will be interested in looking at the functions of influencing resource allocation in the agricultural sector and influencing the macroeconomic environment and the ways the system might be improved.

The Functional Analysis and Responsibility Charting

The mapping of the ATMS is carried out using a modified form of a project management tool called a responsibility chart. The responsibility chart identifies all relevant actors in a particular project, describes their role, and determines the level of responsibility that they have with respect to a particular function (e.g. 'makes final decision,' 'must be consulted'). In applying this tool to the ATMS, we identify the key organizations or classes of participants, describe their principal mandates and place within the system, and assess their level of participation in each of 13 key functions that the system must be able to perform (or at least influence in its own behalf). Having determined the level of participation, we describe the mechanism by which the organization participates in the function.

The thirteen key functions of the ATMS are

1. define macroeconomic strategy;
2. determine the intersectoral allocation of resources;
3. develop human resources for the agricultural sector;
4. generate domestic political support for agricultural research;
5. generate external support for research;
6. set clear goals for the agricultural sector;
7. allocate resources within the agricultural sector;
8. determine agricultural research strategies;
9. generate and assess technology;
10. transfer technology;
11. provide support service to technology adoption;
12. evaluate the impact of technology development efforts;
13. ensure the marketing and use of the product.

All of these functions can be associated with the various resource, management, and external variables discussed above.

We can illustrate this with a responsibility chart from the case study of Panama. Table 1 shows the responsibility chart for the function of 'generating technology' (one of the 13 functions described).

The responsibility chart provides three ways of looking at a system:

- the 'structural' (number of organizations involved in the system and their mandates);
- the 'functional' (the critical functions of the system and how they are carried out);
- the 'operational' (the mechanisms that are used to perform these functions.

The concentrated technology-generating sector contrasts with the fragmented and overlapping activities of various organizations performing the technology transfer function, which grew in the vacuum created by the abolition of the extension service during the reform in the late 1960s.

There are three principal advantages of constructing responsibility charts:

Table 1: Panama: *Responsibility Chart: Generation of Technology*

INSTITUTION	ROLE	MECHANISM TO PARTICIPATE IN TECHNOLOGY GENERATION
MIDA	coordinate	overview of agricultural sector
MIPPE	none	none
Legislature	finance	none
ORP	none	none
CAN	none	none
CAR	none	none
CAL	none	none
Crop Commiss.	none	none
BID	none	none
USAID	finance	support IDIAP, previous support to FAUP
CHD	finance	technical assistance in dual-purpose livestock
HCA	none	none in generating sector
World Bank	none	none
IMF	none	none
IDIAP	decide/exec.	on-station and on-farm research
FAUP	execute	research stations, on-farm research
CIMMYT	execute	provide germplasm, research methodology, IDIAP/FAUP
CIAT	partic.	CIAT approach: germplasm for acid soils strategy
CATIE	partic.	rice farming systems Baru, technical assistance
CIP	execute	research on station, support to PRECODEPA
Rutgers	partic.	Rutgers staff in onions, potatoes, pastures, cattle
ISNAR	partic.	nascent collaboration in economic studies
Chemonics	none	none
SENEAGRO	partic.	proposed role in farm-level trials; validation
BDA	partic.	BDA gerente is member IDIAP Junta Directiva
BNP	none	none
Private Banks	none	none
ENASEM	none	none
Seed Companies	none	none
Input Suppliers	none	none
ANDIA	none	none
COAGRO	none	none
IMA	none	none
ISA	none	none
ENDEMA	none	should be linked to IDIAP for mechanization
IPACOOP	none	none
Pioneer Seed	execute	hybrid seed produced for sale in Latin America
Citricos	execute	abandoned disease research, 4-ha varietal trials
Nestle	partic.	provide land and labor to test IDIAP material
United Brands	execute	research on station with production interest
Corp Bayano	none	none
SONA	partic.	field level of trials of technology
ANAGAN	none	none
CONAC	partic.	some asentamientos collaborate in on-farm trials
Arroceros	finance	rice tax partially allocated to research
Low-Income Farm	partic.	on-farm trials in IDIAP/FAUP programs
Small Farmers	partic.	on-farm testing of IDIAP/FAUP material
Large Farmers	none	none
Asentamientos	partic.	on-farm testing on some asentamientos
Molineros	none	none

1. they make very explicit the hypotheses about the role and behavior of institutions within and outside of their principal mandate areas;

2. they point out the presence of superfluous institutions or the absence of essential actors with respect to each function;

3. they help suggest alternatives for improvement of a structural nature (combine institutions, create new ones) or of a managerial nature (strengthen the mechanisms for performing the function through more resources, additional meetings, more permanence of staff, etc.).

It is in this respect that the information helps lay out the range of alternatives from which a preferred scenario is chosen.

With respect to the Panamanian ATMS, we identified several critical weaknesses:

- few agricultural institutions influence agricultural policy;
- the system is complex and fragmented;
- there is an absence of mechanisms for establishing policy;
- real coordinating structures are different from the formal ones;
- external assistance is uncoordinated;
- system is isolated from domestic support;
- fragmentation leads to some duplication, and even contradiction, in the messages reaching farmers.

From these observations, hypotheses about alternative structural and management improvements were formulated, carefully taking account of the target farmers to be served and the historical fact of autonomy among the various parastatals involved in the sector. This history limits the degree of centralized direction that the system will permit.

The Policy Analysis

The third tool in the Stage I analysis looks at the implications of key macro policies for the agricultural sector. The technique is to identify those policies that affect the *level* of economic activity, *relative prices* of agricultural inputs, factors of production and outputs, and which reflect key policy decisions for *direct investment* in technology generation and transfer.

The key variables that operate at the macro level are obviously the exchange rate and the level of government involvement in the sector. Policies influencing the real cost of imported chemicals and equipment, the wage rate and the real rate of interest will influence the nature of technology demanded.

Table 2 shows the key policy variables that were seen to be important in the case of Panama. The analysis identifies the policy and assesses its impact on the agricultural sector. At the same time, it explains the reasons why such a policy exists (often to serve interests outside the agricultural sector). By recognizing that some policies are unlikely to be changed in order to facilitate the generation and diffusion of improved technology, one can avoid recommendations that would never be implemented.

In table 2, we can see, for example, that the use of the US dollar serves a variety of interests and has serious implications for the agricultural sector. In particular, it means that agriculture would have to attain US levels of productivity (a considerable challenge for research) or the country would have to live permanently with a system of compensatory import restrictions and export subsidies. It is clear that this is one policy that will never be changed in order to benefit the agricultural sector. Therefore, research strategy must take into account the relevant alternatives. In similar fashion, the way in which government intervention in the market is organized permits the appropriation of benefits by particular interest groups. If this is considered undesirable, mechanisms will be required to direct the benefits towards those the interventions are supposed to serve.

We have looked at the way that broad macro policies may be constraints on the agricultural sector. The purpose is not to argue that agricultural research has to take over the task of the ministry of finance or planning, but to indicate that there are a number of policies that affect the type of technology that the system will be asked to produce, and the research sector should be able to influence these decisions. A change in some of these policies may be required for the long-run benefit of the society.

We have also put forward a way of looking at the structures and mechanisms that are responsible for the maintenance of these policies. In the next section we look at the role that better economic analysis within the research system can play in influencing the policy environment.

Table 2: *Panama: Implications of Key Macro Policies for the Agricultural Sector*

POLICY	INTENTION OF POLICY	IMPLICATIONS OF POLICY FOR AGRICULTURE
Use of US dollars as currency	Stability of exchange rate, facilitates international service economy, self-generated inflation impossible.	1. overvaluation of dollar hurts export and import substitution; 2. facilitates importation American chemicals, equipment; 3. exchange rate offers no protection from American producers; 4. compensating measures required for agriculture 5. research essential to attain U.S. levels of productivity.
Reaction in budget deficit	Containment of government expenditures on bureaucracy.	1. compression of government budgets for public agricultural sector; 2. makes recruitment of new research staff difficult; 3. budget cuts may tend to fall on operating budgets rather than personnel.
Liquidation of state-owned enterprises	1. reduce budget deficit; 2. liberate investment funds for other purposes	1. closing of sugar mills; 2. review of Citricos de Chiriqui; 3. refrain from creating new public enterprises.
Revise labor legislation	1. social policies of 1970 gave Panama high labor costs; 2. less favorable interpretation of labor code; 3. facilitate the structural adjustment processes	1. power of unions in agricultural industries may be reduced; 2. restrictive practices in food industries may be lightened (e.g. milk, tomatoes, bananas); 3. more flexible hiring and firing practices may generate more employment.
Reinterpret Agricultural Incentives Law	1. progressive dismantling of protection by quotas; 2. self-sufficiency must be at world prices.	1. privileged situation of certain crops will be reduced; 2. increased emphasis on cost-reducing technology; 3. increased attention to nontraditional exports.
Revise incentives to agricultural capital	1. reduce credit subsidy for agriculture; 2. review tax exemption for imported equipment and inputs.	1. exchange rate and import legislation favored over capitalization of agriculture; 2. research oriented towards meeting needs of mechanized farmers.
Expenditure on agriculture	1. relatively high expenditure on agriculture in relation to Agricultural Value Added.	1. high expenditure ratio due to relatively small sector; 2. expenditure has not produced high productivity; 3. expenditure in form of subsidies, bureaucracy, and enterprises; 4. reform of expenditure pattern sought by donors.
Creation of Science and Technology Unit, MIPPE	1. defence of research as necessary function; 2. monitoring of resources devoted to research.	1. recognition that science and technology research is necessary; 2. recognition of need to coordinate research policy among sectors; 3. forum for debate of agriculture versus other sectors.
Credit policy	1. public sector credit small portion total; 2. differentiated clientele.	1. public credit targeted to small and medium farmers; 2. donors have favored specialized credit; 3. private banks select prime customers; 4. government use of credit as means of directing production is weak tool.

The Role of Economic Analysis

Improved economic analysis of research can aid in two ways:

1. justifying increased allocations of resources to the research sector,

2. identifying serious policy errors that affect research's ability to contribute to development.

I would now like to discuss the different types of allocative decisions that have to be made and comment on the different attempts that have been made by research system analysis to deal with them in more scientific or rigorous fashion.

For convenience we look at three levels of decision-making in the ATM system. The highest level is the interministerial level at which the decision on the amount of resources allocated to the agricultural sector is made. It is not always the case that the minister of agriculture or the minister of scientific research is strong relative to other ministries. One of the concerns of the economist working in the research system is to provide him with the information and justifications he needs to increase the political commitment to agricultural research.

At ISNAR we do not attempt to be leaders in the policy field, but we do want to understand the basis on which broad allocations of funds to agriculture are made. Direct comparison of the levels of investment in research countries and analysis of the determinants of the level of research investment are two approaches we are currently using at ISNAR to deal with this issue.

The second level is the level of strategic planning within the ministry of agriculture or other coordinating body to which a block of resources will have been given. This is the process by which national development objectives and client needs are translated into a set of research objectives and priorities based on carefully delineated programs by commodity, region, factor, or research area. This leads to a broad allocation of present and intended future resources to these programs. This decision-making usually takes place in the ministry of agriculture, the agricultural research council, or ministry of scientific research.

The productivity of agricultural research is often poorly understood at the national planning level. Research is necessarily of a long-term nature and uncertain outcome. Moreover, the output of research is a potential for production increases; the chain of intervening policies between success at the research level and success in production make it difficult to ensure that there will be an impact on production. In such a case politicians may be excused if they prefer activities with an immediate payoff.

Economists have attempted to provide policy-makers with two ways of judging the adequacy of their investment in research. One is an input measure and the other is a measure of the productivity of agricultural research. The World Bank Sector Policy Paper (1981) establishes a target level of investment in 1990 as follows:

> 'In a number of countries, national research programs are weak and, therefore, not able to adapt fully and utilize technologies being developed by the international research community. A rational allocation of financial resources for research on a global basis requires substantial increases in funds to strengthen national programs and to complement any further expansion of the international system. A desirable investment target for research for many countries with poorly developed agricultural research systems would be an annual expenditure (recurrent, plus capital) equivalent to about 2 percent of agricultural gross domestic product (AGDP).'

The Bank qualifies this target by noting, however, that the rate at which annual research expenditures can be increased and effectively utilized will depend on several factors, including the absolute size of the existing system, the availability of qualified technical staff, and the financial capability of a country to support a larger research effort.

Table 3 shows the expenditure for a sample of 67 market economy countries. The measurement of a country's effort relative to other 'similar' countries (or relative to the Bank's 'target') may provide some policy-makers with reason for concern that they are not up to the 'norm.' It is not, however, a very powerful indicator. A high expenditure may indicate a temporary inflow of donor funding which has distorted the picture or, conversely, describe a system bloated with unproductive functionaries. Therefore, any input measure should be supplemented with other measures such as the ratio of scientists with advanced degrees relative to total university-level personnel or the level of operating funds per scientist.

Table 3: *67 Developing Market Economy Countries Classified in Order of 1980 Expenditures on Agricultural Research as a Percentage of their Agricultural GDP*

COUNTRY	*GNP PER CAPITA US$*	*AGRICULTURAL RESEARCH EXPENDITURE 1980 '000 US$*	*% OF AGR GDP*
EXPENDITURE OVER 1% OF AGRICULTURAL GDP			
PANAMA	1,730	3,200	5.33
ZIMBABWE	630	10,560	2.42
GUYANA	570	2,428	1.85
ARGENTINA	2,390	166,330	1.64
MEXICO	2,090	172,402	1.36
BARBADOS	1,620	767	1.35
VENEZUELA	3,630	39,172	1.32
MALI	190	7,354	1.24
SENEGAL	480	9,797	1.21
KENYA	420	24,052	1.19
BRAZIL	2,050	245,000	1.15
CYPRUS	1,520	2,411	1.12
TOTAL		**683,483**	
EXPENDITURE BETWEEN 0.5 AND 1% OF AGRICULTURAL GDP			
FIJI	1,450	2,349	0.88
MALAYSIA	1,620	36,334	0.82
CHILE	2,150	10,353	0.81
BURUNDI	200	3,616	0.81
ZAMBIA	390	5,208	0.80
IVORY COAST	1,150	24,370	0.78
TOGO	410	1,892	0.76
MALAWI	230	4,562	0.75
NIGERIA	1,010	134,964	0.74
COLOMBIA	1,180	38,572	0.64
MOROCCO	900	19,981	0.62
LESOTHO	420	465	0.60
PAPUA NEW G	780	5,052	0.59
BENIN	310	2,403	0.59
URUGUAY	2,810	4,174	0.59
SUDAN	410	14,636	0.57
CHAD	120	1,602	0.56
TUNISIA	1,310	6,764	0.55
EL SALVADOR	660	4,974	0.50
TOTAL		**332,262**	
EXPENDITURE BETWEEN 0.25 AND 0.50% OF AGRICULTURAL GDP			
BANGLADESH	130	26,616	0.48
EGYPT	580	23,717	0.45
JORDAN	1,420	850	0.44
LIBYA	8,640	2,793	0.41
PAKISTAN	300	25,277	0.41
SRI LANKA	270	4,342	0.41
GUATEMALA	1,080	4,700	0.39
MADAGASCAR	350	4,801	0.39
TANZANIA	280	7,219	0.35
ECUADOR	1,270	6,436	0.35
BOLIVIA	570	2,808	0.34
INDIA	240	154,781	0.33
PERU	930	8,912	0.33
TURKEY	1,470	34,426	0.28
BURKINA FASO	274	1,105	0.28
PARAGUAY	1,300	3,100	0.28
NICARAGUA	740	1,999	0.27
THAILAND	670	23,276	0.26
INDONESIA	430	44,485	0.26
TOTAL		**381,743**	
EXPENDITURE UNDER 0.25% OF AGRICULTURAL GDP			
COSTA RICA	1,730	2,082	0.24
SYRIA	1,340	2,293	0.24
KOREA (REP)	1,520	29,031	0.23
JAMAICA	1,040	772	0.23
MAURITANIA	440	284	0.22
SIERRA LEONE	280	698	0.21
NEPAL	141	2,797	0.20
CAMEROON	670	3,788	0.20
DOMINICAN REP.	1,160	2,515	0.20
PHILIPPINES	690	16,254	0.20
ZAIRE	220	5,098	0.20
RWANDA	200	945	0.18
ETHIOPIA	140	3,400	0.18
GHANA	420	10,095	0.17
HONDURAS	560	978	0.16
LIBERIA	530	394	0.11
UGANDA	300	7,452	0.11
TOTAL		**91,876**	

ISNAR has been building a data base on national agricultural research systems which aims at obtaining comparable information on staff and research expenditures across countries and through time. Considerable effort is going into adjusting the figures so that meaningful comparisons can be made. A project currently under way seeks to analyze the determinants of a government's commitment to agricultural research. We hope to identify a set of macro variables which are systematically related to the level and orientation of agricultural research expenditures. From among the parameters which appear to influence agricultural development efforts, we can concentrate our attention on those that are subject to actions which will modify the 'policy environment' for agricultural research.

Low-income countries show low rates of investment in research relative to their agricultural GDP; we seek to understand how much of this is due to their fiscal weakness, the degree of commitment they have to farmers under different circumstances, and the factors determining the trends in funding that we are observing.

The Rate-of-Return Approach

Many studies have been done which attempt to measure the rate of return on past investments in agricultural research. Expenditures incurred in the past are presumed to have been made in expectation of future gains in productivity, either in increased output from the same factor inputs, or in the form of cost reductions to produce the same level of output.

Numerous studies have shown that investment in agricultural research has yielded consistently high internal rates of return. Usually these studies measure the reduction in unit costs produced by technological innovation and compare it with the costs of achieving that cost reduction.

One of the advantages of the rate-of-return approach is its ability to estimate separately the share of benefits which accrue to producers and consumers. From there it is a simple matter to introduce distributional considerations into planning. Technological change in basic foodstuffs will usually have the effect of lowering food prices, and lower income groups will benefit more. Scobie (1984) illustrates this with the case of two consuming groups, one very rich and one very poor, with known expenditures on wheat as shown in table 4 below.

Even though the richer group captures the largest amount of total benefits, the poorer group enjoys a larger percentage increase in its real income because of the larger percentage of their income that previously went to consumption of this commodity. Thus the goal of equity is served by selecting basic foods as a target of research and maximizing the net economic benefit from the use of scarce research resources.

Table 4: *Distribution of Gains from Cost Reduction in Production of Wheat*

	Poor Group	**Rich Group**
Number of people	100	100
Income per capita	5	50
Total income	500	5000
Amount spent on wheat	400	1000
Original price of wheat	10	10
New price of wheat	9	9
Cost of buying original quantity of wheat	360	900
Gain in income	40	100
Gain in income as percentage of original income	8%	2%

The rate of economic return studies have been criticized on several accounts:

- They have been carried out at too high a level of aggregation (e.g. hybrid maize in the US, rice in Japan, etc.) to provide a guide to future investment.
- They have been biased in favor of successful research projects and do not look at the agricultural research system as a whole.
- They have problems with data and do not separate out other important productivity-increasing factors or the effect of price distortions.
- Past productivity is not an indication that future investment will lead to the same high gains.

However, the rate of return approach remains attractive because

- Its treament of agricultural research as an investment is something that can be intuitively understood by planners and entrepreneurs who are used to making financial calculations.
- It can incorporate many of the other goals of society (employment generation, income distributional effects, and foreign exchange value) by the use of shadow prices which reflect the true scarcity of the factors or social value of gains to different groups.

This type of analysis brings out the third contribution that better economic analysis can make to improving the policy environment: helping governments avoid long-term errors in agricultural policy. It also presents a dilemma for the research manager. This can be illustrated by a case from CIMMYT.

CIMMYT has been a leader in applying a variant of economic return analyses based on the concept of comparative advantage. The analysis is aimed at both research resource managers and policy-makers. It provides a framework for assessing how the comparative advantage a region might have in the production of a given crop changes with changes in selected policy variables or with the introduction of new technologies. In particular, it permits the assessment of private profitability versus profitability to the nation and an analysis of the distortions introduced by taxes and subsidies.

The method attempts to identify the crops in which a country should be investing. The measure of comparative advantage is the domestic resource cost (DRC) of earning (or saving) one unit of foreign exchange through production of the commodity. In order to make DRC calculations, we need to know the foreign exchange value of the product, foreign exchange input costs, the domestic currency cost of production, and the opportunity cost of capital.

Applied to the case of Ecuador, the CIMMYT analysis elucidates an important dilemma faced by the research manager. A brief account of the case is in order.

During the oil boom in the mid 1970s, Ecuador experienced a rapid domestic inflation caused by inflow of resources with fixed exchange rates. This inflation made the cost of imported wheat to consumers fall in relation to the price of domestic wheat production and alternative domestic goods. The linking of the guaranteed producer price for wheat to the price of wheat imports at official (overvalued) exchange rates, created a disincentive for local producers. Consequently, Ecuador became 90% dependent on imported wheat. Land previously under wheat was put into cattle for beef and dairying since prices of domestic animal products were rising due to restrictions on imports of these commodities. The question CIMMYT needed to answer was, 'Would it be economic to produce wheat locally and, if so, what policy incentives would be needed?'

The method involved the following steps :

(1) value locally produced wheat at the equivalent price of imported wheat;

(2) value imported inputs at their import cost plus internal transport and marketing margins;

(3) value labor and capital at their opportunity cost (return to alternative uses) in Ecuador;

(4) make similar calculations for competing crop and livestock enterprises;

(5) compare returns to the nation of land used in wheat versus other uses;

(6) establish whether the net impact of policy on the different products was positive or negative.

Applying the DRC criterion, CIMMYT found

(1) wheat offered the highest returns to land after potatoes, while extensive dairying offered the lowest;

(2) wheat offered the highest increase in economic returns per hectare as a result of the use of improved technology;

(3) the net policy effect was negative for wheat and positive for dairying.

The dilemma for the research director is the following: under current policy arrangements there is little demand for research on wheat, and new technology alone cannot overcome the unfavorable policy environment. However, in terms of true national profitability, wheat offers interesting returns in the long run, and the research leader might be vindicated if he maintains a strong research program anticipating the end of easy wheat imports and a return to emphasis on domestic production. However, in the short run he does not strengthen his institute by appearing to work on crops of low priority to both policy makers and clients.

The preceding case clearly brings us back to the need to have appropriate tools for setting priorities within the framework of the larger policy environment of the agricultural technology management system. The information, formal priority-setting methodologies, and

channels of communication must exist which enable research leaders to identify and be allowed to work on programs which maximize the expected contribution to society's goals.

Unfortunately, the economic analysis that underlies these latter approaches is not intuitively grasped and policy-makers do not participate in the process easily.

CONCLUSION

In the preceding pages, I have attempted to indicate that the 'policy environment' need not be a fixed constraint on the system. Appropriate efforts by research managers to change some of the constraints facing them is part of their function. We have presented a systems framework in which the research system's relationship to the policy environment can be studied. This includes an approach to studying the objectives and implications of key policies and a way of looking at the structures and mechanisms which produce and defend those policies. The research system may seek to belong to those structures or influence those mechanisms for its own benefit. Finally, it is directly within the means of the research system to carry out analysis of policies and provide convincing information which will have the effect of improving the policy environment for research.

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STRATEGIC PLANNING

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In the first day of this workshop we have already learned something of the special circumstances and problems that small island nations face in their efforts to develop their agriculture. Their national agricultural research systems are usually quite small. You might therefore ask whether they have any need to consider strategic planning for agricultural research. Surely it is only of interest to large nations?

In this session I will try to show that strategic planning involves a process of thinking that is useful even in small nations with comparatively small agricultural research systems. Indeed, it is largely independent of scale; an individual research center has as much need for a strategic plan as does a large organization with complex operations.

Strategic planning originated about 20 years ago in private sector business. It is not a single concept or procedure, but it embraces a number of different approaches. Experience has shown that these approaches can be applied to agricultural research, or for that matter to a wide variety of other kinds of public sector activities. In other words, they are founded on some basic principles of sound planning.

Later, I will try to illustrate the application of these approaches in two or three actual examples of the preparation of strategic plans for agricultural research. The examples I have chosen are of large research systems, but I have chosen them because they illustrate well the steps involved. As we progress, I think you will begin to see that the lessons we can learn from them apply equally to the smaller systems with which you are mainly concerned. It might also provide an instructive exercise for the working groups during this workshop to examine how the steps would need to be amended to serve the needs of small national systems.

The Main Features of a Strategic Plan

We can think of a strategic plan as a well-defined course of action towards a specified goal. It focuses on an organization and what it should do to improve its performance; it helps to answer questions about what the organization ought to be doing, as contrasted with what it already does. What businesses should it be in?

The focus is on a course of action planned for the future; there is more emphasis on the future than on the present situation. The strategy comes first; resource needs follow.

It is externally oriented; in other words, it is outward looking, towards the needs of the organization's clients (for an agricultural research organization this would include development institutes, extension services, and producers).

It is goal-driven; the goals and the strategy are spelled out. The reasons for choosing a particular course of action are explicitly stated.

The plan takes account of the strengths and weaknesses of the present organization.

It includes a strategy for change, i.e. how to make the transformation from the present state to the one planned.

This last feature, in particular, and the much greater emphasis on the future, distinguish strategic planning from the traditional, and therefore perhaps more familiar, long-term planning which is based on an extrapolation of past trends to the future.

Some System Concepts

From this description it can be seen that strategic planning involves many of the same concepts as the systems approach to the analysis of national agricultural research systems (NARS) as part of a broader agricultural technology management system (ATMS). The ATMS approach involves analysis at three levels: the system level, the institutional level, and the commodity level. The three levels of analysis are logically linked to one another and are iterative in the way they help to identify opportunities to improve the system.

This paper concentrates on the strategic planning stage, which in a national agricultural research system is concerned mainly with the first two levels; planning at the stage of the transformation of strategic plans into plans for action, to formulate and conduct a program of research, takes place at the institute and commodity levels. We will be considering these later stages of planning, which entail progressively more detailed definition of the courses of action proposed, in the sessions on "research planning" and on "programming and budgeting" in this workshop.

The Process

Accounts of the strategic planning process differ, but the differences are mainly ones of emphasis and of the order in which the steps are performed; most of the accounts contain the same essential components. The account of strategic planning which follows has ingredients from several sources, but it is based on a model that some CGIAR centers might begin to use. The process involves a number of steps, but the sequence in which they are performed may vary. The process is iterative and heuristic (that is to say, there is a self-teaching component involved).

The steps are as follows:

1. Plan to plan: the process begins with formation of a strategic management group (SMG), who will be responsible for conducting the strategic planning exercise. The group might consist of five to 15 people (not more), internal to the organization. Outside interested parties (e.g. from government or a board of governors) may be involved in legitimizing the process at the beginning and again during the formulation and implementation of strategies. External consultants might be of help to start the process. The strategic management group (SMG) would, at an early stage, organize discussions with senior staff and others. They would seek initial agreement among all those whose support is necessary for the successful formulation and implementation of the plan. They would seek agreement on the purpose of the effort, who is to be involved, and the timetable. The support of management is essential if strategic planning is to succeed.

2. Examine the mandate of the organization and, where necessary, question it if it seems there would be advantage in modifying the mandate. Here it is valuable to depict the historical context, that is, critical events, changes, and trends in the organization's environment; the overall direction of the organization, and the norms that have characterised it (e.g. past changes in funding, the increasing demands placed on the organization over time, changes in the kind of service or product demanded and significant changes in its own management practice). Such changes might be, for example, from a focus on the construction of facilities to one concerned with making full use of those facilities; a movement from provision of nonspecialized to specialized services and products, from a reactive to an anticipatory orientation in planning. As part of this first stage, the SMG begin to form an idealized image of the organization as they believe it should look in the future (e.g. the balance between centralization and decentralization, dependence on government and other sources of funding, the balance between basic, applied, and adaptive research, dependence on expatriate skills or the development of indigenous capability). The idealized image helps to develop the future planning horizon. In the process the SMG share and exchange ideas among themselves and others in and outside the organization.

3. Weigh the advantages and the costs of such changes. Define the immediate clients of the organization and their needs. We have noted already that the direct users of the output of an agricultural research organization are usually development agencies and an extension service. Producers are often indirect beneficiaries. Although an agricultural research organization may not have a direct responsibility for extension, it must have a clear understanding of farmers' needs if its research is to be relevant. Therefore, it will usually have some direct contact with producers (often through on-farm trials). Some descriptions of the process indicate the need at this stage to

consider a wider clientele, and they refer to 'stakeholders,' defined as any individual or group who is affected by or who can affect the future of the organization (e.g. clients, but also government, donor agencies, and its own staff).

4. Assess the environment for future operations. What are the trends, opportunities, and difficulties (whether scientific, economic, social, or institutional) expected in the future? What other organizations doing similar work may be collaborators/competitors? Many of the factors listed here may be ones over which the organization has little control.

   The kind of things that would be noted here might be, for example, new opportunities for research leading to a wider choice of agricultural commodities, new ways to increase export earnings, and ways to extend the base of financial support.

5. Assess future priorities. How do national development priorities affect the organization as strategy? Is there broad agreement between the two? If there is disagreement, what additional data and analysis does the organization need to put forward to try to resolve the difference?

6. On the basis of 2, 3, and 4, formulate a statement of the mission (operational mandate) of the organization. The statement would encapsulate, in no more than 100 words, the purpose of the organization, who its major clients are, the main elements of its strategy, and the principal values that guide it. There should be a consensus among the governing body, management, and staff on the mission statement, and it is important that all support it. A coherent strategy should follow naturally from and provide a sound rationale for the mission statement.

7. Identify and justify the main areas of business (which might be termed *enterprises*). The mission statement makes the overall purpose clear; in this next step the overall purpose is partitioned into component parts. The criteria for defining the business areas should relate to aspects of the organization's environment, not its internal structure. A major objective of strategic planning is to provide a sound rationale for the major business categories and subcategories the organization wants to engage in in the future. That is, the link between the mission statement and the business area must be made explicit.

8. Formulate the operational goals the organization should attempt to achieve in each of its main enterprises. This is a further division of the overall mission and of the main areas of enterprise into more detailed operational goals. It is closely related to the next step and the two should be carried out simultaneously.

9. Examine the strategy options and formulate the preferred strategies for achieving these goals. This step is the core of strategic planning. It needs to answer questions about how the proposed strategies are expected to meet the operational goals, and why they rather than other options are preferred.

   The first task is to identify strategic issues. A strategic issue is a difficulty or problem that has a significant influence on the way the organization functions, or on its ability to achieve the future it visualizes, for which there is no agreed response. They are fundamental policy questions about specific courses of action that could be followed to achieve each operational goal (e.g. the mode of collaboration with other organizations, or whether a particular course of action exceeds the constitutional mandate of the organization). Issues can be internal or external to the organization. The dynamic nature of an organization means that the list of issues will change with time, and as part of a continuing process the SMG should review and update the list of issues periodically. The issues are best expressed as opposing choices. Examples of the kind of strategic issues that an agricultural research establishment may encounter are

   - *Equity vs efficiency:* the relative values it puts on equity concerns (e.g. catering to the needs of small-scale producers, each with limited resources, but making up for a large proportion of the population), as opposed to ones of efficiency (concentration of efforts on comparatively few large producers, where the impact on national production will be greatest).

   - *Central vs supplementary funding:* the preference for the independence associated with domestic funding of research, and the need to supplement this with outside sources which brings with it restrictions on how the resources can be used.

- *Applied vs adaptive research:* the allocation of effort to the generation of new technology (and maintaining the scientific capacity needed for this kind of work) with longer term benefits in mind versus the adaptation of whatever technology is already available, with the immediate payoff this may bring.

The outcome is a set of preferred strategies for achieving each operational goal. It is important at this stage to limit attention to broad strategic choices (as we shall see, formulation of detailed strategies for functional units comes later, in step 16). The preferred strategies should as far as possible build on strengths, overcome weaknesses, exploit opportunities, and diminish difficulties identified in other steps in the strategic planning process. For an agricultural research organization, strengths might include its accumulated knowledge of the agriculture of the country, the diverse services it can provide, and the specialized skills of its leading scientists. Its weaknesses might be a lack of expertise in certain fields of research, poor coordination of research, and field stations that are not representative of the main agricultural environments.

10. Assign priorities to each enterprise and to each of the sub-units they contain. This is to show relative orders of importance; some activities will be more critical than others in terms of achieving the organization's objectives. Also, some activities must be started or completed before others can commence. Here too would appear the first outline of the future allocation of resources (personnel and funds).

11. Identify the main values that will guide the organization in the future (its external orientation towards its clients and its environment, its internal orientation towards its staff).

12. The *current* situation is examined next. Identify the current guiding values of the organization (is it seen as outwardly oriented, open, and flexible by its clients; is its internal orientation hierarchical and bureaucratic, or decentralized?).

13. Review the organization's present mission, its main enterprises, operational goals, strategies, priorities, strengths, and weaknesses. The purpose is to take stock of the present situation in terms comparable to those used to describe the future strategy in steps 6 to 10. Here as there, attention is confined to the strategic level, and there is no consideration of operational details.

14. Identify the gaps between present and future strategies (steps 6 to 10 vs 12) and present and future values (step 11 vs 13).

    Differences in mission, business areas, goals, strategies, priorities, and values indicate the degree of change desired, and together these differences represent the objectives to be pursued in formulating a change strategy (step 15).

15. Formulate a change strategy, that is, the operational moves to be made, and their timing, to enable the organization to implement the strategic plan. The implementation stage deals with broad questions that may be raised by a change in strategy as well as with steps to install it. It is therefore wise at this stage to examine again the feasibility of the chosen strategies. First, to assess the probable reaction of the principle 'stakeholders' who will be affected by it or who may influence its successful implementation, and second, to assess the resources (managerial, professional, physical, and financial) needed to implement it. Together these assessments make clear the kind of commitments that are needed.

16. Formulate the objectives, strategies, and priorities for each functional area within the main enterprises. The functional areas concerned are those that are totally dependent on the strategies and main enterprises chosen by the organization. Most research support functions, computer services, and the purchasing function would fall in this category.

    The interaction between steps 15 and 16 is important; decisions taken in one of them may influence the decisions to be made in the other.

17. Establish a means to monitor and evaluate the implementation of the strategic plan.

    It is worth noting here what may appear at first to be a conflict between the accounts of strategic planning process in the ATMS paper and in the description given above. In the account above, the emphasis during the first steps in the process is concerned with outlining the desired situation for the f[illegible] In the ATMS account the process consists [illegible]: first, an assessment of the present scenario an[illegible] critical problems; second, the generation of a range of options from which a preferred scenario is

chosen; third, the establishment of an action program and choice among the strategic options for implementation. Here the emphasis is on an analysis of the present situation first and it goes on to observe that in many cases the strategic planning process is faulty because action-oriented managers jump from the problem to action without considering the options among different possible scenarios. The tools developed in the ATMS approach lend themselves to completing the first and second steps of the process, and consequently, they help to ensure that a range of options is considered before choosing the preferred scenario. On the other hand, the initial emphasis on the future in the account above has the merit that it may help to overcome the tendency for the present situation to limit the vision of the future. The difference between the two accounts may be more apparent than real if we bear in mind that the process is iterative, and the steps are not in a fixed sequence. It is a point that may be worth discussing further in this workshop.

PERCEPTION

John Marjoribanks
Commonwealth Development Corporation

The following exercise was to demonstrate to participants key aspects of individual perception.

Instruction 1

Arrange yourselves in pairs as you sit. Inside the folded paper marked 'A' in front of you is a picture of a woman. Open it but do not let anyone else see it. Study it intensely for two to three minutes. Fold it up again and put it away from you. Quickly write a brief description of what you have seen.

Instruction 2

Inside the folded paper marked 'B' is another picture of the same woman. Examine it together, but do not discuss it. Record your own answers to the following questions in your notebook without consulting each other.

1) Is she looking over her shoulder or is she turning her face slightly to the right?

2) Can you see her neck?

3) Has she got a small nose or a large nose?

4) Can you see her ear?

When you have both finished, compare your answers with those of your partner and if there are any differences attempt to resolve them. You may not be able to agree but you must decide.

Do not turn over until instructed.

Instruction 3

Has everyone now seen both the wife and the mother-in-law in the composite picture?

If not, continue your explanation-arguments until everyone has been convinced that there are two women in the same picture. Get help from another pair if necessary.

Instruction 4

Now rearrange yourselves as you sit in groups of four, and as a group answer the following questions, recording your group answers.

Questions for your group for the female picture exercise

Please consider these together while looking at picture B.

1. Is the picture an objective fact?
2. Why did people see it differently?
3. Is this a matter of intelligence?
4. If someone cannot see what we see, is there something wrong with him?
5. Why was it difficult to communicate what we saw in the picture to our partner?
6. Were we 'preconditioned' by the picture we saw first?
7. Did it affect our perception?
8. What sorts of influences might precondition us in life?
9. If we have been preconditioned, can we immediately put ourselves in someone else's shoes and really take over his conditioned values?
10. Can we really feel exactly how someone else feels?

A

A

B

Notes on preconditioning

(1) You were given two almost identical pictures, one emphasizing the old woman, one emphasizing the young woman. These preconditioned you to perceive a particular image in the composite picture (the last one).

(2) Having been preconditioned by the first picture, *you perceived an image* in the composite picture *which was different from what most of your partners saw* because they were differently preconditioned.

(3) All of you were *unaware* that you had *been preconditioned* until you were told about it. Preconditioning is something that usually happens to us unawares.

(4) The composite picture is an *objective fact*. But you perceived it according to the prior conditioning you had received.

(5) This preconditioning affected your perception of the composite picture so that you saw a preconditioned pattern of fact and not the total objective pattern of fact which was in the picture.

(6) In three minutes you were preconditioned. Longer and heavier preconditioning is even more difficult to recognise and deal with.

(7) We are all preconditioned by the forces operating in our environment: by the groups we belong to; by the community we live in, with its criteria and its values, forces, family influences, religion, etc.; by our economic condition, etc.

(8) Preconditioning is not much influenced by intelligence. People who do not perceive the facts as we perceive them are not necessarily of lower intelligence although this is often our reaction to them.

(9) We carry our preconditioned values, opinions, and attitudes about with us. It is impossible to shake them off 'at a stroke' and adopt the values, opinions, and attitudes of others. We definitely do not want to.

(10) We can only try hard to understand (in terms of feelings) the preconditioned state of others, to have 'empathy' and be 'congruent', recognizing that perfection in this will always elude us.

(11) 'Empathy' is the capacity for participating in another's feelings and ideas and presupposes respect and a degree of trust. Without those there can be little real communication. Respect and trust are the fabric of the bridge over which communication can travel from one preconditioned person to another.

(12) 'Congruent' means 'coincident throughout, being in agreement, correspondence, and harmony.' It implies that a community of values can become an even better bridge for communications than empathy.

MANAGEMENT CASE STUDY
Rice Research in Kaini

Paul Bennell
Research Officer
ISNAR

Introduction

It was early September 1986 in the small island state of Kaini. Mr. John Salati, Director of the Department of Agricultural Research, arrived for his monthly meeting with his boss, Mr. Kootan Nebuda, the Director of Agriculture in the Ministry of Agriculture, Forestry, and Fisheries. 'Good morning, John. And how are things at DAR? Hectic as usual?' Salati nodded affirmatively. 'I had a long meeting with our Minister yesterday,' continued Mr. Nebuda. 'He is very worried about the latest trade figures, which show another large increase in rice imports into the country. I did my best to reassure him that we are doing all we can to stimulate national rice production which, as you are well aware, is the government's most important agricultural objective. Unfortunately however, he was not satisfied and he has requested that a comprehensive evaluation of the national rice research program be undertaken as soon as possible.' 'And just what will this entail? We've never done one before,' responded Salati curtly. 'I don't know exactly', answered the Director, 'but what I do know is that we must act decisively. What I want you to do therefore is, in consultation with your colleagues in DAE, work out what should be evaluated, how you propose to do it, and when the evaluation will be completed. Please have all this information ready for me by early next week so that I can properly brief the Minister.'

Kaini and Its Agriculture

The Republic of Kaini is a small, politically independent island state. The island is roughly oval in shape, 70 miles long and 55 miles wide. Apart from the mountainous eastern extreme of the country, the terrain is relatively flat with fertile volcanic soils. The climate is subtropocal. Kaini is geographically isolated, the nearest neighboring island of any significant size being some 400 miles away.

At the last census, in 1980, the total resident population of Kaini was 285,000. Average annual population growth during the early to mid-1980s was approximately 2.9%. Emigration from Kaini is considerable, with some 70,000 Kainians reported to be working overseas in 1985.

The Kainian economy is heavily reliant on agriculture. Agricultural products (mainly bananas, coconuts and cocoa) accounted for 90% of exports in 1986. Nevertheless, agricultural imports have been rising rapidly in recent years, comprising nearly 40% of total imports in 1986. Agriculture is the principal occupation for 71% of the economically active population in Kaini. The agricultural sector is dominated by smallholder production. At the time of the last comprehensive agricultural survey, in 1982, there were approximately 17,000 farm households accounting for 90% of total cultivable land.

The main food crops in Kaini are coconuts, taro, yams, and vegetables. Although grown mainly to meet subsistence needs, production for the market is of increasing importance. Traditional shifting cultivation techniques predominate and thus agricultural productivity is low, particularly with respect to land. A recent report on smallholder agriculture in Kaini concluded that 'there is limited scope for the intensification of agriculture with the present production technology and within the existing socioeconomic institutional framework.' While some academic observers talked about the 'subsistence affluence' of Kaini, in fact farm incomes are low (less than US$300 per capita per annum in 1986) and relatively stagnant in real terms.

The availability of statistics on the Kainian economy, and agriculture in particular, remain very limited. Since no detailed farm surveys had been undertaken since 1982, only very approximate estimates were available

for agricultural production by main commodity (exhibit 1).

The Department of Agricultural Research

The Department of Agricultural Research (DAR) is part of the Ministry of Agriculture, Forestry, and Fisheries in Kaini. Established in 1967, DAR has overall responsibility for all crops and livestock research in the country. DAR has one main experimental station at Nakita with adequate office and laboratory facilities and 45 hectares of agricultural land. The station is well sited with respect to representative soil types.

DAR had 15 professionals, 11 technical support staff, and 65 unskilled field laborers at the end of 1986 (exhibit 2). Turnover of professional staff has been high, mainly owing to unattractive conditions of service (in particular salaries and promotion opportunities).

As a ministerial department, DAR is entirely dependent on government funding (exhibit 3). DAR researchers undertake mainly adaptive research on a relatively wide range of commodities (exhibit 4). They are also heavily involved in extension and advisory activities.

Exhibit 1

Relative importance (in gross value terms) of main agricultural crops grown in Kaini, 1980 and 1985.

	1980	1985
Root crops	25	28
Vegetables	9	12
Coconuts	22	20
Cocoa	20	15
Bananas	12	10
Rice	5	8
Other	7	7
Total	100	100

Exhibit 2

Name	Highest Qualification	Discipline	Experience (years)
J. Salati*	M.Sc.	Soil Scientist	9
A.T. Noansi	M.Sc.	Entomologist	4
P.N.N. Pant	B.Sc.	Agronomist	8
R.E. Foatong*	M.Sc.	Entomologist	8
P. Sooluming	B.Sc.	Soil Scientist	5
S.L. Abengu	M.Sc.	Agronomist	3
T.A. Jones* (expat)	Ph.D.	Breeder	22
O. Kinyanjui	B.Sc.	Breeder	1
B.B. Masuri	B.Sc.	Agronomist	4
A.N. Holo+	B.Sc.	Pathologist	1
W. Schmidt (expat)	Ph.D.	Pathologist	5
J. Taylor* (expat)	Ph.D.	Entomologist	18
N.K. Toolatu	B.Sc.	Breeder	2
W.P. Oteti*	M.Sc.	Breeder	7

* *Full-time member, rice research program*

\+ *Part-time member, rice research program*

The National Rice Improvement Program

At the request of the Prime Minister, an international team of agricultural experts visited Kaini for three weeks in 1977. The team's main recommendation was that the government should take immediate steps to promote rice production in Kaini. National rice consumption was increasing rapidly in the mid-1970s (6.0% per annum on average) and, with only very limited domestic production, this meant that over 90% of rice had to be imported. However, given the prevailing agroecological conditions in Kaini, the team concluded that 'we see no reason why the country should not achieve self-sufficiency in rice production during the next 15-20 years .... Realizing this potential will require a vigorous research program which can effectively overcome key production constraints, which, to date, have kept the productivity of rice cultivation so low.' These constraints were broadly identified as the low yield potential of local rice varieties coupled with various pest and disease problems.

The Kaini government accepted the team's recommendations concerning rice and, in 1978, the national rice improvement program (NRIP) was inaugurated. A single, overriding program objective was delineated, namely to achieve national self-sufficiency in rice production by 1990.

Given that national capacity to undertake a comprehensive rice research program was limited, two expatriate researchers were appointed. Dr. T.A. Jones, a British rice breeder with many years of experience in tropical agriculture, was the first program leader. Mr. R.E. Foatong, a Kainian, took over as program leader in 1983. Another young Kainian graduate, Mr. W.P. Oteti, was also recruited to work with the expatriate entomologist on a full-time basis (exhibit 2). In addition to the four full-time members of NRIP, two DAR professionals (a soil scientist and a pathologist) assigned 50% of their time to the NRIP. The two NRIP expatriates were expected to leave Kaini in late 1987.

Between the financial years 1978/79 and 1985/86, the NRIP received 35.0% of DAR's total budget from government. Donor assistance was readily forthcoming for NRIP and used to meet the costs of the expatriate personnel and the training of national staff. Since 1978, nearly 70% of all donor support for agricultural research in Kaini had been devoted to NRIP.

Teamwork among NRIP researchers and technical support staff was encouraged as much as possible. Both program leaders were particularly effective in generating and sustaining enthusiasm for the program and able to sort out quickly tensions among team members whenever these arose. In general, morale in the NRIP was high, especially when compared with other senior staff in DAR, many of whom resented what they regarded as the preferential treatment given to the NRIP.

In addition to carefully programmed on-the-job training, considerable emphasis was placed on the

Exhibit 3

DAR Budget 1980/81 - 1985/86 ('000 Kaini dollars)

Year	Salaries	Operating	Capital	Total	Inflation Rate (annual)
1980/81	729.0	341.7	68.3	1139	4.5
1981/82	777.4	334.9	83.7	1196	4.5
1982/83	831.9	346.6	59.5	1238	3.6
1983/84	890.1	335.2	64.7	1290	5.5
1984/85	947.8	320.4	66.8	1335	9.7
1985/86	1000.1	324.7	45.2	1370	8.3

provision of formal postgraduate training for the NRIP researchers. Within the first six years of the program, the four Kainian professionals participating in the NRIP had successfully completed a master's degree at an overseas university in an appropriate area of specialization.

The NRIP sought to remove key constraints to rice production in Kaini. Research work was organized in five disciplinary projects, which were intensively reviewed at planning meetings at the end of the main cropping season in January (exhibit 5). During the initial stage of the project, researchers were confident that research project objectives clearly focused on the main production constraints. Most experimentation was undertaken at the research station. However, after four to five years they realized that not enough was known about the main farming systems in Kaini. Consequently a number of farm surveys were undertaken by NRIP researchers during 1982. As a result of these surveys, NRIP project objectives and resource allocations were significantly revised so that they more directly addressed on-farm production constraints. NRIP researchers also started to conduct more rice research trials on farmers' fields which, although more time-consuming and expensive, brought research much closer to farmers.

Exhibit 4

Main Research Activities in the Department of Agricultural Research

Commodity	Pro[illegible] Researcher Years
Taro	2.3
Coconuts	2.1
Bananas	1.4
Cocoa	0.7
Vegetables	0.8
Rice	5.0
Subtotal	**12.3**
Factor (soils, farm mechanization etc.)	2.7

The NRIP obtained support from relevant overseas research institutions, in particular the International Rice Research Institute (IRRI) at Los Baños in the Philippines. IRRI researchers had visited Kaini at least once a year and all NRIP researchers had attended at least one of IRRI's short-term training courses. Since Kaini was such a small country, getting this level of assistance from IRRI had taken considerable skill and patience.

Under the auspices of the Regional Rice Research Network, NRIP researchers in Kaini collaborated with rice researchers working in the eight countries of the region. With five (full-time equivalent) professional staff, the NRIP was very large in the regional context. All but one of the eight member countries had smaller populations than Kaini although all of them attached considerable importance to expanding national rice production. Collaboration mainly took the form of annual regional meetings where information was exchanged on each country's rice research activities. With a relatively large rice research capacity, NRIP had done much to assist other rice researchers in the region. However, relations had not always been easy. NRIP researchers in particular often questioned what they had to gain from participating in the network.

With regard to technology dissemination, NRIP worked closely with the Department of Extension, which was also part of the Ministry of Agriculture, Forestry, and Fisheries. The Department had 11 professional extensionists in 1986 and one district extension officer (with two years of post-secondary training) for each of the 30 administrative districts in Kaini. NRIP pushed

Exhibit 5

Main Projects in the National Rice Research Program

- Development of cultivars for rainfed conditions
- Cooperation with regional and international research units in exchange and development of cultivars and gerplasm
- Development of economically viable fertilizer practices
- Development of economical means of pest control
- Development of cost-effective weed control practices for rice and cropping systems which include rice

hard for the creation of an Extension Liaison Unit which was eventually established in 1984. Extension personnel worked closely with NRIP researchers in the management of on-farm experimental trials and demonstration plots. Regular training in rice production was provided by NRIP researchers to all extensionists.

By 1985 NRIP had developed a comprehensive range of recommendations for rice production. Mr. Foatong was proud of this achievement: 'We knew next to nothing about growing rice in this country when we started in 1978. We certainly know a lot more now.' The rice breeding program was regarded by NRIP researchers as being particularly important. In 1985 the first variety developed by NRIP, KN 25, which was a cross between IRRI and local germplasm, was officially released.

Experimental results on-station and on-farm showed that average yields from KN 25 were 225% higher than the best local variety.

In economic terms, it was estimated that farmers who grew the KN 25 variety could expect, if all the main agronomic recommendations were followed, a net return per hectare of K$850, which was more than a 50% improvement over the traditional rice technology. The net return per unit of labor was estimated to be approximately 20% higher with the KN 25 technology.

NRIP researchers recognized that Kaini farmers were strongly risk-averse but did not believe that the new technology posed any serious problems in this respect.

NRIP researchers were convinced that the KN 25 technology was both technically and economically viable. However, no information on the spread of KN 25 among Kainian farmers had been systematically collected. Some feedback had been obtained from extension staff but this was rather limited. This was partly due to the fact that after the release of KN 25 there had been two consecutive years of abnormally low rainfall. However, with the cropping season about to start, the 1986 rains looked a lot more promising.

Conclusion

The following Monday morning Mr. Salati arrived at his office at the Nakita Research Station. Discussions with the NRIP researchers about the evaluation had not been easy. As hard-working researchers, they resented what they regarded as yet another interruption to their work. As one of them put it: 'We are a small country -- we don't have an army of economists to undertake evaluations of this kind ... in fact we don't even have one.' Salati realized that he would have to tread carefully, and he had only two hours to prepare the memo for Mr. Nebuda.

RESEARCH PLANNING AND MANAGEMENT IN FIJI

Param Sivan

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Summary

The Research Division is one of the five main divisions of the Ministry of Agriculture and Fisheries and it has the responsibility for research work on all crops other than sugar cane. Livestock research is carried out in the Animal Health and Production Division of the Ministry. In 1982 a major review of research in the Ministry was carried out by the International Service for National Agricultural Research (ISNAR). Following the review, ISNAR assisted the Ministry in formulating a long-term research plan covering the years 1984-1989 and beyond. This paper briefly reviews the methods and procedures used for establishing research priorities, objectives and resource allocations prior to the review, reasons for re-evaluating these, establishment of new procedures and development of the new research plan, and benefits and problems of implementing the plan.

Research Planning and Problems Prior to Development of the New Plan

Before the new research plan and procedures were implemented, there was no clear national policy on agricultural research. Although the previous Development Plan 8 (1981-1985) called for research to develop low-cost technology for agriculture and increase production of products for domestic consumption and for export, these were too broad to implement. They did not sufficiently narrow down areas or commodities to develop.

There was no clearly stated policy to develop research to generate new technology for agricultural development. Funds and resources allocated to research were grossly insufficient to implement a large number of projects which were all thought to be equally important since no priorities were set. In the absence of an overall research plan and specific research programs, the work of the Research Division was based on projects. Individual research officers developed project proposals on commodities or disciplines and these were considered and approved by a research committee made up of senior research staff and headed by the Director of Research. The result was a large number of projects, and it was difficult to see how they were related to each other and how each contributed to overall development of any one commodity. Also, there were only limited inputs from extension and farmers into the research programs because there was no formal means to ensure this. Extension staff often felt that the research programs did not always reflect the real problems on farms.

Also, since allocation of staff and other resources was not made to specific programs based on priority, and the Research Division was called upon to fulfill a number of nonresearch functions such as seed production, providing soil and plant analytical services, and control of registration and use of pesticides, it was difficult to monitor resources actually going into productive areas of research, and considerable research funds were used to provide services.

Because limited research resources were spread among a wide range of research projects and nonresearch functions, it was difficult to make great impact or develop any one or a given number of commodities adequately. Although useful research was done in some areas, it was difficult to convince the policy-makers of the great benefits of research. The Research Division also did not make any special effort to generate greater support by educating policy-makers on the benefits of research. The support for research among the policy-makers was minimal, and this was reflected in the allocation of resources to the Research Division.

Also, because of the lack of a plan, there was no planned long-term development of staff and resources. Numbers

of scientists and funds for research showed little improvement over a number of years.

The Review of the Research Division

To improve the functioning of the Research Division, and to make it more effective in developing technology to meet the needs of agricultural development in the country, assistance from ISNAR was obtained in 1982. The ISNAR review of the division (ISNAR, 1982) highlighted a number of areas that needed attention and development. Among the major areas highlighted were

The need for greater involvement of users (extension staff and farmers) in the research planning process to identify problems and establish research programs and priorities

The need for a long-term research plan to develop manpower, physical, and financial requirements matched against the requirement for agricultural development and to set out research programs and priorities for research.

The allocation of funds, staff, and facilities to the Research Division were inadequate to develop technology to meet the anticipated requirements of agricultural development. There was heavy emphasis on development projects. There were cases where projects with large expenditures had failed because there was no prior research to show that such projects were viable. Greater support for research was urgently needed.

The reports from research, although timely, did not fully relate to all its client groups — especially policy makers, extension staff, and farmers. There was a need to strengthen this area to facilitate a quick and efficient flow of information from research to its clients.

There was greater need for research, extension, and farmers to work together to monitor and evaluate research. There was a need for greater economic input into the research programs to ensure that recommendations made by research were economically viable.

There was a need to separate nonresearch functions from actual research work. If this was not possible then separate funds and resources including staff should be provided to research to carry out the nonresearch functions.

Table 1: *Research Programs of Department of Agriculture, Fiji*

Program 1:	Rice Improvement
Program 2:	Root Crop Improvement
Program 3:	Tree Crop Improvement
Program 4:	Pulse Improvement/Crop Diversification in Sugar Cane Areas
Program 5:	Vegetable and Maize Improvement
Program 6:	Tropical Fruit Improvement
Program 7:	Livestock Improvement
Program 8:	Soil Management/Plant Nutrition
Program 9:	General Services

The review highlighted the problem areas in the Research Division. With the review it was possible to convince the policy-makers in the Ministry (Minister, Permanent Secretary, and other Divisional Heads) that if the Research Division was to generate the technology expected from it for agricultural development, it needed considerable additional support and strengthening of its weak area.

Again, ISNAR provided considerable assistance to develop the first research plan. In early 1984 a task force was formed comprising heads of various divisions in the Minstry and senior representatives from the Ministry of Finance, Central Planning Office, Public Service Commission, and ISNAR. The task force identified the main commodities to be developed. For each of these commodities, a multidisciplinary subcommittee was formed consisting of research and extension staff to develop the research program for the commodity.

A draft research plan developed by the task force was circulated to a wide audience, including government policy-makers, for their views and comments.

The above procedure ensured that the plan was in line with government policy for agricultural development and that the research programs included inputs from extension staff and farmers. The final agricultural research plan, prepared jointly by the Government task force and ISNAR, was published in 1985 (ISNAR, 1985).

The Research Plan

The plan identified nine research programs (table 1) for research to pursue over the next six years and beyond.

and projected staff, funds, and other facilities required to implement the programs. In each program the objectives for research and projects that needed research work were identified. (For an example see table 2, which details the objectives and projects for the rice improvement program.) It was left for the Ministry to set priorities for programs and projects within the program depending on its short- and long-term needs for development.

Benefits from the New Plan

The organization of research into programs ensured a multidisciplinary approach to problems. For instance, the rice program is implemented by a team consisting of a breeder, agronomist, weed control scientist, soil scientist, entomologist, agricultural engineer, and an extension education specialist. Since they work as a team to formulate and review projects, there is greater collaboration among the scientists of various disciplines in solving problems.

The plan has been in operation since 1985. From about this time there has been considerable improvement in staffing, funds, and other resources allocated to the Research Division. Tables 3 and 4 show the professional and subprofessional staff in crop research programs in the Research Division prior to and after the implementation of the plan. (In addition to this, currently six professional and 16 subprofessional staff are engaged in livestock research.) For a five-year period prior to the review the division gained only four new posts, but for the five-year period after the review, the division gained nine additional posts for professional staff. Also more subprofessional posts were given in the second period and this year there were at least two subprofessional staff for every one professional scientist. The plan recommended 27 professionals for crop research and four professionals for livestock research. In total numbers, this has now been surpassed, although the need for an economist and the strengthening of the technology transfer unit are yet to be met.

Table 2: *Rice Improvement Program: Objectives and Projects*

1. Improve varieties through breeding/introduction (IRRI) for

   (a) Irrigated conditions
   (b) Rainfed wetland
   (c) Rainfed dryland (wet zone, dry zone)
   (d) Acid sulphate/saline soils

2. Improve agronomic practices

   (a) Optimum plant density for acid sulphate soils
   (b) Interaction of plant density with rates of N
   (c) Effect of seedling age at transplanting

3. Determine nutrient requirements of rice

   (a) Dryland at Koronivia
   (b) Irrigated at Koronivia and Dreketi
   (c) Acid sulphate/saline soil
   (d) Basal N and top dressing NPK on improved variety
   (e) Effect of organic matter

4. Improve methods of weed control

   (a) Irrigated conditions
   (b) Rainfed wetland
   (c) Rainfed dryland

5. Develop economical methods to control major pests, brown plant hopper and leaf roller

   (a) Chemical means
   (b) Biological means

6. Introduce and adapt appropriate machinery for use by small farmers

   (a) Animal/tractor-driven seed drills
   (b) Manual wetland seeders
   (c) Manual wetland transplanters
   (d) Tractor mounted/small reapers
   (e) Threshing machines

7. Extension Education

   (a) Training of extension staff
   (b) Demonstrations on farms
   (c) Field days, etc.

Table 3. *Professional Staffs in Research Division*

Year	Locals B.Sc.	Locals M.Sc. Ph.D.	Expatriates	Total
1977	9	5	5	19
1982	10	8	5	23
1987	20*	6	6	32

** Four B.Sc. holders currently doing M.Sc.*

Table 4: *SubProfessional Staff in Research Division*

	Technical (Diplomates)	Administration (Clerical, stores, etc.)	Total
1977	56	17	73
1982	58	17	75
1987	67	17	84

Ratio Professional: Technical (32 : 67) = 1 : 2.1

Table 5 gives the Research Division's budget for the years prior to and after the implementation of the research plan. From 1982 to 1987 the government contribution to research increased from about $1.2m to $2.1m and aid from outside sources increased from a mere $40,000 to nearly $1.3m. The total research budget, including the administration costs for crop research, is now nearly $3.8m, and for livestock research $0.9m. The total projection for both of these in the plan for 1987 was $2.3m.

Since research is now organized in programs and human and other resources are allocated according to programs, it is easier to see and monitor the emphasis given to different research programs. In line with government plans for agricultural development, priorities can be assigned to programs and projects within the programs and resources allocated to reflect the priorities.

Currently in Fiji the highest priority is given to rice development. The rice improvement program in research is also given a high priority and staff and funds allocated to this program reflect this. The tree crop program has the second highest priority. Table 6 gives the allocation of professional staff among the various programs, and table 7 the allocation of funds among the various programs in 1987. About one-third of the staff and funds are committed to the rice program. The tree crop program, which includes coconut and cocoa research, is allocated 20% of the budget but has only 13% of the professionals working in it. Recruitment of additional staff for this program is being considered. If the research programs clearly reflect the national requirements for agricultural development, then it is easier to obtain support from donors. For instance, if high priority is given to the development of a commodity but very small research resources are budgeted for it, then it is easier to argue for and obtain additional support from the policy-makers. If national support is limited, then aid from outside can be pursued with the blessing of the policy-makers. If research is well planned and priorities identified, this also makes it easier to attract support from outside donors.

Also, with planned programs it is easier to direct donors' assistance to programs and projects that the nation needs instead of getting aid in areas where the donors want to give. Within the last three years, a substantial amount of aid from outside has been injected into the rice, coconut, and soil and plant nutrition programs, which were identified as priority areas. From this year the programs for vegetables and maize improvement and the pulse improvement/crop diversification in sugarcane areas have been considerably upgraded with additional staff and funds because of the government decision to intensify vegetable and cereal production in the Sigatoka Valley and crop diversification in sugarcane areas.

Within programs it is also important to develop priority areas. Sometimes giving priority to projects that can bring quick results can bring great benefit to research. In

Table 5: *Budget for Crops Research: Research Division*

	1977	1982	1987
Administration		281.0	347.9
Research	662.7	1230.2	2119.9
Aid in kind*	-	50.0	1287.6
Total	662.7	1561.0	3755.4

** Includes salary for expatriate staff, field and laboratory equipment for research, and training of local staff*

Table 6: *Professional Staff Allocation for Crop Programs : Research Division 1987*

Discipline	Rice	Root Crops/ Ginger	Cocoa	Coconuts	Pulses/Crop Sugarcane Area	Maize	Vegetables	Fruits	General Services	Total
Breeding	1.0	1.0	0.5	1.0	0.5	0.5	1.0	0.5	-	6.0
Agronomy	2.0	1.0	1.0	0.5	1.5	0.5	1.0	0.5	-	8.0
Soil/Plant	2.5	0.25	-	-	0.25	0.5	0.25	0.25	-	4.0***
Nutrition Plant Protection	1.0	1.0	0.75	0.25	0.75	-	0.5	0.75	1.0	6.0
Agricultural Engineering	0.5	-	-	-	0.75	0.25	-	-	-	1.0
Weed Control	0.5	-	-	-	0.25	-	0.25	-	-	1.0
Food Technology	-	0.25	0.25	-	-	-	0.25	0.25	-	1.0
Analytical Services	-	-	-	-	-	-	-	-	2.0	2.0
Training & Extension Education	3.0	-	-	-	-	-	-	-	-	3.0
Total	**10.5***	**3.5**	**2.5**	**1.75****	**3.5**	**1.75**	**3.25**	**2.25**	**3.0**	**32.0**

* *Includes four Japanese Aid Specialists*

** *Includes French Aid Coconut Breeder*

*** *Includes Australian Aid SCLP Project Manager*

Table 7: *Allocation of Funds for Crop Programs : Research Division 1987 ($,000)*

Discipline	Rice	Root Crops/ Ginger	Cocoa	Coconuts	Pulses/Crop Sugarcane Area	Maize	Vegetables	Fruits	General Services	Total
Cash	395.9	123.1	153.8	495.1	280.3	87.9	211.7	186.2	185.9	2119.9
Aid in kind	880.0	100.0	-	100.0	134.6	33.0	20.0	20.0	-	1287.6
Total	**1275.9**	**223.1**	**153.8**	**595.1**	**414.9**	**120.9**	**231.7**	**206.2**	**152.7**	**3407.5**

recent years in Fiji, priority has been given to developing improved varieties in rice, root crops, vegetables, and pulses. Releases of improved varieties that are doing well on farms have greatly increased the confidence of extension staff, farmers, and policy-makers in research. This has been very useful in obtaining additional support from donors, both government and outside.

Planned programs also allow research managers to appreciate better not only the staff numbers required but also the areas in which staff training needs to be developed. In small countries like Fiji, which only recently expanded research programs, most of the scientists recruited are relatively young and inexperienced. Long-term planned training of these scientists is needed to obtain the right numbers of scientists needed for different disciplines and programs.

With a small pool of scientists, most of whom need further training, it is difficult to allow too many to be away on training without a serious effect on the current programs. However, if training is planned, it should be possible to release several scientists at a time for further training. Current practice in Fiji is that four scientists are allowed postgraduate training at one time. This allows training to proceed without holding back research.

The plans and programs need continual revision to reflect the changing situation and current needs of the government. The long-term plan gives general guidelines for research over time. Each year, using the plans and programs as a guideline, the multidisciplinary team of research scientists working in the programs have formal meetings with extension counterparts to prepare the work program for the Research Division for the following year. In November/December every year the detailed work programs for the following year are discussed at the joint meeting of research and extension staff, which is attended by all senior staff of the Ministry. The projects approved form the work program for the Research Division for the following year. This annual exercise allows continual extension input in the research programs and, if there is need for changes in the programs, these can be incorporated.

Also as part of the joint meeting, a three-to-four-day seminar is organized in which the research staff present the reports for the year. In addition to this, in July every year the research staff present mid-year progress reports at a meeting which is again open to senior extension and other Ministry staff. This is useful to continually update the senior Ministry staff on new findings.

As extension staff are continually involved in research program formulation and evaluation, they appreciate and support research much more. They also more willingly support projects that need to be done or verified on farms.

Some Problems in Implementation

As in many other organizations, the research/extension interface has been one of the great problem areas. A quick and efficient flow of information from research to extension is essential both for agricultural development and for research to be recognized as producing relevant technology for development. The research review identified this as one of the weak areas, and with subsequent follow-ups, ISNAR suggested the setting up of a Technology Transfer Unit in the Research Division. The Unit would have full responsibility to organize training courses, field days, farm demonstrations, etc. and to publish relevant publications for quick dissemination of information from research to extension staff and farmers.

Since a Training and Communication Section which performs some of these functions already exists in the Ministry it has not been possible to quickly set up the Technology Transfer Unit in the Research Division. However, the need for this unit and its close association with research is recognized. With Japanese assistance such a unit has now been set up in the rice program. It is planned to expand this unit to cover other research programs. However, in the meantime, with assistance from ISNAR, staff in the Training and Communication Section of the Ministry have been trained to organize more relevant training courses and produce more relevant publications for extension staff and farmers. The Annual Report of the Research Division has also been redesigned to make it more useful to extension staff and policy-makers.

The plan identified the need for an economist in the Research Division to ensure that the research projects and recommendations made from research are economically viable. Because of the shortage of economists in the country and the salary scale in the civil service, it has not been possible to recruit one. Until such time as an economist can be appointed, research scientists are asked to look into this aspect where possible. Within the civil service it is not always possible to provide the incentives to attract and retain the best qualified staff for research.

Conclusion

Through the review of the Research Division, the

development of the Research Plan and subsequent follow-up assistance in implementation of the plan, ISNAR has greatly assisted the research system in Fiji to focus its attention appropriately on the needs of agricultural development in the country. With the implementation of the research plan, it has been possible to direct limited research resources to priority programs and projects in the country. This has allowed research to produce more relevant technology for agricultural development. This, together with the formal involvement of policy-makers and extension staff in research program formulation and evaluation, has considerably improved the image of the research system in the country. Because of this, it has been possible to obtain considerable support for research in the last three years, both from the government and from abroad.

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DISCUSSION OF RESULTS OF QUESTIONNAIRE

Paul Bennell
Research Officer
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Paul Bennell presented the main results from the management questionnaire completed by workshop participants. Two sets of information were most interesting: time allocations to main activities and assessment of key performance determinants.

Task Time Allocations

From table 1 it can be observed that directors of agriculture spend 40% of their time undertaking routine administration but only 1% of their time actually interacting with farmers. It is perhaps surprising that policy formulation and technical supervision only account for 10% and 5%, respectively, of their working year. If they could, directors of agriculture in the South Pacific would like to spend much less time on routine administration, just 20%, and significantly more time talking to farmers (10%) and performing personnel management (20%) and technical supervision (15%) functions.

Research directors distribute their time more evenly among the various activity areas than their directors of agriculture. Personnel management is the most important activity in terms of time commitment but research directors also spend reasonable amounts of time talking to farmers (8%) and doing their own research. It must be stressed that these are median values only.

Interestingly, taken as a whole, research directors do not want to change significantly their present work time allocations. It would seem that they want to spend more time on research planning (15%) but less time on personnel management (10%) and their own research (5%).

Performance Determinants

The second part of the questionnaire asked respondents to make the following evaluation: 'The performance of your organization could be improved in a number of ways. Some of these are listed below. Please rank them according to your estimation of their relative importance in improving the effectiveness of your organization.' The analysis of the responses for the first- and second-rank performance determinants are presented in tables 2 and 3.

Among directors of agriculture, the need to improve communication with farmers and better coordination between agricultural units accounted for over 80% of first-rank responses. Their second rankings focused on better day-to-day management (67%), with 17% indicating more technical training and 17% improved coordination.

Again, the responses of research directors were more evenly distributed among the various areas of improvement. However, 44% identified more technical training for their staff as their priority for performance improvement and 22% better day-to-day management. Among their second rankings, 22% specified the need for higher salaries.

Table 1:

Responses* to question: *What percentage of your time during the last year have you devoted to the following activities? Are you totally satisfied with this breakdown? If not, estimate what a more desirable allocation of your time would be.*

Activity	Directors of Agriculture		Directors of Research	
	A	D	A	D
Policy formulation/research planning	10	10	10	15
Technical supervision	5	15	9	10
Personnel management	10	20	15	10
Routine administration	40	20	5	10
Own research	0	5	10	5
Meetings, other govt.	10	10	7	10
Talking to farmers	1	10	8	10
Meetings, other visitors	10	5	5	10
Participating in training	5	5	5	5
Others	0	0	0	0

A actual D desired

** Median percentage values which do not therefore necessarily add up to one hundred.*

Table 2:
Individual Assessment of the Most Important Organizational Performance Determinants among Workshop Participants

Area of Improvement	Directors of Agriculture	Research Directors
More technical training	0	44
Better day-to-day management	0	22
Improved physical facilities	0	11
Higher salaries	0	0
More operating resources	0	11
Improved planning and evaluation	17	0
Better communication with farmers	50	0
Improved coordination between agricultural units	33	0
More effective regional/ international collaboration	0	11

Table 3:
Individual Assessments of Second Most Important Organizational Performance Determinant among Workshop Participants

Area of Improvement	Directors of Agriculture	Research Directors
More technical training	17	11
Better day-to-day management	67	11
Improved physical facilities	0	11
Higher salaries	0	22
More operating resources	0	11
Improved planning and evaluation	0	11
Better communication with farmers	0	0
Improved coordination between agricultural units	17	0
More effective regional/ international collaboration	0	0

LEADERSHIP

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Introduction

The idea of leadership is right at the heart of the whole body of management theory that has been built up over the last hundred years. Why is it that some people lead the way and others follow? What's special about the boss? In writing this paper, I am attempting to give a summary of my views (and those of others which I have read) on the concept of leadership. My aim is to present some ideas which may be of practical use. The question to be answered is 'How can I become as effective a leader as possible?'

The 'Great Man' theory

Perhaps the first concept of leadership to arise was the 'great man' or 'trait' theory. This is the idea that leaders are people who possess certain qualities or traits which, in themselves, enable those lucky enough to possess them to exercise leadership over others. The trait theory has a certain emotional appeal to all of us. We like to consider that leaders are Great Men. In a sense it validates their position as leaders and our own position as followers. It allows us psychologically to cope with the fact that we are not 'at the top of the tree' — after all, we rationalize, leaders are special people.

The number of biographies that have been and still are being written show the popularity of the 'great man' idea: for what is a biography but a portrait in words of a great man? The theory is still under serious discussion among students of management as well.

The 'Human Relations' School

The first step away from looking only at the leader came with the development of the 'human relations' school of thought some 50 years ago. It was realized that one of the keys to successful leadership (at the time it was put forward as the key) was the relationship between a leader and his follower. The emphasis of study moved away from the qualities of the leader himself to the interaction between him and each of his subordinates. The strongest influence on this interaction was seen as the behavior of the leader, which gave its name to the 'behavioral' theory of leadership.

Two main styles of leadership behavior were identified: concern with the task and concern with people. These two styles have been given many different names by different theorists in the years subsequent to the first research work in this area. This unfortunately contributes to the confusion felt by most practical managers when reading about leadership. Some of the terms are given below.

initiating structures	consideration
concern with task	concern with people
task behavior	support behavior
concern for results	concern for relationship
autocratic	democratic
theory X	theory Y
boss-centered (authoritarian)	subordinate-centered

Many theorists of the so-called 'neo-human relations' school have said that the two styles are mutually exclusive — an either/or situation. One of the most frequently quoted examples of this type of theory is that put forward by Robert Tannenbaum and Warren Schmidt in an article in the Harvard Business School (vol. 36 No. 2) in 1964.

Tannenbaum and Schmidt presented their idea of the relationship of these two types of behavior as a continuum running unbroken from one extreme to the other. They represented this concept with the following diagram:

The leader's behavior is seen in terms of his decision-making style, particularly in regard to the level of involvement of his subordinates in decision-making. The behavior range available to the leader is from autocratic, on the left, to democratic, on the right. The autocratic manager maintains a high degree of control; he tells his subordinates what to do and pays little attention to what they may think of his decisions. The democratic manager hands control to his subordinates; he allows their feelings to exert full influence over the work of the group. And, of course there are all the various possible behavior styles between these two extremes.

The underlying premise of this theory is that the further towards the 'democratic' end of the continuum a manager moves, the better will be his relationship with his subordinates and the more highly motivated will they be. This then is likely to give rise to higher productivity. However, research studies have failed to confirm the whole of this theory. So a very 'democratic' manager is likely to have a contented work group but not necessarily bring about productivity in your work group.

Does this mean then, that in order to get high productivity, a leader should be fully task-oriented, a real slave driver, and to heck with what his subordinates feel? It does not, for there is no significant inverse correlation either: being a hard task master does not necessarily bring about high productivity in your work group.

This apparent dilemma points up two further disadvantages in the 'neo human relations' approach. One is that it focuses too closely on the relationship between the boss and his subordinate and does not consider the whole situation in which leadership takes place. The other is that to view leadership behavior as *either* task oriented *or* people oriented is too constrictive: can leaders not be concerned with *both* getting the job done *and* maintaining good relationships with subordinates.

A 'Situational' Theory

Dissatisfaction with the model of leadership that had developed out of the 'neo human relations' school of thought led to the growth of an approach in which a wide range of factors were seen to influence every leadership situation. As can be seen from the diagram below, the attributes of the leader (Great Man theory) and the leader-subordinate relationship (human relations school) are seen as only two of the many influences which are at work. This 'situational' theory seems to be coming much closer to the real world — fragmentary, ever-changing, and full of problems — that surrounds the manager in today's organizations.

A model for leadership has been proposed by A.S. van den Berg (July 1979) based largely on the work of Paul Hersey and Kenneth Blanchard, who published their 'Life Cycle Theory of Leadership' in the Training and Development Journal of May 1969. This model is a useful practical application of the 'situational' theory which I would like to discuss in some detail.

Before doing so, however, I want to spend a little time examining four words often used in the context of leadership, the meanings of which may be imprecise. These four words are 'Power,' 'Authority,' 'Influence,' and 'Leadership' itself.

Power

In this context, power can be defined as the potential to influence, derived from any source. If we talk of A having power over B, we mean that A has at his disposal a tool, if you like, that enables him to get B to do what he wants. There are eight different types of power applicable to this situation.

(i) Coercive power is based on fear of punishment for noncompliance.

(ii) Reward power depends on the ability to provide rewards for compliance.

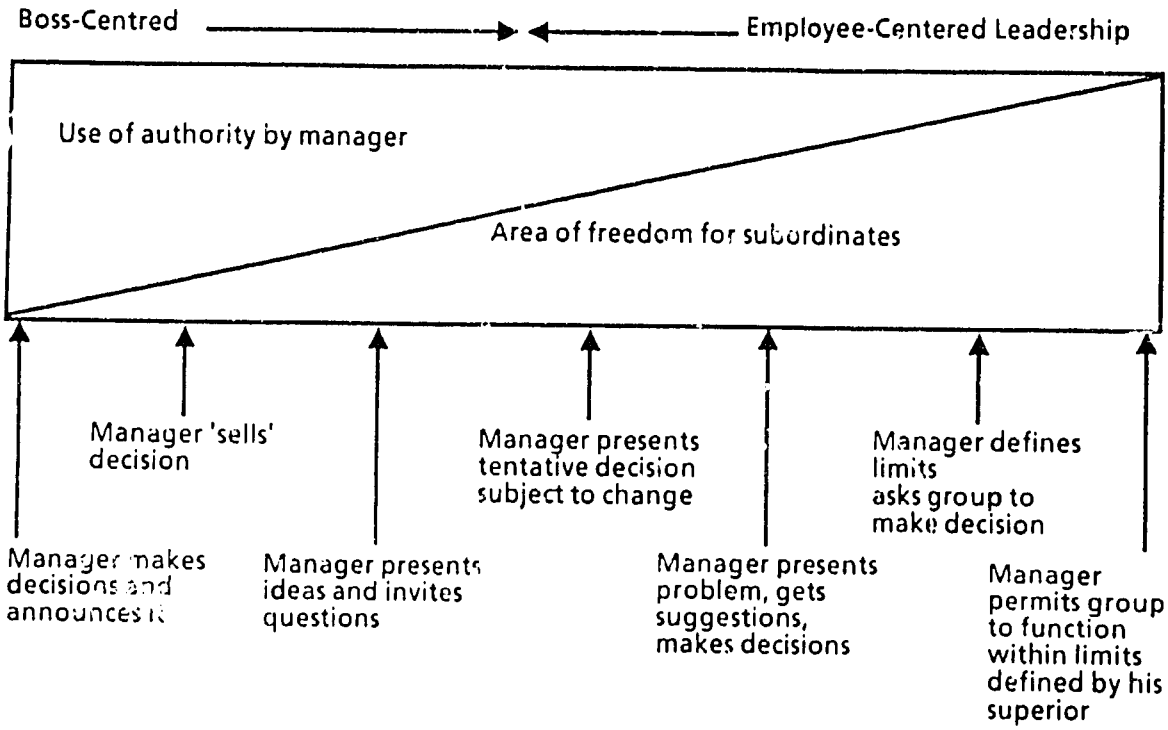
(iii) Connection power is based on connection with important people. Subordinates will comply with your wishes because of your relationship with somebody influential.

(iv) Referent power is based on the attributes of the leader. People will comply with an admired leader's wishes in order to be associated with him.

(v) Expert power is based on possession of knowledge which will help the subordinates work effectively. 'We'll do what he says, because he knows best.'

(vi) Information power is based on access to information which is valuable to others. 'If I do as the boss wants, then he'll keep me in the know.'

(vii) Resource power is based on the control of resources, physical or financial, which are



valuable to others. Thus an accountant may derive power from his control of the financial allocations.

(viii) Legitimate power is derived from the leader's position within the organization: I am your boss, therefore you have to do what I say.

Authority

Just as power can be seen as the potential to influence derived from any source, so authority in this context is the potential to influence derived from one's position in the organization. Thus it is exactly the same as legitimate power.

Influence

To influence persons is to get them to change. In the context of the teacher/pupil relationship, the change might be the gaining of new knowledge. If the pupil fails to gain or retain the new knowledge, then the teacher's attempt at influence has failed. Similarly, in the context of the boss/subordinate relationship, the change might be an increase in productivity from the subordinate. The more power the boss has, from whatever source, the more likely is it that his influence attempt will succeed.

Leadership

A concise definition of leadership might be 'the act of being followed by another.' These few words embody a concept which is vital to a clear understanding of the whole area. The existence of a leader infers the existence of followers. You cannot have one without the other. The narrower the power base available to the leader, the harder his task of leadership becomes. A person with high legitimate power (authority) who has no other source of power is then likely, despite his high position, to be an ineffective leader. Similarly, a person of low authority may yet be able to exercise effective leadership if his other sources of power, such as referent power or expert power, are well developed.

It follows from this that, in an organization, leadership does not necessarily coincide with the formal hierarchy. It also follows that a supervisor who relies on his official position alone to ensure compliance by his subordinates is likely both to find his job very difficult and to be ineffective. One way to become more effective is to analyze the possible sources of power available to you, identify which ones are likely to prove useful and then concentrate on developing them.

Dimensions of Subordinate Behavior

Here's an equation that looks, at first glance, pretty meaningless.

$$P = A \times S \times U \times W \times E \times P \times R$$

Let's put some words to the letters and see if it makes more sense.

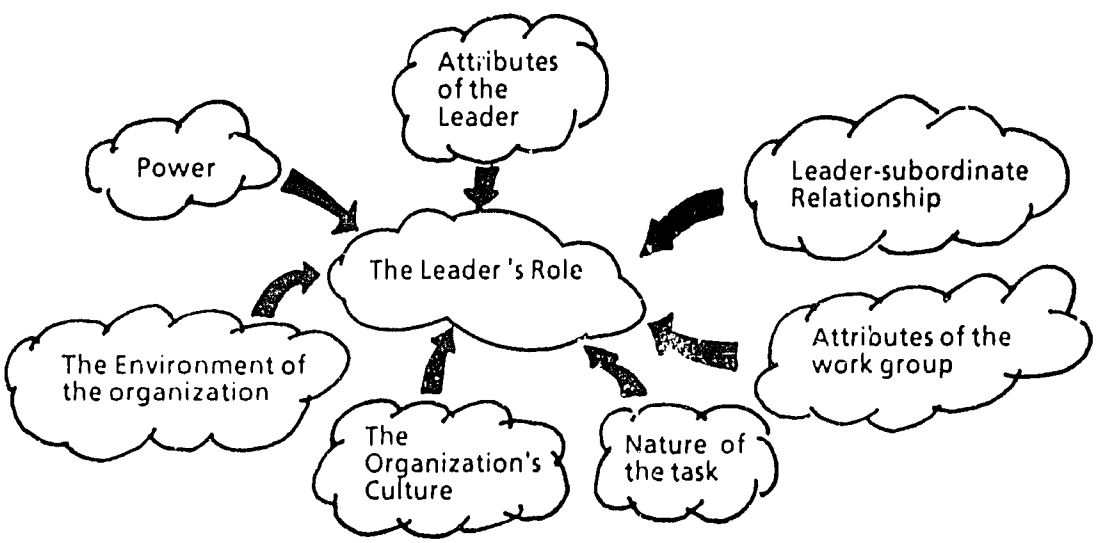
P for Performace	: the way a person does his job
A for Aptitude	: his physical or mental suitability for the job
S for Skill	: his expertness at the tasks involved
U for Understanding	: his appreciation of what needs to be done
W for Work	: his decision to start working
E for Effort	: the level of effort he decides to exert
P for Persistance	: his decision to keep on working
R for Resources	: the resources available to him to do the job.

Now we can rewrite the equation in words.

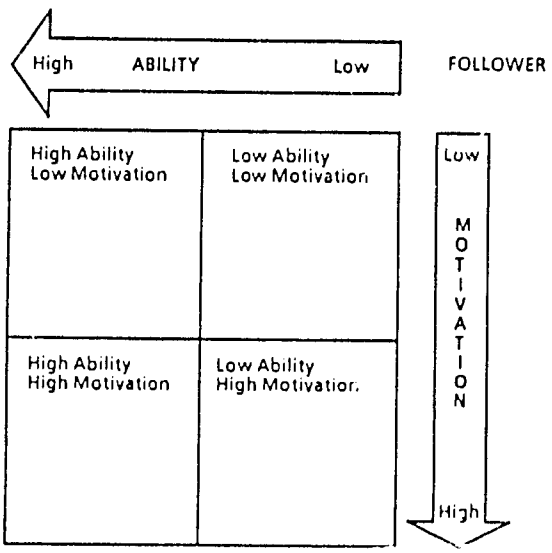
'A person's performance is the product of his aptitude for the work, his degree of skill, his understanding of the task, his decision to start working, how much effort he puts in, how long he keeps going, and, finally, of the resources available to him.' Note that if one of these factors is zero, then performance is zero, no matter how high the other factors are. If you look again at these seven factors you will see that they might be divided into three groups; the first group, aptitude, skill and understanding, could be called 'ability.' The second group, decision to start to work, to exert effort, and to persist, could be called 'motivation,' which leaves 'resources' on its own.

A basic task of a leader is to make sure that his subordinates have the necessary resources to be able to perform satisfactorily. This is very often a major problem inhibiting performances. How often have we heard such remarks as 'no spare parts,' 'no transport,' 'the fertilizer hasn't arrived' and so on and so on? The leader who fails to marshall the resources necessary for his subordinates to carry out their duties will be seen by them as inefficient. It cannot be emphasized too strongly that the struggle to produce resources on behalf of his work group is a major part of a leader's function.

However, let's assume for the moment that these resources are available. That leaves the leader with two aspects of his subordinates' performance to consider: ability and motivation (sometimes called 'competence' and 'confidence'). These two dimensions are not absolute, unchangeable values but depend very much on the overall situation. A subordinate who is highly competent at one particular task may have a very low level of ability at another. Someone who is highly motivated when it comes to doing a demanding professional task may be totally fed up when it comes to writing his monthly report. These two dimensions of



subordinate performance (they are really attributes or qualities of the subordinate) can be represented by the following diagram.



Thus, subordinates (followers) can be identified as belonging to one of four major categories in any particular situation.

LoAbLoMo Low ability and low motivation. Typically this could be a new recruit who has not yet learned the necessary skills nor developed any interest in the work or commitment to the organization.

HiAbLoMo High ability and low motivation. A person thoroughly skilled at his job may lose interest in his work for a variety of reasons either at work or outside it.

LoAbHiMo Low ability and high motivation. A person can let enthusiasm outstrip his ability, which may lead him into making mistakes.

HiAbHiMo High ability and high motivation. A fully trained person with a high interest in the work needs very little supervision and is usually ready to assume extra responsibilities.

These stages are not fixed, but are developmental. An effective leader is likely to try to develop his followers from LoAbLoMo towards HiAbHiMo, either through HiAbLoMo or LoAbHiMo, if for no other reason than to make his own job less demanding. It is fundamentally necessary for the leader to adapt his leadership behavior to suit the stage of development of his followers. It follows from this that the most effective leader will be the one who can most accurately assess the stage of development of his followers, both in terms of ability and motivation (competence and confidence) in any particular situation, and who can then adapt his leadership style to suit it.

Dimensions of Leadership Style

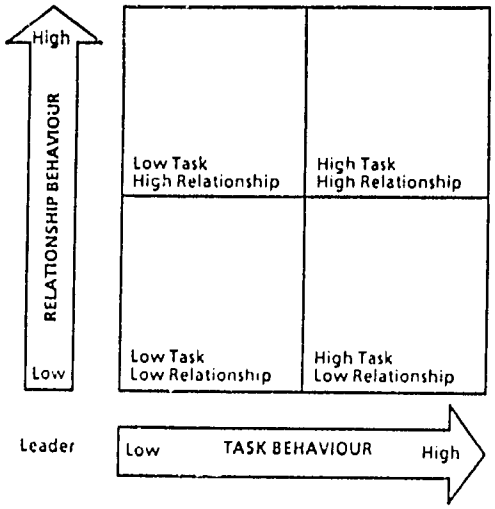
But, you may well ask, how should he adapt his leadership style? For this, let's think back first to the 'neo-human relations' ideas on leadership. Remember that two major types of leadership behavior were identified: concern for the task and concern for relationships. Two main limitations of these ideas have become apparent. First, 'task' behavior and 'relationship' behavior were seen by some theorists as either/or: the more 'task-centered' your leadership style, the less 'people-centered' it could be. Secondly, researchers failed to establish a correlation between leadership style and subordinate performance.

But these two flaws in the theory didn't invalidate the basic idea that there are two main types of leader behavior, task-centered and people-centered. It was only the way that this idea had been applied that was invalid. Let's knock down the assumption that the two styles are either/or. Remember the diagram drawn by Tannenbaum and Schmidt in which both styles were shown on one axis, the horizontal, so that more of one meant less of the other? We could now draw a new diagram with one style on the horizontal axis and one of the vertical – so that the level of one would have no effect on the other.

Two things become apparent. One is that we now have a diagram of leader behavior that bears quite a lot of similarity to the diagram already drawn of follower qualities. The other is that leader behavior can now be described in four main categories rather than two.

HiTaHiRe High task and high relationship behavior. Leaders using this style spend a lot of time with their followers, both actively checking that the work is being done and encouraging and supporting them.

LoTaHiRe Low task and high relationship behavior. A leader using this style concentrates his energies on improving his boss/



subordinate relationships and encouraging high morale among his followers.

HiTaLoRe High task and low relationship. In his style, a boss is much more concerned making sure his subordinates can do the job and with seeing that they do it than he is in bolstering their motivation or confidence.

LoTaLoRe Low task and low relationship. The leader using this style keeps a 'low profile' all round and lets his subordinates get on with the job with the minimum of interference.

Integration of Leader, Subordinate and Situation

The similarity of the two diagrams, subordinate attributes and leadership style, is no accident. It arises because of the way in which we can integrate the two dimensions of each diagram to provide a very useful view of the situation in which the leader operates.

The more highly developed the ability of the followers, the lower the need for the leader to use task-oriented behavior. If your subordinate is very very good at his job, you don't have to show him how to do it. Doesn't that sound like common sense? Sometimes it's surprising how much apparent 'common sense' is overlooked or ignored. The more highly motivated your followers are, the less you need to use relationship-oriented behavior. If your subordinate is highly self-motivated in a particular job, continued encouragement will be seen as patronizing and insulting.

And, for both of these statements, the corollary is equally true. In other words, subordinates of low ability call for a lot of task behavior from their boss, while subordinates with low motivation need a lot of support and encouragement from their boss. We can integrate our two diagrams to demonstrate this.

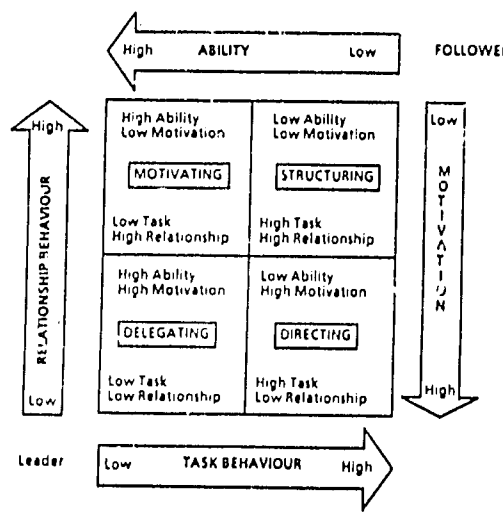
If the followers are low in both ability and motivation, the leader should adopt a highly structured style — close supervision, including instruction, training, encouragement, and feedback. If the followers are high in ability but low in motivation, the leader should use a highly motivational approach — lots of encouragement, feedback, and stimulation but less emphasis on job skills.

If the followers are low in ability but high in motivation, the leader's role is to channel that enthusiasm in the right direction — to direct them in the task but not to try to be encouraging, which could be resented. If the followers are high in ability and high in motivation, the leader can delegate a large amount of responsibility to them and concentrate himself on long-term goals and strategies.

Strategy for Effective Leadership

An individual who finds himself in a position in which he is expected to exercise leadership could seek to make himself as effective as possible by following these steps:

1. Identify the sources of power available, their relative strengths and their values in different situations.



2. Seek to strengthen those powers seen as most useful.

3. Examine himself and attempt to make a realistic assessment of ways in which it would be useful to change (referent power and expert power are particularly relevant here).

4. Assess the nature of the task to be accomplished in any particular situation by his work group.

5. Assess the stage of development of his subordinates in terms of ability and motivation in relation to the task to be accomplished.

6. Determine the most appropriate style of leadership for those subordinates in that situation — structuring, directing, motivating, or delegating. Note that steps 4, 5, and 6 will often be taken without conscious thought by effective leaders.

7. Be prepared to alter his leadership style if the situation should change.

8. Attempt at all times to develop his subordinates towards high ability and high motivation, which will allow him then to move towards a delegation style of leadership.

MANAGEMENT CASE STUDY

Research-Extension Linkages in Talau

Paul Bennell
Research officer
ISNAR

Introduction

'We must do something to improve the relationship between agricultural research and extension in Talau.' The Director of Agriculture, Dr. Solomon Turk, was becoming increasingly agitated. His visitor, Mr. Patrick Smythe, Visiting Fellow at the Talau Institute of Public Administration, looked suitably concerned. 'I just don't understand what is going wrong,' continued Turk. 'You would have thought that this relationship should be logical and straightforward. After all, the overriding objective for both the researcher and the extentionist is to improve the welfare of our farmers. And this cannot be achieved unless they cooperate fully with each other. But here in Talau our researchers and extentionists just don't seem to get along at all well. Instead of working together as they should, they seem to go their separate ways. I sometimes think that each group is more concerned with its own welfare than with that of the farmers. Of course, differences between staff in separate departments are bound to arise every now and again but, between research and extension, these seem to have become blown up out of all proportion. When I worked as a plant breeder at DAR 15 years ago, we had much better relations with our extension colleagues. Just what has happened?' Dr. Turk, who was now perspiring heavily, jumped to his feet. 'And this is where you come in, Mr. Smythe. If you are agreeable, I would like you to undertake an in-depth study of this problem. I don't suppose you know much about agriculture, and you are certainly not a Talauan, but with your training and experience in management, I'm sure you can do a good job.'

The Policy Environment

Since political independence in 1958, the government of Talau had undertaken comprehensive planning efforts in order to promote the economic and social development of the nation. The most recent national and sectoral objectives and targets were specified in the Five-Year National Development Plan 1982-1986. The government recognized that development in Talau depended to a large extent on the performance of the agricultural sector, which accounted for 35.7% of gross domestic product and provided employment for 68.0% of the ecomically active population.

The broad objectives for the agricultural sector were clearly laid out in the National Plan (exhibit 1). However, it had been left to the Director of Agriculture and his senior advisors to translate these broad objectives into more precisely defined targets. It was now 1985 and they still had not found time to complete this exercise. Time was running out.

The government had consistently supported agricultural research activities in the Ministry of Agriculture. However, as more and more research was completed and new agricultural technologies were developed, the government increasingly expressed concern about the transfer of these technologies to producers. Eventually a policy decision was made in 1974 that greater emphasis should be given to technology transfer activities (exhibit 2). As the Minister of Agriculture said at the time, 'We've spent the last 25 years getting these technologies together. They are now available and on the shelf. The challenge now is to make sure they are used by the farmers.'

The Department of Agricultural Research

DAR was established in 1947 as part of the Ministry of Agriculture. It had a comprehensive national mandate to undertake crop and livestock research, in addition to providing important agricultural services (seed multiplication and certification, soil and plant analysis, and dairy services).

Exhibit 1

Government Objectives for Agriculture during Five-Year National Development Plan 1982-1986

- Target growth rate of 3.5% per annum (in real terms)
- An increase in both land and labor productivity in all forms of agriculture
- Extension of the role of agriculture as a major foreign exchange earner
- A rapid reduction in the levels of absolute poverty in the rural areas
- Conservation of the land and environment for future generations
- Maintenance of food self-sufficiency for all major crops (maize, cassava, coconuts, yams)
- Substantial increase in employment for the rapidly growing labor force

Exhibit 2

Approved Expenditure, Ministry of Agriculture 1970-1985
(T$ million in current prices)

	Year			
Head	**1970**	**1975**	**1980**	**1985**
Administration	3.1	4.7	5.2	6.3
Research	10.3	11.7	14.5	19.6
Extension & Training	8.9	10.8	22.0	33.7
Veterinary Research and Services	4.7	6.0	8.9	9.2
Subsidies	20.4	32.8	39.7	50.9
Total	**47.4**	**66.0**	**90.3**	**119.7**
Total Government Expenditure	316.0	468.0	734.1	1260.0

Since the mid-1970s DAR had given priority attention to the technological needs of the 255,000 smallholder farmers in Talau. There was a healthy emphasis on adaptive research, which was increasingly based on researcher- and farmer-managed on-farm trials. Of the time devoted to research activities in 1985, approximately 30% was spent by DAR researchers on on-farm trials (exhibit 3). DAR managed most of these trials itself. However, the Department of Agricultural Extension had sought DAR's help for some of the more complicated demonstration trials for which it was responsible.

DAR had nine main research and service units (exhibit 4). All but three of these were located at the national agricultural research center, some 20 kilometers outside the capital, Pina. The regional research stations covered the three main agroecological regions in the country.

Commodity research teams with researchers drawn from all relevant DAR units and also the Faculty of Agriculture at the National University had been established for the main export and subsistence crops (coconuts, coffee, pineapples, cassava, rice, maize, and yams) in the late 1970s. Despite some initial anxieties, these teams had worked well. Morale was generally high.

DAR employed a total of 426 staff in 1986: 113 researchers, 143 field and laboratory technicians, and 170 skilled and unskilled workers. Most researchers had graduated from the faculties of agriculture or science at the National University. Research still remained the most popular career choice among these graduates. And, with large numbers graduating each year, competition for the few vacant posts at DAR was intense. However, agricultural research was not an attractive career choice among agricultural diplomates from the College of Agriculture, which was DAR's main recruitment source for field technicians. After completing their two-year training, they preferred to find employment in the private sector, where salaries were generally much higher than in the public sector. Even within the public sector, opportunities for agricultural diplomates were better in extension and production organizations (exhibit 5).

Most researchers were sent overseas for postgraduate training, usually within three or four years of joining DAR. By the mid-1980s DAR had managed to build up a relatively experienced and well-qualified professional cadre (exhibit 6). This was reflected in the quality of research being undertaken. DAR was proud of its achievements. During the 1960s crop researchers had played the lead role, mainly in the plantation and large

Exhibit 3

Percentage Time Allocations to Major Activities Undertaken by Researchers and Subject-Matter Specialists, 1975-1985

Year	Admin./ management	Research On-station	Research On-farm	Own training	Training others	Extension/ technology transfer
Researchers						
1975	10	57	5	5	10	13
1980	10	53	12	3	6	16
1985	12	37	17	3	6	25
SMS						
1975	8	0	20	3	23	46
1980	8	0	23	2	24	43
1985	7	0	28	1	28	36

Exhibit 4

Research and Service Units, DAR

Unit	Location	Professional staff
Head Office & Biometrics	ARC	4
Crop Breeding Institute	ARC	9
Plant Protection Research Institute	ARC	8
Seed Services	ARC	4
Livestock Production Research Institute	ARC	24
Soils & Chemistry Research Institute	ARC	11
Dairy Services	ARC	6
Gatuni Regional Research Station	Molong	14
Klindali Regional Research Station	Kandi	18
Bembenani Regional Research Station	Buhwong	15

farm subsector. This had been the government's main priority after independence. In the livestock area, the pasture and nutrition research on cattle had been outstanding.

DAR recognized that the impact of their work on the smallholder subsector (and especially the resource-poor farmers in the low-rainfall areas) had been fairly limited to date. But now that this was the government's priority target group, DAR was confident that, given adequate resources and realistic expectations on the part of the government, important breakthroughs could be made.

DAR was entirely dependent on government for its funding. Although its budget had increased by over one-third between 1980 and 1985, when inflation and successive currency depreciations were taken into account, the Department in 1985 was actually worse off in real terms compared with 1980. And yet, during this period, the number of researchers employed had increased by 15.0%. With the resulting shortages of operational funds, researchers had become very frustrated. DAR pressed government to create a semiautonomous agricultural research institute which would have the autonomy and resources to ensure high

Exhibit 5

Median Incomes ($p.a.) by Years of Work Experience of University Graduates and Agricultural Diplomates in DAR and DAE, 1985

Years Experience	University Graduates		Diplomates	
	DAR	DAE	DAR	DAE
0-2	1250	1200	800	880
3-4	1320	1270	870	950
5-6	1680	1530	980	1100
7-8	1890	1660	1040	1260
9-10	1930	1780	1110	1370
11-12	2210	1850	1340	1600
13-14	2420	2010	1410	1770
15-16	2640	2220	1470	1980
17-18	3000	2550	1610	2090
19-20	3210	2780	1760	2270
21-25	3480	2850	1880	2430
over 26	3600	3020	1930	2650

Exhibit 6

Qualification and Experience Profiles of Senior and Middle-Level Agricultural Research and Extension Personnel, 1985

	Highest qualification				Years work experience				
	Ph.D.	MSc.	B.Sc.	Dip.	0-5	6-10	11-15	15-20	over 21
Research									
Managers	1	1	0	0	0	0	1	1	0
Researchers	15	59	39	0	24	29	22	25	13
Technicians	0	0	0	143	19	24	28	33	39
Extension									
Managers	0	0	3	0	0	0	0	2	1
Subject-Matter Specialists	0	0	33	0	15	8	7	3	2
Training Unit	0	1	2	2	0	2	2	1	0
Farm Management Unit	0	0	4	1	2	0	1	2	0
Agricultural Info. Unit	0	1	3	1	1	1	1	1	1
PAEO & DAEO	0	0	0	55	10	13	10	10	12

Exhibit 7

Outline of Organizational Structure of the Department of Agricultural Extension, 1985

Director of Extension (1)*

Asst. Director
Field Services Division (1)

Provincial Agricultural
Extension Officers (8)

District Agricultural
Extension Officers (47)

Field Agricultural
Extension Officers (252)

Asst. Director
Technical Services Division (1)

(i) Subject-Matter Specialists (35)
(ii) Agricultural Information Unit (4)
(iii) Farm Management Unit (4)
(iv) Training Unit (3)

* ( ) = *number of professional staff in post*

levels of research productivity. However, this had not been accepted by government. In his response to the proposal, the Minister of Agriculture stated, 'If anything, DAR has too much autonomy already.'

The Department of Agricultural Extension

Like DAR, the Department of Agricultural Extension (DAE) was part of the Ministry of Agriculture and was therefore under the direct authority of the Director of Agriculture. From its establishment in 1967 until 1975, extension officers had undertaken multiple functions (including provision of credit and inputs to farmers and statistical data collection) but since then, their activities had been confined solely to information dissemination. This was not a popular decision in DAE, but it was felt that only by specializing in this way could the technology transfer function be undertaken in an effective, professional manner and linkages with DAR strengthened.

DAE's head office was located at the main ministry building in Pina. Most of DAE's 750 staff were employed in the field services division (exhibit 7). This division was hierarchically organized on a provincial basis. The overall extension officer:farmer ratio was 1:1300 in 1985. DAE had always regarded small, resource-poor farmers as its primary client group.

Formal educational requirements for provincial and district AEOs were five years of secondary schooling and an agricultural diploma from a recognized college. Field AEOs required two years of secondary education and successful completion of the two-year agricultural certificate course run by the Ministry of Agriculture's own training center.

The Technical Services Division had 35 university-trained subject-matter specialists, all of whom worked at head office. The SMS group was responsible for (i) taking research results from DAR and developing suitable technology packages and recommendations for farmers and (ii) communicating this information to agricultural extension officers in the field through the development of appropriate publications and training activities. They worked closely with the Agricultural Information, Farm Management, and Training units, which were also part of the Division. When necessary, the SMSs did their own adaptive research. This had increased in importance since the mid-1970s (exhibit 3). In general, each SMS worked on his own, rather than in a team.

The Field Services Division was able to attract and retain good-quality staff. In the Technical Services Division, on the other hand, recruitment of high-calibre graduates for the SMS posts had become increasingly difficult, and

there were 10 vacancies in 1985. Extension had a poor image among agricultural graduates. Research was generally considered to be more interesting and of higher status and, equally important, public-sector pay and promotion opportunities were more attractive (exhibit 5). Resignations among more experienced SMSs had increased rapidly since the late 1970s. As a group, therefore, SMSs were relatively young (exhibit 6).

Concerted efforts had been made by the Director of DAE, Mr. Quwani, to persuade the Public Service Commission to reward the SMs in the same way as the researches. Part of the problem was that the Director of Agriculture did not believe that the SMSs required postgraduate training. The SMSs were very aggrieved about this, not only because they considered they needed this training, but also because, without postgraduate qualifications, they could not earn as much as researchers. Diploma-level extensionists, on the other hand, were encouraged to upgrade themselves to the SMS level by obtaining a university agriculture degree. Mr. Quwani had himself done this. As he kept pointing out, especially to his research colleagues, 'I came up the hard way.'

Attitudes, Values, and Opinions

As part of his study, Mr. Smythe interviewed representative samples of agricultural researchers, subject-matter specialists, and senior field extension officers in order to find out how they viewed the relationship between DAR and DAE and how they thought it could be improved. Being an outsider without any particular axe to grind was important. Smythe stressed that the interviews were strictly confidential. He was struck by the eagerness and openness of his interviewees. For most of them, it was the first time anyone had seriously asked them for their views on this subject.

Smythe summarized, in note form, what he saw as the main attitudes and opinions of the two groups. At first, he didn't think that this would be easy to do, but looking through his questionnaires he was surprised at the high level of uniformity of responses. It certainly appeared that there were strongly held group attitudes and opinions.

Research Responses

- Agricultural research is undervalued by politicians and senior policy-makers. Extension, on the other hand, is given preferential treatment. DAR should become a semiautonomous research institute outside the central government structure.

- Basic disagreement with current extension strategy. Reliance on a limited range of recommendations disseminated in a cookbook fashion is inappropriate. Need instead well-trained farm management advisors, especially among resource-poor farmers in the rain-fed agricultural areas, where farming systems are highly complex and varied. Until such a group exists, DAR has little alternative but to continue to undertake its own technology transfer activities.

- Field extension officers lack basic knowledge and skills to fulfill this advisory role. They are still strongly motivated by traditional values and attitudes. They cannot provide the feedback to DAR that is needed.

- The present numbers of SMSs are adequate, but better training is required. In general, DAE staff lack confidence and are defensive in their dealings with DAR.

- DAR researchers are strongly committed to solving the problems of farmers. They understand these problems fairly well, although more farming systems research needs to be done. DAR research is generally of high quality and relevant. The main problem is that DAE is not capable of ensuring successful transfer to the farmers. All too often DAR gets the blame for DAE's ineffectiveness.

- DAR should have the responsibility for undertaking all research in the country. However, DAE field personnel could play a greater role in assisting DAR's on-farm trials.

- DAR should provide more training to DAE staff but can only do this if more professionals are employed.

- Present involvement of DAE staff in annual review meetings of the commodity research teams is adequate. DAE staff should not be formally incorporated as members of these teams.

Extension Responses

- There is no practicable alternative to the present departmental structure in the ministry. However, new coordinating mechanisms are required. A DAE-DAR planning committee should be established in order to work out joint goals and coordination of activities. Present DAE involvement in DAR review meetings is totally inadequate.

- The present extension strategy makes sense, given existing resource constraints. There should, however, be considerable increase in the number of SMs in order to improve DAE capacity to assess agricultural technologies and train their own officers.

- DAR researchers are not sufficiently in touch with farmers, especially the poorer ones in the rain-fed agricultural environments. They spend too much time at their research stations doing research on problems that are mainly of interest to them. They are evaluated on the basis of their publication output rather than how they have contributed to improving agricultural productivity. Most of them are too individualistic. DAR does not employ any social scientists.

- DAR researchers regard themselves as superior to extension professionals. They tend to treat DAE staff in the same way as their own field staff. They are very conscious of their professional status and want to distance themselves from DAE.

- In the past, the credibility of DAE among farmers has been badly affected because of the nonviability of many of DAR's technologies.

- Formal recognition and encouragement should be given to the considerable amount of adaptive research undertaken by DAE.

- DAE researchers are generally poor communicators. They lack the temperament and appropriate training. They have a poor understanding of the technology transfer function. DAR needs a specialized information unit to translate DAR research results into usable forms.

- DAE is doing a good job under difficult circumstances. There is, however, a serious motivation problem among field staff. Salaries, housing, and transport facilities are all poor.

- Lack of political and senior management commitment to improve DAE-DAR relations. Previous Directors of Agriculture should have sorted out the problems a long time ago, but they nearly always had research backgrounds and were therefore biased in favor of DAR.

Conclusion

It was past midnight. Mr. Smythe sat at his desk surrounded by large heaps of books and papers. He had completed his interviews with DAE and DAR staff and had spent days reading through various reports and memoranda. It was three months since Smythe had first seen Dr. Turk. He knew the Director was getting impatient.

Collecting all the information he needed had been relatively straightforward. It was the 'What should be done?' part of the report that Smythe was most worried about. He knew that he must present a clear action program for the Director of Agriculture to follow. This should be based on a precise analysis of what the main linkage functions between DAE and DAR should be, how they had been undertaken in the past, and finally, what steps should be taken to achieve the desired relationship. Finding common ground between the two departments was difficult, but Smythe knew that this provided the only feasible basis for improving the relationship in the future.

THE LOGICAL FRAMEWORK APPROACH: AN OVERVIEW

Peter Goldsworthy
Senior Research Officer
ISNAR

The log-frame is simply a way of laying out in an orderly manner the logical reasoning that everyone uses implicitly whenever they make a plan of action. It seeks to provide a structure which will assist planners and evaluators to specify the components of their activities and identify the logical linkages between a set of means and a set of ends.

The log-frame is a 4 x 4 matrix in which the rows represent the levels of project objectives, including the means required to achieve them (the vertical logic), while the columns indicate how the achievement of these objectives can be verified (the horizontal logic) (figure 1).

Narrative Summary	Verifiable Indicators	Means of Verification	Important Assumptions
GOAL			
PURPOSE			
OUTPUT			
INPUT			

Figure 1: *The Logical Framework*

The Vertical Logic

From the bottom to the top in the left column is a 'narrative summary' of the four levels of objectives of a program. It should provide a clear, concise statement of project intent and indicate the plausibility of the assumed linkages between levels.

Inputs are the activities to be conducted under the project and the means (resources and staff) to undertake them.

Outputs are the specific achievements (variety, technology, knowledge) to be produced from the inputs and which are not dependent on other activities.

Purpose is what the project is expected to achieve once completed. The purpose is the reason for which the research output is necessary and sufficient. In the example of a breeding program, it is expected that if a hybrid coconut with the required characteristics is developed (output achieved), then producers will adopt it and production will increase (purpose achieved).

Goal is the reason for undertaking the project, the ultimate objective of the program to which the project will contribute.

The first three levels (inputs, outputs, purpose) are specific to the project itself, while the highest level, the goal, relates the project to the program of which the project is a part; or it relates a program to other programs to which it is a contributor. In the example (figure 2), the *inputs* required for the project are a breeding program, staff, facilities, and funding. The *output* resulting from this provision is a new hybrid coconut, and the *purpose* is 'to increase the production of high-grade coconut oil.' The ultimate goal of the project is 'to increase hard currency earnings.' The

	Narrative Summary	Verifiable Indicators	Means of Verification	Important Assumptions
Then	**GOAL** To increase cash income of rural producers	Changes in patterns of expenditure	Farm & village surveys	Policy continues to support rural incomes
If Then	**PURPOSE** To increase production of taro + cut costs	By year C: -Production of taro doubled -No new land cleared -Cost reduced	-market & production statistics -Farm surveys -Extension reports	-Fertilizer/credit circulate on time -Demand for taro continues to give incentive to producers
If Then	**OUTPUT** New taro varieties + management	Year B: Variety yield >tons in 150 days Management system permits interval of 4 not 2 years between fallows	-Expen. records -On-farm test -Research report	-Close liaison extension service for on-farm testing
	INPUT Root crop specialist support staff germplasm facilities funds	Staff and facilities in place by end of year A	Quarterly and annual report Accounts and administrative reports	-Annual funding available on time and in accordance with budget

Figure 2: *The Logical Framework: Specific Example*

achievement of the purpose will clearly contribute to the goal, but just as clearly, it is not the only component of the goal. The development of the new hybrid is a *necessary* but *not a sufficient* condition of the goal "to increase hard currency earnings." Put another way, the achievement of the project purpose will not automatically satisfy the project goal if other complementary projects, aimed at the same goal, fail to achieve their purposes.

It is important to examine the hierarchy from the bottom upwards. Each lower level activity contributes to the achievement of the next higher level result.

The vertical logic from inputs to goal is based on causal relationships in which each level is related to the level above it. This cause-and-effect linkage can be expressed in terms of an if-then relationship:

- If inputs are provided then outputs will be produced;
- If outputs are produced then purpose will be achieved;
- If purpose is achieved then the goal should be achieved
  (provided other complementary requirements are met).

The Horizontal Logic

The second column, 'Verifiable Indicators,' specifies the criteria to be taken as evidence of the achievement of each level of objectives. Objectively verifiable indicators must satisfy the following conditions:

- They must clearly indicate the criteria for success of the project;
- They must focus on what is important in the objective for project purposes;
- They must be sufficient in number and detail to provide an adequate measurement of achievement of objectives;
- They must be independent;
- They must be objectively verifiable;
- They may rely on indirect indicators (where it is not possible to give a direct verifiable indicator of achievement);
- They must specify the nature, quantity, quality, and time required for the objective to be achieved.

When elaborated in terms of objectively verifiable indicators, the *Purpose* statement becomes a description of the end-of-project status.

The third column, 'Means of Verification,' indicates how the evidence specified under 'Verifiable Indicators' can be found and measured.

Identification of the indicators of achievement and of the means of verification does two things: it sets up in advance the criteria for measuring project success, and it provides a sound basis for subsequent monitoring and evaluation.

Important Assumptions

The last column, 'Important Assumptions,' lists those factors which may influence the progress or chances of success of the project, but over which the project has no control (e.g. political changes, government intervention, unexpected movements in the economy and exchange rates, the weather). Of many potentially important assumptions, only the most important for each level of hierarchy are listed. Assumptions are particularly important for the project at the *input* and *output* levels. In the example, *inputs* include not only the proposed activities included in a breeding program but also the means necessary to implement these activities (the availability and timeliness of funding, staff, supplies, and equipment).

In the example to illustrate how the logical framework is used, the four levels of objectives range from a specific breeding project to a national policy objective. In practice it may be more useful to develop a set of nested log-frames, each covering a narrower range of levels of objective, from specific research topics to national agricultural policy objectives.

PLANNING AND MANAGING REGIONAL RESEARCH ACTIVITIES: THE IRETA EXPERIENCE

Leonard H. Fernando
Consultant, Former Director IRETA

IRETA

Towards the end of 1980, the Heads of Agriculture of the South Pacific Islands agreed to support the University of the South Pacific (USP) in establishing an Institute for Research, Extension and Training in Agriculture, IRETA. The University Council, with its regional representation, ratified this and sanctioned the use of funds required to initiate the work of the Institute. While the School of Agriculture continued its regional responsibility for agricultural education at degree and diploma level, IRETA used available resources for regional research, extension and training in agriculture. IRETA's broad objectives, in respect to these three components of agriculture, were formulated to serve the needs of the South Pacific Islands in their development programs in agriculture. This was in accord with the Vice-Chancellor's statement in 1975 that 'the University is more than a teaching institution. It is a major, perhaps the major resource base in the region; it must be development oriented and it must be capable of being used by the countries of the region, as they seek to bring about their development plans.'

Since 1980, IRETA has continued to function in unison with the School of Agriculture. The expertise of 17 academic members of staff in the School of Agriculture has been made available to IRETA's Regional Program. With provision for 11 scientific positions in IRETA, 28 agricultural scientists in both the School and IRETA cover a wide range of agricultural specialization and provide a service to the South Pacific Islands. IRETA reciprocates by contributing to the teaching and training programs in the School. Students participate in experimental agriculture and are therefore well prepared to undertake such work in their home countries. Through IRETA and the School of Agriculture, regional links in agricultural research, extension, and training have been strengthened in the countries supporting the University of the South Pacific.

Donors

(i) The EEC

IRETA's first aid donor was EEC, with substantial funds provided for an Applied Agricultural Research Program. Technical assistance was provided through the appointment of a Director for IRETA and fellows in agronomy, crop production, and food technology. In addition, short-term consultancy was provided for, as well as equipment for research, books for the library, funds for technical meetings, including the Regional Board meeting. Provision was made for training programs and for an attractive IRETA complex of buildings, as a gift from the European Economic Community to the peoples of the South Pacific. Total EDF funds provided under Lomé I and II to the end of 1986 amounted to ECU 1,002,359 and were made up as follows:

	ECU
Consultancy	319,242
Technical Assistance	242,789
Training	50,711
Research	37,910
IRETA Building	288,703
Equipment	52,256
Library	10,748

Residual funds under Lomé II were used in 1987, with a total of about 1.1 million under Lomé I and II.

For 1988 onwards, funds sought under Lomé III are

approximately ECU 1.53m. When the EEC first funded IRETA and its Applied Agricultural Research Program, a Regional Research Advisory Board (RAB) was formed composed of Regional Heads of Agriculture. In 1984, this Board accepted the recommendation of the EEC evaluation team that the activities of both institutes, IRETA and IRD (Institute of Rural Development in Tonga), should be integrated and the Board was accordingly renamed the Regional Advisory Board (RAB) to IRETA and IRD.

The scope of the Regional Board thus changed from regional research to agriculture and rural development. Although funded by the EEC, the Board later covered programs in agricultaral research, extension, and training and also rural development, funded by all aid donors.

(ii) USAID

Of importance to IRETA was Project Support by USAID for SPRAD, South Pacific Region Agricultural Development, in response to the expressed desires of the governments of the South Pacific region. The project was designed to contribute to teaching, research, and extension, with long- term and short-term technical assistance faculty through the Universities of Hawaii and Cornell. The broad objective of the project was to promote agricultural productivity and socioeconomic development among the rural peoples of the South Pacific region. The project was designed to strengthen the capacity and resources of the University of the South Pacific in agricultural research, extension, and education. Aid amounting to US$5,817,720 was given for the 1981-86 period and was composed of a contract of US$4,490,767 to the Universities of Hawaii and Cornell for agricultural scientists in crops, soils, engineering, education, and extension and also specialists in library services. USP was given a grant of US$1,326,963 during the same period for:

Construction of houses for SPRAD staff	404,177
Scholarships	445,614
Agricultural Liaison Officers	207,381
Workshops	91,559
Administration	20,430
Regional Travel for SPRAD Staff & others	119,443
Equipment and other requirements	15,454
Satellite Manager	10,259
Regional Research Projects	12,760

The SPRAD Project has been extended to a second phase with funds close to US$7m.

(iii) Other donors

In 1986 *ABD* made an important contribution to perennial crop research and development in the South Pacific region through the appointment of a tree crop research planner. This project covers perennial crops such as coconuts, cocoa, coffee, spices, and fruit trees through IRETA. Representation on the RAB has been extended to ADB and to Papua New Guinea. Assistance for these crops through ADB amounts to US$250,000 over the initial two-year period. FAO has also expressed an interest in research and development of fruit trees and has contributed towards a preliminary meeting for this purpose, which was held at Rarotonga in the Cook Islands.

West Germany, through *GTZ*, the German Agency for Technical Cooperation, funded a splendid Plant Protection Laboratory which was staffed by research scientists from West Germany and was fully equipped to undertake research, education, and training over a five-year period, 1980-1984. Research in this laboratory resulted in two regional students being awarded Master's Degrees, and two students from West Germany received Doctor's Degrees.

New Zealand, *Australia*, the *UK*, and the *Netherlands* have contributed to the School of Agriculture, with indirect benefits to IRETA.

UNDP, *FAO*, *CFCT*, *CGA* (The Commonwealth Group in Agriculture), *CTA* (the EEC supported Technical Centre for Agriculture and Rural Cooperation), and *ACIAR* have been closely associated with IRETA in technical meetings and training programs. These are listed for the 1983-1987 period:

Technical Meetings to Research and Development 1983-1987 (held at IRETA except where otherwise stated

	Sponsored by
Commonwealth Workshop on Post-Harvest Losses, May 1983	**Commonwealth Secretariat**
South Pacific Is. Regional meeting on Coconuts, November 1983	**EEC**

South Pacific Is. Regional meeting on Food Technology, Development, and Needs, November/December 1983 **EEC**

South Pacific Is. Regional Meeting on Coconuts, at Santo, Vanuatu, July 1984 **EEC**

Workshop on Smallholder Livestock Development, November 1984 **Commonwealth Secretariat**

Commonwealth Consultative Group on Agriculture (CGA), April, 1985 **Commonwealth Secretariat**

Technical meeting on Smallholder Livestock Development in the South Pacific, November 1985 **CTA***

South Pacific Is. Regional meeting on Coconuts November 1985 **EEC**

Linkages between Extension, Research, and Education in Agriculture and Forestry of Asia and the South Pacific **CTA**

Consultative meeting of Heads of Research Institutions in Agriculture and Forestry of Asia and the South Pacific **EEC**

International Forum on Soil Taxonomy and Agrotechnology Transfer, July 1986 **IBSNAT and others**

Workshop on the Production of Quality Seed (CGA), June/July 1986 **Commonwealth Secretariat**

South Pacific Is. Regional meeting on Coconuts, at Santo, Vanuatu, August 1986 **EEC**

Meeting on Atoll Agriculture at Tarawa, Kiribati, October 1986 **EEC**

Agroforestry in Tropical Islands, February 1987 **CTA**

Appropriate Food Production Systems around Rural Homesteads, March 1987 **CTA**

Meeting on Research and Development of Fruit Trees, Cook Islands, May 1987 **FAO and ADB**

South Pacific Islands Regional meeting on Coconuts at Honiara, Solomon Islands, June 1987 **ISNAR and ADB**

Workshop on Research, Planning, and Management in the South Pacific, October 1987 **ISNAR/ADB**

These meetings have been the main opportunities for agriculturists in the South Pacific region to meet. Meetings or workshops in Agricultural Extension or Agricultural Education have not been included, nor has the annual Regional Advisory Board Meeting, which is attended by the National Heads of Agriculture or their deputies.

Regional Research

IRETA's coordination of the South Pacific Network for coconuts was accepted by Vanuatu, FAO, and APCC. This was made possible by Vanuatu's willingness to help the South Pacific with the resources of their excellent IRHO-supported station for coconuts at Santo, Vanuatu, on the understanding that IRETA would coordinate this activity with EEC funding. IRETA has organized a meeting, every year from 1983, mainly for the research and development aspects of coconut growing, with a training component.

Of the five meetings held so far, two were at Santo, Vanuatu, two at Alafua in Western Samoa, and the last at Honiara in the Solomon Islands. ACIAR participated in the meetings for collaboration in coconut germplasm research and embryo culture. FAO and SPC were represented at some of the meetings. UNDP/FAO sponsors a network of coconut research institutions in Asia and the Pacific, with the Asia and Pacific Coconut Community (APCC) participating in the project.

Regional research on root crops and vegetables has been funded by USAID under the SPRAD Project and this work has established close contacts with the region. Regional projects on breadfruit and solarization have been funded by USAID. The atoll experiments at Tarawa in Kiribati have been ongoing with support from EEC, SPRAD, and FAO. The work has been reorganized with the location of an EEC-funded agronomist at Tarawa in 1985 for research on atoll agriculture related to atoll countries in the region. EEC has funded research on cereals and pulses; in consultation with the Department of Agriculture in Fiji

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* *CTA is the EEC-sponsored Technical Centre for Agricultural and Rural Cooperation in the Netherlands.*

and IRRI, work was initiated in Western Samoa on the production of cereals and pulses as food and livestock feed, grown in cropping systems based on taro.

The organization, resources, and activities of IRETA have been briefly presented. The planning and managing of regional research will now be discussed.

Planning and Managing Regional Research

As already explained, the University of the South Pacific (USP), through its School of Agriculture (SOA) and IRETA, has established links with the National Departments of Agriculture of those South Pacific Islands that are members of USP. The USP School of Agriculture and IRETA have an obligation to participate in agricultural research at the Alafua Campus, where students are presently trained in diploma, degree, and postgraduate programs. The research in progress at the Alafua Campus provides an opportunity for both staff and students to promote experimental agriculture and extend relevant findings to the South Pacific Islands. Adequate provision for this is accordingly important. Each head of section of the school at Alafua is allowed a small budget for staff and materials for field and laboratory research. The management of the sectional budget is the responsibility of the heads of sections, who also decide the time available for staff to undertake teaching and research. The teaching of two full courses a semester, four a year, is expected to allow sufficient time for research, and the teaching staff welcome this opportunity, as their advancement and promotion is dependent on the value of their research. It is stipulated by agreement that this research is relevant to the needs of the region and that extending the research to more than one country in the region would satisfy the definition of regional research. University teaching and research are in this way jointly promoted. The limitations are usually a lack of support staff, compensated for partly by student participation, and the inadequacy of funds for research and travel in the region. If teaching loads are too heavy it is very difficult to undertake a consistent research program. Apart from teaching, other commitments in a university post can be time-consuming.

It is worthwhile to promote student participation in research with members of the academic staff and to provide adequate resources for this purpose. IRETA staff who hold research positions also participate in school teaching, and they are not therefore in full-time research. They share their resources for research between the school and IRETA; they have travel funds which are often made available to their colleagues in the school.

Research equipment and material, books, and vehicles made available through external aid are shared between IRETA and school staff.

Interdisciplinary collaboration between sections, such as crops and soils, exists but can be improved for more broad-based research activities, and this also applies to multidisciplinary research. This would lead to a sharing of scarce resources, and even more to a sharing of time, with a more comprehensive approach to a package of recommendations. The value of research is enhanced, and the researchers interact in a more meaningful way. Such planning and management has to be through heads of sections and their colleagues and the Director of IRETA. In this comprehensive planning, research initiative should not be stifled, for instance where small plots must precede the formulation of a project. Those responsible for research, planning, and management are often broad-minded enough to accommodate these aspirations and efforts, particularly when the expenditure involved is small and is part of an unspecified general budget. Research interest, initiative, and action should be promoted. Costing may not be worthwhile until a project begins to develop. Research planning and management should therefore make some provision for inexpensive preliminary experiments

IRETA takes overall responsibility for research among scientists at the Alafua Campus of USP and when they operate in the region; aid funds for research are utilized when projects are formulated and approved. Inputs into national programs of research are important and are preceded by communication. National funds are often inadequate to meet such research, and aid funds are accordingly necessary in such situations.

Regional projects are formulated in consultation with the region. This consultation may be person-to-person between staff at Alafua and the region or at a consultative meeting of research persons in the same discipline, as for instance in crop production and protection, soils, or livestock. Provision for such consultation is rewarding; a scientist from Alafua going into the region can be useful, and also scientist(s) from the region visiting Alafua. Funds provided for such consultation are insufficient.

For planning research projects that are regional, more time is required to have formulation done before an

annual RAB meeting. This does present difficulties. A research committee was formed by the RAB for this purpose. Representation covered only a few countries close to Western Samoa and it was eventually decided to allow time on the RAB agenda for a discussion of research projects. These projects are formulated by agricultural scientists in the School of Agriculture and IRETA and discussed at IRETA staff meetings. Participation by countries in the preparation of regional plans is important, and leadership for some regional research projects should come from countries of the region. This has been successful with leadership for coconuts from Vanuatu through support and technical assistance from IRHO.

Linkages with other international organizations are important, and benefits can be derived therefrom. Regional research is limited by insufficient funds and by inadequate manpower in the smaller countries to collaborate in regional research. IRETA attempts to remedy this by locating scientists outside Alafua, as at Kiribati, and soon it is hoped, at Vanuatu, where all nationals are engaged in agricultural extension and services. Cook Islands have a good research station, supported by New Zealand, with emphasis on horticultural research. Fiji, Tonga, Western Samoa, and Solomon Islands have well-established research stations: in some of these, national scientists and support staff are insufficient for the programs that are undertaken.

Finally, it should perhaps be said that the planning and managing of regional research is more involved than that of national research. External aid has contributed much to regional research programs.

The coordination of agricultural research in the region would benefit all countries, but more particularly the smaller countries that have meagre research facilities, and can therefore benefit by technology transfer. Sufficient time for research is seen as a problem at Alafua and in the countries of the South Pacific Region.

A STRATEGY FOR IMPROVING EXTENSION SERVICES IN A SOUTH PACIFIC ISLAND COUNTRY: SOME LESSONS FOR AGRICULTURAL RESEARCH

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1. In early 1980, after a number of expert studies, the following conclusions were drawn:

   (a) The agricultural extension division of the Department of Agriculture was the weakest division, in that it did not have an appropriate program capable of persuading the farmers to adopt improved *income-increasing practices necessary to increase production*. This was in large part due to the inadequate content in terms of proven developed technology suitable for recommendation and adoption by farmers, and to the absence of a suitable 'method' for the conduct and management of field extension.

   (b) Extension services did not have the professional staff capable of mounting an extension program designed to modernize agriculture. This was in large part due to

   - the shortage of staff employed in the service, irrespective of quality of experience and training;

   - the low level of education and training of candidates recruited into the service.

   Extension was very much the 'poor relation,' unable to attract or to retain staff because of unattractive salaries and terms of employment. As a result, quality people were not being attracted into extension, with the resultant employment of 'untrained' persons, which then further compounded the problems of providing suitable in-service training.

   (c) There was a lack of facilities for in-service training for field staff which tended to exacerbate the problem of staff quality. Furthermore, the lack of transportation and housing in the districts had become major constraints on an effective service.

   (d) In the case of research, considered as a service to benefit farmers, there was no 'research program' properly organized and directed toward this single purpose. While the results of research were supposed to help farmers, very often they tended to be fragmentary, fell short of critical needs, and together with extension, were inadequately planned and coordinated.

2. Recognizing that strengthening was a must, in late 1980 the Department initiated a substantive program to improve the effectiveness of extension services. The principal program components included physical facilities for training, residential district extension centers, transportation for field staff, staff training and development, and evolving a method for the efficient conduct and management of extension work.

3. In the development of the extension program, the principal goal was to reach the largest numbers of farmers and to make contact with them on as regular and as frequent a basis as possible within the resources available. It was assumed that on meeting farmers, extension personnel would have something worthwhile (i.e. program content) to pass on which would prove useful to improve farm production.

   Taking due note of the constraints and limitations and starting with what was available, the strategy took the following planned steps:

   (a) In order to show improvement in the field-effectiveness of contact with farmers in the quickest time possible, it was decided to start by evolving and implementing a 'method' for the conduct of field extension work which

would allow for complementary interaction with increasing numbers of farmers on a regular basis and also provide opportunities for concurrent regular training activities for both extension staff and farmers. For this purpose a modified form of the 'Training and Visit System' (eventually evolved to the *A'oa'o ma Asiasi* in the Samoan context) was adopted. The component parts were

(i) The organizational structure was that which was already in existence within the Department, i.e.

Chief Agricultural Officer (CAO)	Administrative Head
Senior Agricultural Officer (SAO)	Region
Agricultural Officers (AO)	Zone
District Extension Officers (EO)	District
Farmers	Village-Farm Level

(ii) The principal technique for the system was a systematic program of regular visits to farmers combined with in-service training for the extension officers within every set four-week period/cycle, scheduled as follows:

	Mon.	Tues	Wed.	Thur.	Fri.	Sat.	Sun.
Week 1	V-1	V-2	V-3	V-4	V-5	Holiday	Holiday
Week 2	V-6	V-7	V-8	V-DF	T(AO)	"	"
Week 3	V-1	V-2	V-3	V-4	V-5	"	"
Week 4	V-6	V-7	V-8	T(TS)/ T(AO)	T(TS)	"	"

Code: V = Farmer Visits: Numbers 1 to 8 = Farmers in Villages/Groups
T(AO) = Training Meetings by Agricultural Officers
V(DF) = Visit to selected Demonstration Farms
T(TS) = Training by Technical Specialists

The system was organized to provide for the supervising agricultural officer to supervise, guide, and train his own assigned district extension officers on a set schedule. Likewise the monthly training sessions (T-TS) for two days at the national Extension Training Centre gave all extension staff intensive training on specific agricultural practices directly relevant to farming needs during that period and on administration practices directly important to the conduct and management of extension programs. The overriding objective was to ensure that on every level there would be clearly delineated control to make possible close personal guidance and supervision.

(iii) The farm-visit component was directed at establishing contact with farmers on a regularly scheduled basis, once every two weeks on the same set day; the farmers in the village or group concerned were informed of the schedule.

(iv) The training meeting of the agricultural officers — T(AO) — scheduled for every fortnight provided for forward planning of individual work schedules, for the full two weeks and for a review of feedback on field performance and farmer problems, needs, and requirements experienced during the previous two-week work period.

(v) With this system it was possible to plan out the full year's work schedule, inclusive of individual work plans, in-service training for staff, and farmer training activities.

4. The key feature of this 'method' was its effectiveness as a management tool to instill a sense of work discipline and a work ethic in all who worked in extension, from senior supervisory levels to field officers. It provided for a continuous interchange of information within extension services so that the staff saw themselves as one entity instead of individuals working in isolation. The continuous close supervision and monitoring of work performance made it possible for untrained and inexperienced staff to receive guidance and direction almost every day on ways to improve their capabilities while carrying out their field duties.

5. However, when a managerially operative system had been established, and its local effectiveness improved over time through continuing modifications and adaptations, what emerged as the most immediate need was the content of the recommendations and advice being promoted with farmers — at least in terms of adequate technology, relevance, and usefulness to the farmers. This is where the research

services came in, specifically their ability to produce meaningful results and their ability to make them available to extension services for onward transmission to farmers. This was the requisite foundation for the preparation of a sound, efficient extension program. In other words, without a sound relevant research program producing useful findings, it was not possible to plan an effective extension program.

Research and Extension Services in an Island Situation

1. In the setting of South Pacific 'island' countries, any discussion of agricultural extension and agricultural research would be based on these known factors.

   (a) that both extension and research are component parts of the total formal government organization, the Department of Agriculture, Forests, and Fisheries;

   (b) that both extension and research are a 'service' to farmers, including fishing communities;

   (c) that extension and research must be considered together in that both exist to effect and facilitate national agricultural development.

2. In the wider sense of island development, agricultural development is the degree to which farmers and people who work the land and fish the seas increase their crop, livestock, and fish production so as to further improve their living standards and quality of life.

   At the same time, quality of life includes having adequate food, a reasonable minimum level of financial security, and a living environment in which the farmer and his family (i.e. the 'farm family') can and do live within accepted society norms.

3. The heart of the research-extension-services complex is the island farmer. He/she is primarily of subsistence type, practicing, in the main, a mixture of subsistence agriculture and cash cropping. In 1987 the farmer we are speaking of is more money-oriented with wages, remittances, credit, and cash money in greater demand. He/she lives and farms in an environment in which tremendous social changes are taking place, as evidenced in the political changes being experienced.

4. The prime measure of the success of extension and research must therefore be made in the context of the benefits the farmer receives, both in terms of increased cash income from agriculture and in making farm work and farm life more rewarding and qualitatively better (i.e. the good life).

5. The functions of extension and research are part of the overall mandated responsibilities of the Department of Agriculture in that these are considered as required by farmers in order to effect and facilitate agricultural productivity. It is therefore generally agreed that the better articulated these roles are to each other, the greater the likelihood of farmers receiving maximum benefit. At the same time, in the wider context of the governmental system, extension and research must also be viewed in relation to other service entities — such as stores and supplies, credit, marketing, processing, etc. — that provide services to farmers.

6. This presentation takes the viewpoint that any meaningful discussion on the planning and management of extension must be done in the totality of the complex environment of which extension is a component part.

   It argues that the efficiency of extension does not depend primarily on new technology from research, nor on the methodology of extension per se, but more on the organizational capacity and the managerial capabilities of the persons in the interacting systems as they operate and function within the socioeultural norms of their island country. Therefore, when considering such organizational concepts as management, planning, human resource development, communication, and evaluation, we must be extra careful that we are looking at things from the same perspectives — and not you in terms of the 'western model' sense, and I in the 'island way.'

   In most island countries the managerial and senior levels in research are filled by expatriate scientists.

   One could perhaps sum up their personal characteristics as 'not tradition-bound; innovative, modern; success- and achievement-oriented; efficiency-minded; individualistic; having a strong work ethic; receptive to new ideas; experienced administrator and managers; goal-oriented, and conscious of the benefits of delegation, sharing and team work; postgraduate-trained; mature in age, and experienced (10 years) in research.' On the other hand, in the national managerial and senior levels you will find both graduates and non-graduates.

The former are generally young, with limited work experience, and their personal characteristics are generally 'tradition-bound though by outward appearance modern in outlook; status and prestige-conscious; possessing a certain urge to resist change; having a tendency to be cautious of foreigners and experts; cautious of new ideas; somewhat indifferent to efficiency; somewhat elitist; family-oriented; their limited experience in the basic principles of bureaucratic management has made it difficult to readily accept such concepts as delegation of authority.' Nongraduates are more steeped in local tradition and in many instances openly resist the basic principles on which successful management depends.

Concluding Lessons for Research and Extension Managers, Planners, and Practitioners

1. The respective functions of research and extension are clearly interdependent and should be mutually reinforcing. However, in real life, within the larger framework of the Department, bureaucratic rivalry, competition, and conflict are very often evident. Some of the more prominent limitations include

   (a) a misunderstanding of and even ignorance of farmers and farming in the country;

   (b) a misunderstanding and lack of appreciation of each other respective roles and their interdependence;

   (c) conflicts between extension and research workers as to what should be researched and how research priorities should be decided upon. And when we add to this the added complexities inherent in the expatriate-national division, the challenge becomes even greater.

Lesson 1: Those engaged in research and extension and agriculture development (policy-makers in finance, planning, etc.) must learn to be fully educated on the true nature of farmers and farming in their country.

Lesson 2: Those engaged in research and extension must learn to appreciate and respect each other as partners with a common mission — the betterment of the farmer.

Lesson 3: Those engaged in research must accept that persons in extension are professional agriculturalists who could better indicate those issues/problems of more immediate relevance to farmers, and that their contribution therefore is crucial to determining research priorities.

Lesson 4: Those engaged in research must accept that in traditional settings, research is not necessarily the search for a new technology all the time but more a searching out of existing technology buried in tradition or dormant somewhere from the past, and/or simply scientifically finding out, recording, and classifying what is on hand in the country as the first step toward planning future direction. Modern Western-oriented research and new technology invariably implies acceptance of changes to some facets of island sociocultural systems. The benefits of this new technology must be carefully researched against the sociocultural costs.

Lesson 5: Those engaged in research must make sure that they are planning from the perspective of local farmers and not from the foreign perspective of 'He who pays the piper calls the tune.'

Lesson 6: Those engaged in research must learn to talk and communicate at the farmer level. If extension personnel already speak at this level, both researchers and extension workers could readily use this farmer-level communication to address and understand each other more effectively. Researchers would then not need to hide behind their interpreters, the extension workers.

2. In its traditional Western interpretation and usage, extension is perceived as the principal means whereby the new technology emanating from research gets passed on to farmers, hopefully to be adopted by them and used to improve farm productivity. The basic premise upon which this traditional model is founded is that there would always be the number of trained and qualified people for each of the two specializations. Unfortunately, in island countries the availability of suitably qualified persons in large enough numbers will always be doubtful. The nature of island situations, small populations, few training opportunities, considerable migration, and mobility to other occupations, points to the necessity to plan for 'smallness' in the scale of operation. In other words, the future management plans for research and extension must be based on small numbers of staff.

The presentation therefore makes the proposition that research and extension in island countries should not be developed on the basis of separate entities. Instead, the way forward should be through an integrated formulation of research- extension-farmer-service, with no distinction between researchers and extension workers.

Lesson 7: Those engaged in research and extension, together with the policy-makers, should address the concept of 'unity of approach' and devise an organizational and management structure in which joint and integrated programs would be developed which would make farming a rewarding and sought-after occupation.

INFORMATION MANAGEMENT FOR AGRICULTURAL RESEARCH IN SMALL DEVELOPING COUNTRIES

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CAB International

Introduction

The 1981 funded ISNAR survey of the Pacific Region found that in all seven countries surveyed research was underfunded and under supported. The major constraints identified were lack of funds and qualified personnel, inadequate facilities, ineffective organization and poor planning, and isolation of researchers. Many of these aspects are already being tackled and will doubtless be discussed elsewhere in this meeting. Of concern to the information specialist is the apparent lack of recognition and awareness of the role of information in at least partly mitigating some of the effects of these constraints.

Pivotal Role of Information

Provision of information should have a pivotal role in research planning and management. What proportion of these scarce funds and personnel are being wasted or diverted in the pursuit of apparently new work, when time spent in seeking out and making use of the findings of past research might very well obviate the need for this? It is all too easy to forget or be unaware of what is known and what has been done already: the newly trained researcher wants to rediscover the wheel; the expatriate 'expert' seeks to make his mark and justify his presence: both would be more effective if they made effective use of information.

The recurrent cost of agricultural research, especially in small countries, is frequently mentioned. One solution advocated is to concentrate on locally relevant applied research and development, leaving basic research to regional and international focal points. Costs could be further reduced if the value of information is sufficiently recognized to have information provision incorporated into the overall plan for research organization.

Managing Access to and Provision of Information

Three key elements or functions can be identified:

1. finding the information — awareness of sources;
2. evaluating it — sifting it for usefulness, analyzing and consolidating it;
3. providing it — getting it to the persons who need it when they want it in a form they can understand.

1. Sources

Awareness and knowledge of information sources, i.e., being able to find it, is a basic requirement in information provision and management. These sources may be

local : archives, annual reports, departmental files, statistics, newspapers, national journals, conference proceedings, consultants' reports.

regional : the same kind of material, but with a wider focus — possibly via focal points — libraries or specialized research centers.

international: access to material inaccessible from local or regional sources, using bibliographic databases via abstract journals, online services of CD-ROM.

other : directories, guides to sources

The level of access to these sources will depend on the level of knowledge and awareness of those given the responsibility of information provision.

2. Evaluation

The information gathered from all these sources will be

of varying quality and usefulness; making use of the data requires careful and knowledgeable sifting of the grain from the chaff, the relevant from the outdated or superficial, as well as awareness of the exact problem the information is required to solve. The Permanent Secretary to the Ministry of Agriculture considering increased food production will require a brief on resources and potential of different crops, while the Chief Extension Officer will require directions on how to grow them.

3. Provision

This is the critical element. How many agricultural research departments make specific allocation of funds and resources to the provision of information? How many allocate part of their building, personnel, and training funds to creating an information unit? Sometimes provision of a library or information center is written into the development plan, and a building may even be erected, but all too often it is an empty shell with no trained, committed personnel in charge, no relevant up-to-date publications, and no dialogue between users and providers.

The phrase 'information resource center' conveys much more than 'library.' It implies a two-way flow between resources and user, and that the person in charge is a communicator rather than a mere custodian of books. Ideally this 'facilitator' or 'catalyst' will be a trained information professional (even though many of you will know of agricultural liaison officers in the Pacific Region who are effectively doing the job of bridging the gap between users and sources). In the interests of maximizing returns on investment in research, put information provision at the top of the list of priorities in planning.

Role of CAB International

Concentrate on finding and training personnel and on identifying real information needs; these are two areas where an organization like CAB International can be of most assistance. Let me tell you about two ways we can do this.

Training

First, we can train your information personnel, either at CABI itself, or at regional or national level. We run an annual two-week course, 'Information on Agriculture,' in the UK, with 15 to 20 participants from all over the developing world, each funded by a development-oriented sponsor. For example, CTA has funded several over the last two years.

We also run courses geared to particular national or regional needs; some of you will remember such a course held in Fiji in June 1984. Since then, we have been to the Caribbean (1986) and next year we will be running a tailor-made course in Kenya, geared to local needs and putting a lot of emphasis on how to communicate information to those who need it. Participants benefit immensely from the formal parts of the course, as well as from exchange of ideas and experience, and they return home with extra confidence and vigor to improve their own information services.

Access to Literature

Most of you will be familiar with CABI's traditional abstract journals, may know about outline access (which I understand is impossible from Western Samoa), and may be aware of the CD-ROM, potentially the most useful form of access to our vast bibliographic resources for the developing world.

Inadequate access to source documents has been identified as one of the major constraints for agricultural research scientists in developing countries. CABI's recent mission to Africa confirmed this view, as have discussions with World Bank consultants and agricultural research and library personnel from many countries. The situation is attributable to several factors: shortage of foreign exchange to purchase primary literature (especially journals) or photocopies from abroad, poor liaison between national and specialist research libraries, lack of awareness or ability to use information services and resources, poor telecommunications, and lack of contact with colleagues abroad. In response to this 'cry for help' from our African member countries, in 1987 CABI set up a pilot project particularly geared to the needs of individual researchers. Research workers in nominated institutions in each country are kept up to date with the published literature in their specific fields of interest. An SDI profile is set up for each researcher, using selected keywords related to his specific subject area to select the tiny relevant fraction of the 11,000 records added each month to the CABI database of published literature on agriculture. The profile is defined and refined through discussion and correspondence between the researcher and CABI information officers. The profile is run against each month's input to the database on the computer at CAB International Centre, Wallingford, and abstracts of all relevant records are listed and

despatched by post. If the researcher wants to read the original documents — as he/she will in many instances — he/she can ask for photocopies by mail from the CABI Document Delivery Service.

Some countries have opted to use a coordinator (usually a librarian/information officer or researcher with special interest in or responsibility for information provision) to liaise between CABI and the researchers, helping them design the profile, and also ensuring that priority and topical research interests are represented.

We shall be evaluating response to and success of the project during the next year, and hope that users will feel the service, in its limited pilot form, is sufficiently worthwhile to get real funding for the period beyond 1988.

COMMUNICATION

John Marjoribanks
Commonwealth Development Corporation

1. The Goals of Communication

(a) To understand others;
(b) To get clear reception or perception;
(c) To get understanding;
(d) To get acceptance (i.e. agreement and commitment) in order;
(e) To get effective action.

(a) Understanding Others

Each one of us is different from everyone else. We are different psychologically and physiologically. We vary in intelligence, education, religious beliefs, social background, and experience. These differences create different frames of reference with the result that each person looks at the world around him in a particular and unique way. Our physical and mental makeup and our environment have a direct effect upon our perception and judgement.

We are continually receiving information; some we ignore and the rest we seize upon and interpret in the light of our past experience in order to forecast, as accurately as possible, what is going to happen in the future. This may be called the process of judgment: that is, making a 'decision or conclusion on the basis of indications or probabilities when the facts are not clearly ascertained' (Webster's New International Dictionary, 1984). All too often, when interpreting information, we see or hear what we are taught 'ought' to be there and/or what we want to see or hear. Thus, there are barriers to communication in ourselves and these barriers also exist in our subordinates, our peers, and our bosses.

(b) Barriers to Reception

(i) The needs, anxieties and expectations of the listener;
(ii) The attitudes and values of the listener;
(iii) Environmental stimuli.

(c) Barriers to Understanding

(i) Language, jargon;
(ii) The extent to which the listener can concentrate on receiving completely, i.e. listening;
(iii) Prejudgements.
(iv) The ability of the listener to consider factors disturbing to his ideas, i.e. the degree of open mindedness that he possesses.
(v) The length of the communication;
(vi) The level of knowledge possessed by the listener.

(d) Barriers to Acceptance

(i) The attitudes and values of the listener;
(ii) Prejudices;
(iii) Status clashes between the sender and the listener;
(iv) Interpersonal emotional conflicts.

(e) Two-way Communication

The argument for 'two-way' communication is not only a moral one — that of giving people the opportunity to fulfill their creative needs, to use their intelligence and imagination — it is also a practical one because the manager too will become more efficient if he or she encourages the members of the group to make full use of their abilities.

Peter Drucker puts the argument against the purely persuasive approach to communication in the following way: 'In many cases human relations has been used to

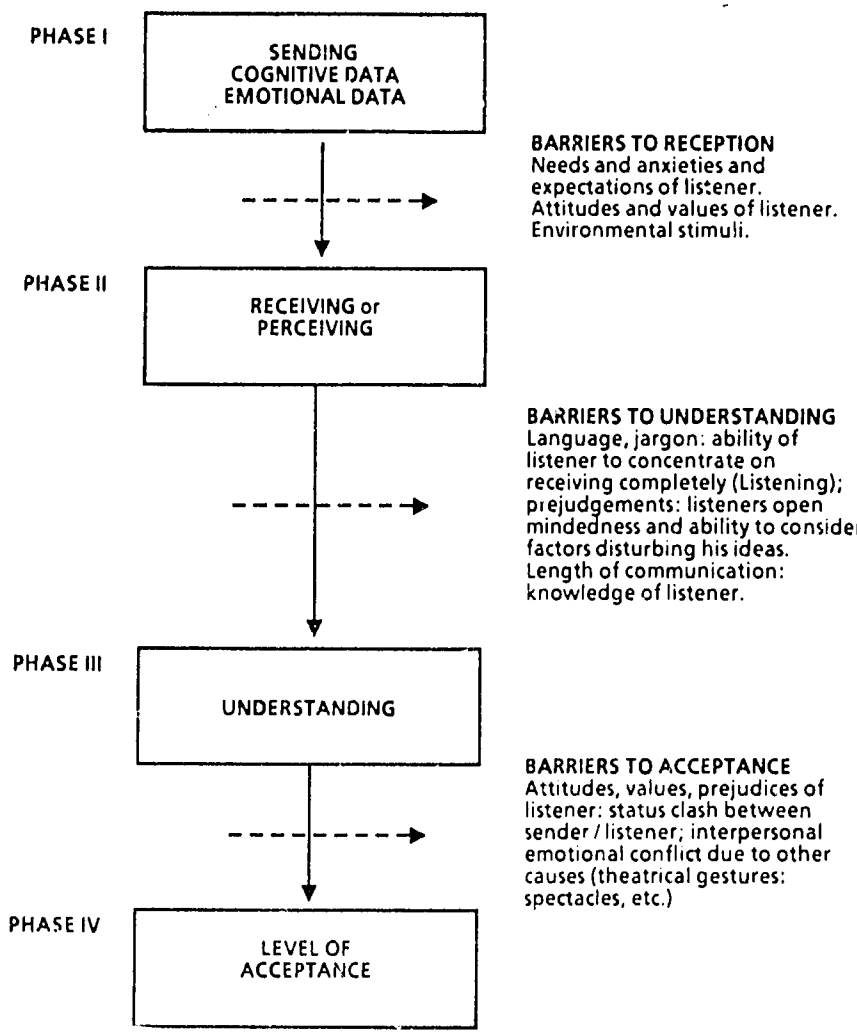

Figure 1: *Phases and Barriers to Communication*

manipulate, to adjust people to what the boss thinks is reality; to make them conform to a pattern that seems logical from the top down, to make them accept unquestionably what we tell them. Frankly, sometimes I think it is better not to tell employees anything rather than to say, 'We tell them everything, but they must accept it, and it is our job to make them accept it.'

The advantages of two-way communication on small groups may be summarised as follows:

(i) Although one-way communication is faster, two-way is more accurate, particularly in complex situations.

(ii) Two-way communication will help both the sender and the listener to measure their standard of achievement and when they both see that they are making progress their joint commitment to the task will be greater.

(iii) The sender may feel that he is under attack as the listener will pick up his mistakes and let him know about them. This is helpful rather than dangerous because a frank interchange of views will lead to a higher level of understanding and acceptance.

How Can I Communicate More Effectively?

Is there any way of coping with these barriers? I would suggest there are several things we can do — both as senders and receivers. In essence these actions can be grouped under the term 'checking out.' This really consists of checking at each of the four stages that the message up to that point is effective, i.e. it is still the original message without distortion. The diagram below illustrates this checking-out process.

Let us take a brief look at what action the sender and receiver can take, jointly and separately.

Jointly:

1. Recognize that some misunderstanding is inevitable and be alert to any evidence of it.
2. Listen, constructively. It is safe to say that none of us ever listens enough.
3. Test or check out our understanding of the message.
4. Share, openly but sensitively, any perceptions and/or feelings engendered by the message.

Sender:

1. Decide *what* to say. Have a clear picture. What do they *need* to know?
2. *When* shall I say it? Timing is often important to effective reception.
3. *How* shall I say it? Be aware of language used — will the receiver understand the words and phrases? Will they have any emotive connotations?
4. *Where* shall I do the telling? Privately? On sender's or receiver's ground? Or in a group setting? On or off the premises?
5. *Why* am I saying it? Examine one's own motives.
6. Check out with receiver.

Receiver:

1. Listen! — constructively and helpfully.
2. Give sender full attention.
3. Be prepared to hear factors which may be disturbing to our ideas and values.
4. Ask for clarification, or repetition, if necessary.
5. Check out with sender.

So these are some of the things we can do as part of the checking-out process. They are all fairly simple actions in themselves and can be said to be quite tangible.

'Listen to the Music'

In any communication situation there is the direct line, consisting of the words, facts, data, information, etc. (the content of the communication). In addition and simultaneously there is an indirect line which is the emotional or 'feelings' aspect of the communication. It is on this indirect line that most of the real messages are sent (and sometimes received). For example, let us take a look at what I am led to believe is a fairly common situation, the domestic silence! It may go on for a few hours, even days I am told. Eventually husband, kind considerate man that he is, anxious to maintain a good relationship, says something like 'What's the matter, dear?' The reply is invariably 'Nothing!' said quietly, tightlipped, and with a rising inflection. Now, the direct line (the words) says 'Nothing,' and may the Lord have mercy on the husband if he acts on that message! The real message is being sent on the indirect line and is saying something like 'Everything is the matter, and it's all your fault!'

Research in this area shows that in the vast majority of face-to-face communication situations people pick up and respond to the indirect line. If the gap between

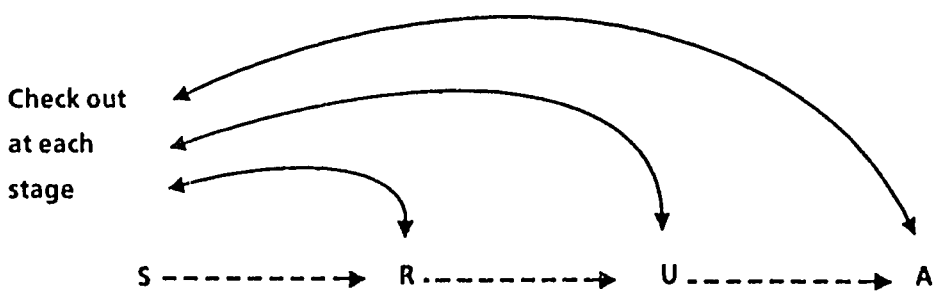

Figure 2: *The 'Checking-Out' Process*

direct and indirect (the arc of distortion) is small, then the message will be clearly understood. If the gap or arc of distortion is large, the receiver will be confused, and will usually take more notice of the indirect line. Can you recall any difficulties with communication during a telephone conversation?

It is a sad state of affairs when most of our real messages are sent and received on this indirect line, and even sadder when we realize that we do little or nothing to improve the situation. Many of us salve our conscience by attempting to improve the superficial direct line like choosing our words, speaking carefully, being brief, etc. — but we seldom tackle the real issue. If most real messages are sent on the indirect line, then we should make an effort to deal with this and, to be effective, bring this into the open. Thus eventually we shall be communicating the indirect messages on the direct line and be much nearer to effective communication, with much less emotionality, frustration, and costly consequences — and, not least, taking far less time over it!

A simple analogy may help us to see what we can begin to do to bring this about. If we think of the direct line as the 'words' and the indirect line as the 'music' we can now look at a communication situation as one where words are being spoken and behind the words there is some music being played. I would suggest we need to develop two skills to handle this effectively. The first is to learn to 'hear the music' — surprisingly, there are some people who never hear it! Secondly, we should learn to 'read the music.' Both these skills can be learned and developed with practice.

Let me refer to my earlier remarks about checking out to overcome some of the barriers. It is still necessary to apply this process to our reading of the music. We just could have misread it and if we do not check it out we run into the trap of acting on assumptions (that our reading was right) with all its consequences. Checking out some of the more tangible aspects is a relatively easy matter and can be developed quite quickly. When it comes to the more intangible, emotional areas it is not so easy.

We must be prepared for, and accept, the fact that we shall make mistakes, but if we give in the first time we get a bloody nose, our communications will never improve.

If we review some of the emotional barriers, most of which impede the acceptance stage, we can see what we are up against and what we can do about it. There is a tendency in all of us to assume that all these emotions exist in others but not in ourselves. So it is rather important that we know something of our own attitudes, prejudices, values, assumptions, self-perceptions, and perceptions of others. It will help us to read the music and enable the other person to really listen, to listen comfortably and not feel attacked, criticized, or threatened. If we try to base our checking out on our feelings, our perceptions, our understanding, we are less likely to come across as making judgments of the other person.

To summarize then, we can say that when we are concerned with effective communication, we need, first, awareness and then some action skills.

We need awareness that some misunderstanding is inevitable; that there are many barriers and what they are; that there is an element of emotionality present; that feelings, perceptions, and values — ours and of others — have a tremendous influence on the quality and effectiveness of communication; that there is nearly always some music behind the words. We need to develop skills in checking out in a sensitive way, in 'hearing the music,' in 'reading the music,' in checking out our reading, in reading ourselves and others, in sharing our perceptions, of ourselves and others in a constructive way.

Let us be quite sure of one thing. There is no such thing as the 'Instant Effective Communication Kit.' We have to work at it. Like all other skills, we need to be motivated for achievement, we need to practice, we need to be able to learn from each experience, whether successful or not and to accept that it will be perhaps months before we see any real results, and we need to work at it for life. Effective communication is part of our total life — not just our 'workplace' life.

THE PLANNING AND MANAGEMENT OF AGRICULTURAL RESEARCH AT THE UNIVERSITY OF THE WEST INDIES

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An Overview of Philosophies on Science, Technology, and Institutional Structure

The fusion of science and technology had its genesis in the idea of the mastery of nature through discovery of the truth of the natural order by the 17th century philosophers Bacon and Descartes. In the 19th century Karl Marx expanded this theme in a specific technological dimension when he wrote, 'Industry is the real historical relation of nature and thus natural science to man.' Max Scheler, the German neo-Hegelian rightist writer amalgamated science and technology into knowledge for domination — *Herrschaftswissen*. In the 20th century, John Dewey, the American philosopher in the tradition of pragmatism, wrote in 1930 that the purpose of science should be shifted 'from knowing as an aesthetic enjoyment of the properties of nature . . . to knowing as a means of secular control.' In other words, philosophies on the cultural and spiritual objectives of science as a means of discovering the truth about nature were yielding to practical or technological philosophies concerned with the welfare of mankind, despite the adverse effects of the fusion of science and military technology (Marcuse, 1966).

The alliance of science and technology was first formally espoused and its efficiency demonstrated in the mid 19th century, when the government of Germany encouraged universities to formulate a scientific base for industry, leading to the great German chemical industry. Meanwhile in Britain, as indeed in most of Europe, the situation was different in that science in universities (following the tradition of Arabian mathematics and pre-Socratic Greek astronomy translated into Latin in the 12th and 13th centuries) was separated from craft-based technologies (the source of the engineering technology which produced the great European cathedrals) and the agricultural technology which had begun with the use of the plough in the Middle East thousands of years before. As a result, it was only in the first Industrial Revolution in Britain (circa 1760-1840) that there was movement from craft-based to science-based technologies. However, when technology was applied to agriculture, leading for example, to the foundation of Rothamsted Research Station in England in 1843, it occurred outside the mainstream of university scientific scholarship a few miles away at Cambridge. It is in this latter mode of separation of science from technology, and as a result, training from research, that the Imperial College of Tropical Agriculture (ICTA), the University of The West Indies (UWI), Jamaica School of Agriculture (JSA), and Eastern Caribbean Farm Institute (ECFI) in Trinidad were founded as institutionally separate entities from the RRC and other Research and Extension Units in the Departments of Agriculture by the British Government in the colonial period (1910-1962). This system was maintained and expanded in the Caribbean Common Market (CARICOM) Region with the formation of commodity research institutes after 1960 and Caribbean Agricultural Research and Development Institute (CARDI) in 1975, despite the establishment of an independent UWI to coincide with the political independence of Jamaica and Trinidad and Tobago in 1962.

The American tradition followed a different path. The 1862 Morrill Act led to the amalgamation of science and technology in university training, research and extension programs in the land-grant universities, which all had strong agricultural components. Just over 100 years later, in 1968, the distinguished British botanist, Lord Ashby, described the land-grant experiment as 'one of the rare innovations in the evolution of Universities.' This innovation led not only to a science-based agriculture but also to an agricultural science in which the agenda for research and training was technology — determined by the needs of farmers, marketeers, and consumers. The system has the added

advantage of close association of university training with technical training in technical colleges, which themselves maintain close linkages with the commercial sector. The result is that over the last 125 years, the US has developed arguably the most technologically advanced agriculture in the world. Moreover, linkages between universities and the private sector which were to lead to the explosion of 'high- tech' industry today were already initiated in the first Science Park in Stanford University in 1947. The park (like the land-grant university) maximizes use of common research and development facilities (land and laboratories) by university researchers and the private sector.

The US land grant university system was partially duplicated in the Indian agricultural universities to contribute to the recent transformation of India from a net importer to a net exporter of grain. The older Scottish system amalgamated technical agricultural training in technical colleges with research and extension, in a system served by university research, training, and outreach. This system emphasizes the generation, evaluation, and delivery of technology, but the inclusion of research establishes an operational linkage of common interest with agricultural science and technology in universities.

In the Scottish, US, and Indian systems described, the common feature is the use of the agricultural institution as the major instrument for delivery of coordinated agricultural research, training, and extension support services for agricultural development. The system also maximizes common experimental station lands and laboratories, infrastructural facilities as well as the contribution of high-cost professional staff in the triple functions of research, training, and extension. In this respect, it is most appropriate to developing countries.

These alternative philosophies on science, technology, and institutional structure inform attempts to forge a new system for planning and managing agricultural research at the UWI. An interpretation of these attempts is here recorded under the following headings:

1. Institutional Evolution of the UWI Faculty of Agriculture in the CARICOM Agricultural Institution System;
2. University Policy on Research;
3. Structure and Organization of Agricultural Research at UWI;
4. Planning and Management of Agricultural Research;
5. New Approaches to Management of Agricultural Research and Development.

Institutional Evolution of the UWI Faculty of Agriculture in the CARICOM Agricultural Institution System

Institutions of agricultural science and technology were first established in the CARICOM region at the turn of the 19th century, with the foundation of the Imperial Department of Agriculture (IDA) in Barbados in 1899 and evolved in four separate institutional lines (table 1). The IDA gave rise consecutively to the West Indian Agricultural College in 1921 and the Imperial College of Tropical Agriculture (ICTA) in Trinidad in 1924. In 1948, following the 1944 Asquith Report of the Commission on Higher Education in the Colonies, the University College of the West Indies (UCWI), with agriculture-related departments including botany, chemistry, and zoology, was founded on the Mona Campus in Jamaica. In 1955, after a 1952 communication from the British Secretary of State for the Colonies, the Regional Research Centre (RRC) was established within the ICTA. Later, in 1960, the ICTA became the St. Augustine Campus of the UCWI with a new Faculty of Agriculture and the RRC carrying separate responsibilities for professional training and research, respectively. The UCWI became the independent University of the West Indies (UWI) with its own royal charter in 1962, but the subsequent agreement between the UWI and the UCWI excluded RRC, which remained the responsibility of the Council of Ministers.

After three commissions[1], the UWI integrated agricultural training, RRC research, and outreach into the Faculty of Agriculture in 1967; but the RRC staff still retained a separate budget and responsibility to ministers of agriculture, through an advisory technical council, which included international donors. This integration lasted until 1974, when now-sovereign governments of the CARICOM Region, after receiving the report of the Campbell 'Commission' and perhaps advised by international donors, including the British Overseas Development Agency (ODA), up to that time a major contributor to RRC research, separated the RRC staff from the Faculty to form the Caribbean Agricultural Research and Development Institute (CARDI) in 1975.

CARDI — Eastern Caribbean Institute of Agriculture Research and Development

The establishment of the UWI Faculty of Agriculture and incorporation of RRC into the UWI in 1960 led to

[1] *Kearns, 1962; Bradfield, 1962; Baskett, 1965.*

FOUNDATION DATES	AGRICULTURAL INSTITUTIONS			
	DEPARTMENT / MINISTRY	TECHNICAL SCHOOL	RESEARCH INSTITUTE	UNIVERSITY
1899 - 1924				
1899	IMPERIAL DEPARTMENT			
1910 1921 1924		Jamaica School of Agriculture (JSA) West Indies Agric. College (WIAC) Imperial College of Trop. Agric. (ICTA)	WIAC ICTA	
1924 - 54				
1924 - 38	Colonial Depts. of Agric. (CDA)	ICTA		
1938 - 54	CDA	ICTA (Teaching Staff)	ICTA (Research Staff)	
1954 - 63				
1954 1955 1960 1962 1963	CDA Ministries of Agric. (MINAG's) - Jamaica T'dad & T'bgo	Eastern Caribbean Farm Inst. (ECFI) later ECIAF Guyana School of Agric. (GSA)	ICTA Regional Res. Centre (RRC) Univ. Coll. W.I. (UCWI), Fac. of Agric. (FOA) UWI, RRC Commodity Res. Inst. CRIs) (Sugar, cocoa, citrus, bananas)	UCWI. FOA UWI, FOA
1963 - 75				
1967 - 74	MINAG's - CARICOM	JSA, ECIAF, GSA	CRI's. UWI. RRC	UWI. FOA
1975			UWI. FOA. RRC.	
1975			UWI. FOA.	
			Caribbean Agric. Res. & Dev. Inst. (CARDI)	
1975 - 85				
1981 1983	MINAG's - CARICOM	ECIAF, GSA, JSA Belize School of Agric. (BSA) Agric. Coll. Jamaica (ACJ)	UWI. FOA. CARDI	Univ. of Guyana (UG) FOA
1985	MINAG's - CARICOM	ECIAF, GSA, BSA, ACJ.	UWI. FOA.	
			CARDI, CRI's	UG, FOA
1990	MINAG's - CARICOM	NARDI's (B'dos, Belize, Guy. J'ca, T & T) ECIARD (Eastern Carib. States)		UG. FOA
		UWI. FOA.		

NARDI's - National Agricultural Research and Development Institutes
ECIARD - Eastern Caribbean Institute of Agriculturew Research and Development.

the creation and expansion of a number of commodity research institutes (CRIs) in the region. Thus, separate citrus and cocoa research units were established within the UWI, a banana research institute (WINBAN Research) created for the Windward Islands and the Research and Development Department of the Jamaica Banana Board consolidated. Coconut research units in Jamaica and Trinidad and Tobago and sugarcane research institutes in these countries, as well as in Barbados, were also strengthened. Rice research was established in Guyana. Today, all of these single-commodity, isolated CRIs, except those for sugarcane and cocoa, have either been closed down or had their budgets drastically cut to the point of institutional impotence.

Achievement of political independence among English-speaking Caribbean states, commencing with Jamaica and Trinidad and Tobago in 1962, led to the redesignation of colonial departments of agriculture as ministries of agriculture, but there were few significant structural changes. Thus, ministries continued to administer separately compartmentalized research and extension divisions (including regulatory and technology transfer functions) within the framework of the rules, regulations and exigencies of the civil service. Technical schools also continued to be either directly managed by ministries of agriculture or by boards with a preponderance of ministry representation. As a result, the critical roles of ministries of agriculture in policy formulation, development plan definition, and management and resource allocation are often compromised by unnecessary ministry involvement in the management and administration of support services for training, research, and extension. The resulting research system in the CARICOM Region is not only fragmented but separated from professional training and, except for the CRIs, from extension functions.

The technical schools of agriculture have also been separated from institutions of research, extension, and professional training, except in the ICTA. They were either founded as or became national institutions. Indeed, even in the ICTA, which accommodated research as well as postgraduate, professional, and technical training in the same institution, teaching staff and operations were separately compartmentalized from those for research, except in the period 1922-1938.

The ICTA (1924-1960) offered a postsecondary technical Diploma (DICTA) for West Indian students, and the best graduates were admitted to read for the Associateship (AICTA), which included research training. West Indians who followed the DICTA course claim in retrospect that it achieved Bachelor's level. Most North American universities allowed DICTA graduates to proceed to Master's training after only one year of undergraduate courses. The prestigious one year postgraduate course in tropical agriculture leading to the Diploma in Tropical Agriculture (DTA) was offered mainly to graduates from British universities destined for the British Colonial Agricultural Service.

The existence of technical training and research in the same institution, albeit in compartmentalized departments in the ICTA, was an interesting experiment in organization of the agricultural science and technology support system, but its impact on Caribbean agriculture was minimized both by the intra-institutional separation of research from training as well as the separation of these functions from the national extension system. We shall return to this theme later.

Whatever the level or the quality of the ICTA training, it supplied a sufficiency of neither technical (DICTA) nor professional (AICTA, DTA) graduates for the Caribbean region. Thus, only 128 DICTA and fewer than 10 AICTA graduates were produced over the period 1924-1960, representing only 37 percent of the 349 students who entered the College. Over 1960-1984 the UWI produced a total of some 1129 agriculture graduates including BSc. (913), MSc. and MPhil. (139) and PhD. (59). Moreover, the three technical schools of agriculture in the region together, have, on occasion, graduated more than 300 students in a single academic year over the period 1970-1980.

The Jamaica School of Agriculture (JSA) was founded in 1910 and had major expansions in 1957 and 1968. The latter expansion provided for a two-tier training system with accommodation for 450 students, in which both the traditional technical two-year Diploma as well as three-year Associateships in Science in Agriculture, ASc. (Agric.), and in consumer education, ASc. (Consumer Ed.), were offered. Graduates with ASc. Honours degrees were exempted from the first year of professional training in the UWI Faculty of Agriculture. The JSA was closed down by the government of Jamaica in 1980 and replaced by the College of Agriculture (COA), which plans to offer a Bachelor's degree in agricultural technology, BTech. (Agric.). COA accreditation has not been requested of the UWI.

The Eastern Caribbean Farm Institute (ECFI) was founded in 1954 to serve the Windwards, Belize, Guyana, and Trinidad and Tobago, but became a national institution wholly financed by the government of Trinidad and Tobago in 1964. However, ECFI

continued to offer places to students from the Eastern Caribbean. In 1969 ECFI expanded its training program to include forestry and became the Eastern Caribbean Institute of Agriculture and Forestry (ECIAF).

Subsequently, in 1983-84, the number of Diploma students from Trinidad and Tobago entering ECIAF was considerably reduced; the vast majority of students were from the Eastern Caribbean and as a result economic cost per student tremendously escalated. But the Institute had earlier established a postgraduate program leading to a Diploma in Agricultural Education at one of its new units, the Agricultural Teacher Education Centre (ATEC). Some of the graduates from this latter program are expected to proceed to secondary schools to teach the new Caribbean Examination Council (CXC) agricultural science syllabus. It should be noted here that the UWI, St. Augustine, offers both a postgraduate Diploma in Education as well as undergraduate and postgraduate degrees in agriculture.

The Guyana School of Agriculture (GSA) was founded in 1963 and in 1980 joined forces with the University of Guyana Faculty of Natural Sciences to offer a Bachelor of Science Degree in Agriculture, with the appointment of one extra member of staff, and with teaching inputs from the Ministry of Agriculture.

It seems then that in the 1980s and beyond, changing national needs for technically trained agriculturists are leading to the evolution of technical schools of agriculture into degree-granting institutions, or technical colleges, but all uncoordinated and outside the framework of the regional UWI Faculty of Agriculture in Trinidad. It will be recalled that, similarly changing needs, enunciated at the time at regional level, led to the evolution of the ICTA from a diploma-granting college into the UWI, Faculty of Agriculture in 1960. The former development constitutes a crisis in the management of tertiary education in the CARICOM Region, in that by instituting unnecessary competition for a limited number of students in similar areas of training, it could threaten the continued existence of both the national and regional institutions.

Apart from brief periods of integration in the ICTA (1922-38) and the UWI (1967-74), the guiding philosophy in the evolution of institutions of agricultural research, professional and technical training, and extension has been the separation of science from technology and teaching from research inspired by the mores of British agricultural institutions and development management. The philosophy is explained in the 1941 Wardlaw commemorative on the 20th anniversary of the ICTA, the 1944 Asquith Report on higher education in the colonies, and the 1952 Communication from the Secretary of State for the Colonies (Wilson 1985a) establishing the RRC within ICTA.

University Policy on Research

The most recent statements of university policy on research are given in extracts from the Academic Board (St. Augustine) Committee on Restructuring Report as follows:

> In the meantime, Governments in Third World countries are increasingly pressing their Universities for a development performance similar to that in the U.S.A. but without investment in commensurate budgetary support. In turn, Third World Universities have, by and large, failed to formulate strategies to win such support for development projects, as was the case in the U.S.A. The result is a proliferation of national research institutes, which replicate staff and facilities already present in Universities, whilst University staff are often grossly underutilized because of scarce research funding, and poor research infrastructure.

The dilemma is illustrated by quotations which underpin conflicting views of the function of universities in developing countries. Thus, the 1944 Asquith Commission Report on higher education in the British colonies, which led to the establishment of the University College of the West Indies in 1948 states:

> Those who control Universities must understand what search after knowledge in a University implies. The knowledge sought is desired for its own intrinsic value. The motive proper to a research worker is to extend the boundaries of chartered knowledge in his own field. Research of this kind is called FUNDAMENTAL RESEARCH and it is fundamental research which is proper to a University. It follows that utilitarian results must not be demanded from research activities or members of staff of a University and that their work must not be judged by its immediate bearing on practical problems.
>
> The urgent need of using science to improve health, agriculture or industry (in the colonies) is so obvious as to require no emphasis here. But it is not the function of the Universities directly to supply this kind of help. To require Universities

to do so, would be to divert them from their proper purpose. To expect them to do so would indicate a fundamental misapprehension of the place of research in universities.

But even as the Asquith report was written, practical developments in the United Kingdom, e.g. the establishment of the Imperial College of Science and Technology in London and the development of applied sciences in many British universities, rendered this view of university research obsolete.

On the contrary, 33 years later, the 1977 Trinidad and Tobago White Paper on the establishment of a National Institute of Higher Education, Research, Science and Technology commenting on the unsatisfactory state of research and development, science and technology services, and higher technical education in the country, criticized the UWI in these terms:

> The major reasons for the unsatisfactory state lie with the historical development of these various activities, leading to a pattern which continues to exist. The various activities were influenced on the one hand by the establishment of the University of the West Indies and on the other by the absence of any meaningful indigenous activities within the private sector in this area. Substantial resources were channelled into the University with the hope that its efforts in the medical sciences, engineering, education and management would be adequate to meet the demands of the country.
>
> The time has come to bridge these two diametrically opposed views of the university by maintaining its role as an institution of academic scholarship, teaching and research while at the same time acknowledging its responsibility for development of the community which supports it.
>
> In CARICOM today the regional UWI is posed with the additional problem of serving a multi-national, multi-statal, multi-public community with considerable variation in current levels of political, economic, cultural and educational development.
>
> It is judged that it is precisely because delivery of a useful service to such a multi-faceted regional community is well-nigh impossible, except in limited areas, that the idea of a restructured University was first mooted. Be that as it may, the acknowledged objective of restructuring is to develop a strategy which would focus on national problems without losing the regional perspective of the University.
>
> The major function of universities in the Third World is to pursue tertiary education, training, research and development (TETRAD) programs as instruments of national development and transformation of society. The UWI has an additional responsibility for transformation and development of the CARICOM Region.
>
> The philosophy of integration of research, education and training and public service for development, partly reflected in the UWI internal organization, is the most appropriate university model for effecting transformation and development. But the model must be modernized to meet current needs in CARICOM at national and regional levels. The modernization envisaged is the pursuit of research and scholarship as the 'engine,' not only for education and training, but also for location-specific service and development programs organized at campus level and networked at regional level.
>
> Since meaningful participation in development and societal transformation entails continuous contribution to location-specific development projects, the semi-autonomous campus/regional university model achieved with UWI restructuring is most appropriate.

Structure and Organization of Agricultural Research at UWI An Overview

The major functions of the UWI Faculty of Agriculture include

- Undergraduate training
- Postgraduate training
- Professional training
- Research and development
- Regional outreach activities
- International and regional exchange
- International and regional conferences and publications.

All the functions, except research and development and, on occasion, international and regional conferences and publications, are organized at department level. There are four departments in the area of agricultural science and technology and two in the area of socioeconomic studies, each with a university-appointed head of department (figure 1).

The research and development function is organized in ten interdisciplinary and interdepartmental programs, each with a program leader (figure 2).

Biotechnology Program

Thus, the management structure of the faculty constitutes a matrix of vertically managed research programs under the immediate supervisory management of a dean. The dean is advised in these management functions by heads of departments (HOD) and program leaders (PL) constituted as a HOD committee and a faculty research advisory committee (FRAC), including both HODs and PLs. He is also assisted by associate deans for academic affairs (undergraduate function), postgraduate studies and research.
Research in the faculty of agriculture is designed to solve many of the problems associated with the low productivity of the agricultural sector in the Caribbean. Research work is financed from the university funds augmented by grants from private organizations, international agencies, and the Trinidad government. In addition, the university has close ties and cordial relationships with the ministries of agriculture in the various West Indian Territories and with many privately owned farms, estates, and plantations.

Planning Faculty Research

Early after its establishment, but certainly by 1967, when Regional Research Centre (RRC) staff were integrated into the Faculty of Agriculture, a policy decision to emphasize research work on food crops rather than on export crops was taken, in view of the existence of commodity research institutes for the latter crops. Within this general policy, research guidelines for each of the ten programs are developed by program participants and approved by FRAC.

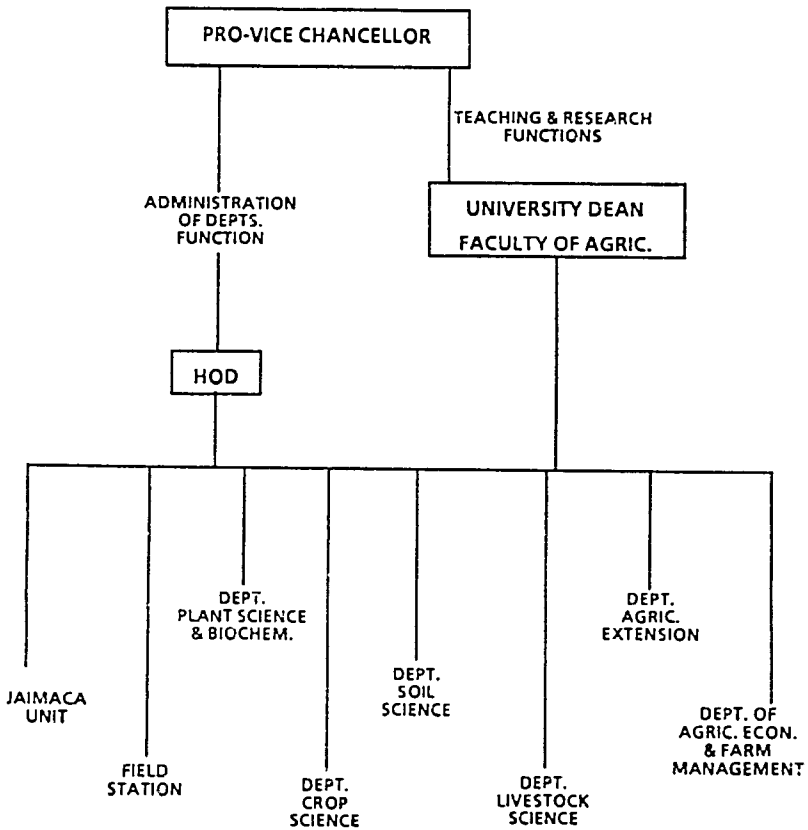
The establishment of programs provides a structured format for the planning and execution of agricultural research. The various programs reflect the scope of research capability within the faculty and the broad areas which are perceived to be of general relevance to the region.

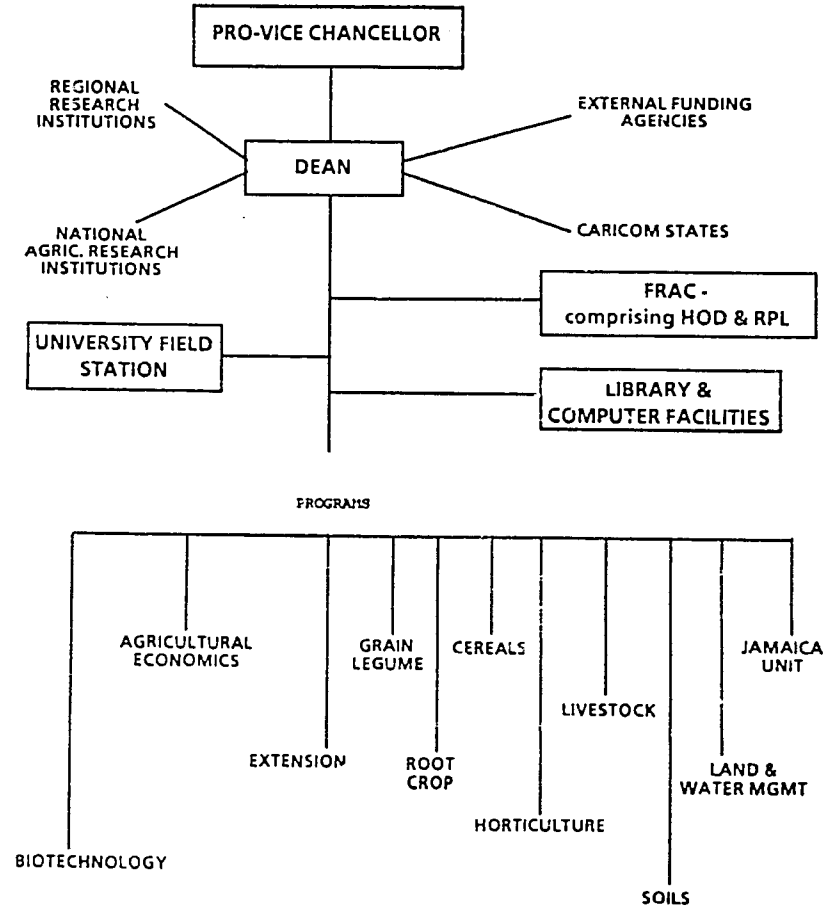
Within the general framework, individual program researchers, under the guidance of the program leader, are expected to develop the projects within programs. While there is no requirement for a formal prioritizing of research projects which are proposed for a program, FRAC requires justification and rationale on the relevance and importance of the research projects.

Given that the faculty requires all programs and projects to conform to its overall policy, it is a fact that priorities within the faculty result de facto from external considerations such as availability of funding, special interest of funding agencies or clients, or the importance of projects to regional governments and economies.

As a consequence, these latter factors determine in large measure the emphasis or thrust of the faculty's research at a particular point in time. Accordingly, in some years one or two programs may indeed dominate the Faculty's research portfolio because of special interest on the part of a regional government. For example, root crops and grain legumes were prominent some eight to ten years ago, whereas some three to four years ago the agricultural economics program was prominent because

Figure 1: *Organization of Teaching and Administration within the Faculty of Agriculture*





HOD = Head of Department
RPL = Research Programme Leader

Figure 2: *Organization of the Research Program at UWI*

of special interest by the Trinidad and Tobago government for agricultural insurance and for agricultural subsidy evaluation.

Program Formulation and Budgeting

FRAC requires programs to be formulated in a comprehensive manner, indicating rationale and relevance, objectives, methodology, participation, resource requirements, financing, and management. The level of detail and specifics beyond this general framework are largely determined by the requirements of the specific funding agency.

Monitoring and Evaluation

Evaluation of performance of research is done at the individual staff, program, or project and institutional levels.

At the individual staff level, university assessment and promotion procedures initiated at departmental level by the heads of departments are conducted by the faculty and university assessment and promotions committees and are based, inter alia, on publications in referred journals. At the program level there has been no formal system in operation in the faculty for monitoring performance. Within recent years the faculty has established a research monitoring unit. However, this unit, at present, only monitors expenditures.

Generally, the research projects within the faculty are monitored either by the funding agency or client or by the project management committee. Such committees may include representatives from external (nonuniversity) agencies, including the client or funding agencies. The experience to date has shown this model for project monitoring to be most effective. It has been used principally in the agricultural economics programs.

Monitoring of programs/projects by funding agency tends to be ineffective when the funding agency is not also the client for the research output. Evaluation may not consider the relevance of the research to the Caribbean situation.

However, more exacting evaluations are conducted by international agencies, e.g. the Rockefeller and Ford Foundations and IRDR, than by regional and national clients. At the institutional level, the University Planning and Estimates Committee (UPEC) has made proposals for departmental evaluation but these have not so far been implemented. However, again there have been many evaluations of the faculty of agriculture by international and regional commissions on behalf of the university, e.g. the Kearns Commission in 1962, the Bradfield Commission in 1962, and the Baskett Commission in 1968 were on the subject of the integration or separation of the RRC from the faculty of agriculture.

The Campbell Commission in 1984 was on the same subject and instituted the separation of RRC from the faculty earlier recommended by the Baskett Commission and accepted by UWI.

More recently the Canadian International Development Agency (CIDA) has conducted an evaluation of the UWI, with a view to funding a program for development therein.

Information Management

Information management is fundamental to efficient resource use. In this regard both information flows into the research system and information outflows must be managed. With respect to the former, information flows on research and development in other institutions, both regional and extra-regional, are necessary to avoid duplication of effort. This is an area which can be improved at the UWI through adoption of more advanced technologies.

On the other hand, the Faculty of Agriculture offers a number of channels for the diffusion of research products — new technology, relevant production and market information, and general knowledge. Extension bulletins, print and electronic media, meetings, conferences, workshops, and journals are all used by the faculty for information generation. There is still, however, scope to be more creative and more effective towards this end.

Program Financing

Since its establishment in 1960 the faculty has received research support from some 27 international agencies as well as from regional and national sources.

Most of the research carried out by the faculty is internationally funded. Examples of projects funded by national and regional clients include Government of the Republic of Trinidad and Tobago (GORTT) projects (e.g. agricultural insurance study, evaluation of subsidy programs, and commodity research programs) and the CARDI baseline survey for a farming systems research and development program. In pursuing its programs of research, the faculty has also collaborated with all

CARICOM governments and regional institutions as well as with some 14 overseas institutions.

University grant funds are intended principally for teaching support. Research support is therefore almost exclusively external funding, with international agencies being the most important source. The amounts, sources, and purposes of research funds are variable and uncertain. While this is not unexpected, it should be noted that it does not allow for realistic long-term planning of research and for cost-effective allocation of research resources.

New Approaches to the Management of Agricultural Research and Development

The historical evolution of the UWI and research institutions in the region indicates significant development over the years. There is nonetheless no question of the further gains which are possible from more effective planning and management of research in the faculty and in the region as a whole. Such a thrust is urgent on account of both the declining performance of the agricultural sectors in the region and also the overall reduction in the availability of research funds.

The recent restructuring of the university, allowing for more autonomy for campus governments in the financing and control of their campus, has also meant growing concern on the part of GORTT on the relevance and cost-effectiveness of research undertaken by the faculty. Indeed, GORTT is concerned with allocation of resources and the management of agricultural research within the country as a whole and also among national research institutions.

In an attempt to address the above concerns the National Institute of Higher Education, Research, Science and Technology, the UWI, Caroni (1975) Ltd. (the State Sugar Corporation), the Central Experiment Station, and the Planning Unit of the Ministry of Agriculture are all supporting a research project on the 'Allocation and Evaluation of Investments in Agricultural Research in Trinidad and Tobago.' This project is being executed in the Department of Agricultural Economics and Farm Management of the University of the West Indies.

The general objective of the study is to develop an effective method for prioritizing, monitoring, and evaluating expenditures in agricultural research. The specific objectives are as follows:

- to assess the cost-effectiveness of research expenditures in selected research institutions and for specific commodity groups;
- to develop a mechanism/criterion for assigning research priorities at the national, farm, firm, and institutional levels;
- to develop alternative institutional framework(s) for optimizing the conduct of research activities;
- to identify constraints in the transfer/extension of research findings.

Conclusions

The model of integrated functions of tertiary education, training, research, and development (TETRAD), including extension, is judged to be the most effective for agricultural development in developing countries. Removal of one or more of these functions from the model results in the weakening of its effectiveness as an instrument of agricultural development.

The long evolutionary process towards this model being experienced in the CARICOM Region seems unnecessary but perhaps unavoidable in the context of some twelve sovereign member states in CARICOM and the earlier history of institutional fragmentation.

However, the model becomes an effective development tool only when there is calculated and thoughtful program planning, allocation of resources, monitoring of projects, and evaluation of performance, that is to say, comprehensive systems for program management.

The need to be efficient and effective with respect to research investment cannot be overstated. Research investments provide the output for advancing science and technology and ultimately for economic transformation and development. Developing nations are characterized by lack of financial resources and in this regard academic institutions which service such nations should lead the way in their contributions to national development. Accordingly, the imperative for such institutions is to provide both the organizational model and management systems to achieve these goals.

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Abbreviations

ICTA	Imperial College of Tropical Agriculture
UWI	The University of the West Indies
JSA	Jamaica School of Agriculture
ECFI	Eastern Caribbean Farm Institute
ECIAF	Eastern Caribbean Institute of Agriculture and Forestry
RRC	Regional Research Centre
CARICOM	Caribbean Common Market
CARDI	Caribbean Research and Development Institute
IDA	Imperial Department of Agriculture
UCWI	University College of the West Indies
ODA	Overseas Development Agency
CRI	Commodity Research Institute
WINBAN	Winward Islands Banana Association
DICTA	Diploma of the Imperial College of Tropical Agriculture
AICTA	Associateship of the Imperial College of Tropical Agriculture
DTA	Diploma in Tropical Agriculture
COA	College of Agriculture
ATEC	Agricultural Teacher Education Centre
CXC	Caribbean Examination Council
GSA	Guyana School of Agriculture
HOD	Heads of Departments
PL	Program Leaders
FRAC	Faculty Research Advisory Committee
TETRAD	Tertiary Education, Training, Research and Development
GORTT	Government of the Republic of Trinidad and Tobago

THE FUTURE ROLE OF AGRICULTURAL RESEARCH IN THE SOUTH PACIFIC: WHITHER IRETA?

Dennis F. Osbourn
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University of the South Pacific

Introduction

I would like to use the general title assigned to me to explore the possible future role and development of IRETA.

The future role of both national and regional agricultural research must be

- To conserve the basic land resource for future generations;
- To feed, house, and maintain the health of the people;
- To substitute, where feasible, for imports;
- To earn foreign exchange by exporting agricultural produce;
- To add value to both locally consumed and exported commodities where this is economically sound;
- To contribute to the improvement of the standard of living of the people of the South Pacific.

What sort of research?

- Speculative
- Strategic
- Mission orientated – applied problem-solving
- Adaptive – development
- On-farm
- Systems research

Is there a need for a regional research program or institute?
I believe there is because

- With the exception of PNG and Fiji, nations are too small to sustain the totality of research needed, Mosher's critical mass, and a satisfactory career structure for research specialists.

- Many of the problems needing solution or constraints that need to be overcome are common to all or to large groupings of nations in the region.

- A center serving the region might justify a specialist scientist or piece of equipment or facility that cannot be justified by any one nation alone, e.g. applied statistician, test equipment for driers, tissue culture facilities.

- The concentration of specialists produced by the School of Agriculture justifies an institute in channeling funds for research and concentrating research effort on regional problems. Teaching at degree level is sterile without active ongoing research.

IRETA and the Policy Context

There is no defined policy for regional research as there is for most nations. The Regional Advisory Board, IRETA staff, and aid agencies interact to produce research priorities, and it has to be admitted, as the last RAB meeting showed, that priorities tend to be aid-determined at present. Although both RAB and IRETA wish to work together to produce a regional policy and priorities for research, they have not found a formula for disentangling national and regional priorities. If several nations give high priority to a problem, it does not follow that this problem becomes a high priority for regional research, as both national and regional organizations may be seeking aid funds to finance their research and can therefore be in competition.

While the creation of IRETA was sanctioned by the finance ministers of the region approving the University Grants Committee's proposals and by the education ministers meeting at USP's Councils, and the RAB was approved by ministers of agriculture to advise IRETA, this is a long way from political approval as a regional

body. The RAB took a first step toward strengthening its grip on regional priorities at its last meeting, but it has a long way to go to achieve full recognition and authority in this field. Nevertheless RAB and IRETA have jointly attracted several aid agencies who recognise a role for each or both in the region.

IRETA has at present the two roles of secretariat and coordinator of the RAB meetings and contractor for regional research funds. IRETA is dependent upon aid funds as the university provides less than 5% of its current annual budget. While the region through the University almost entirely finances the campus administration and the teaching activities of the School it seems most unlikely that it will increase through this channel the funding of IRETA.

Thus for the immediate future IRETA must remain a contractor for regional aid funds. In the longer term it is possible that regional funds as well as aid funds will be channelled to the RAB and it might then be more appropriate for the RAB to become more financially responsible for IRETA, forming a governing rather than advisory body.

Does IRETA meet Mosher Criteria for Productive Research?

- *Specially trained staff.* Table 1 shows that SOA and IRETA have 29 professional scientific staff (13 Ph.D., 11 M.Sc, and 5 B. Sc.)

- *Variety of disciplines.* IRETA and SOA together contain staff in eight major discipline areas.

- *Critical mass.* SOA and IRETA with 29 senior staff in seven disciplines meet the criteria for critical mass but when the proportion of effort devoted to research is calculated (table 2), then it is only the contribution of SOA staff and M.Sc. students that bring the total up to a critical mass.

  In the future, IRETA needs to increase the number of staff devoted to research more than to extension and training.

- *Staff interaction.* The organization of staff into discipline groups aims to bring about interaction of IRETA and SOA staff but possibly inhibits interdisciplinary interaction and project research teams. Should we try to use project teams?

- *Administration encourages leadership.* Creation of separate associate directors for research and for extension and training was aimed at encouraging leadership rather than authority.

Table 1

SOA and IRETA Senior Staff by Discipline and Academic Qualifications

Discipline	SOA	IRETA	Total	PhD	MSc	BSc
Crop Science	4	4	8	6	1	1
Animal Science	3	0	3	2	0	1
Soil Science	3	1	4	3	1	0
Economics & Statistics	2	1	3	1	2	0
Engineering	2	0	2	-	1	1
Extension	1	4	5	1	2	2
Education	2	0	2	0	2	0
Library	1	1	2	0	2	0
Totals	**18**	**11**	**29**	**13**	**11**	**5**

Table 2

Distribution of Time of Senior SOA and IRETA Staff between Research, Extension, and Training and Teaching

		Staff Years		
		Research	*Extension Training Information*	*Teaching*
Senior Staff				
SOA (17 + 1)				
3 Education & Extension		-	1.5	1.5
14 Applied Sciences		6.0	1.0	7.0
1 Librarian		-	0.5	0.5
4 MAgr Stud x 0.5		2.0	-	-
School Totals		*8.0*	*3.0*	*9.0 (20)*
IRETA (11)				
USP	Extension Fellow	-	1.0	-
	Information Officer	-	1.0	-
SPRAD	Crops	0.7	0.2	0.1
	Soils	0.6	0.1	0.3
	Extension	-	0.7	0.3
	Library	-	0.5	0.5
	Radio Satellite	-	1.0	-
EEC	Atoll Agriculture	1.0	-	-
	Applied Stats	0.5	-	0.5
CTFT	Tissue Culture	0.9	-	0.1
ADB	Perennial Crops	0.8	0.2	-
IRETA *Totals*		*4.5*	*4.7*	*1.8 (11)*
SOA + IRETA		*12.5*	*7.7*	*10.8 (31)*

- *Appropriate selection of research projects.* The RAB and the research staff interact to determine priorities with feedback and information on national programs provided by the information service and the agricultural liaison officers. Selection is very much determined by resource facilities and funds available rather than perceived priority needs.

- *Appropriate instruments, equipment, and facilities.* IRETA and SOA are not well supplied with facilities. Land is in limited supply, support staff and funds for equipment and materials are major limitations to productivity of the research workers, and all funding agencies tend to resist budgets containing adequate provision (35%) for nonsalary recurrent expenditure.

- *Combine experiment station with adaptive research and on-farm testing.* Through SPRAD mainly IRETA has funds to achieve this — collaborative trials on tomato and onion cultivars and as part of taro and sweet potato breeding.

- *Research into rural support services and national policies.* Economists from SOA have undertaken some work in this area.

- *Applied research preferred to basic.* All IRETA research is applied.

- *Imported technologies tested.* Solarization of soil, introduction of cultivars, testing of fungicides.

- *Reporting research.* IRETA has good systems in place for reporting research results of both scientists and extension workers but is not feeding the extension workers with as much information as it could supply.

- *On-the-job training.* IRETA has the funds for this but is hindered largely by difficulties in recruiting and retaining junior staff.

- *Taking advantage of international resources.* IRETA is collaborating with or contracting for USAID, EEC, CGA, CTA, ACIAR, CFTC, IFS.

- *Continuity and timely release of funds.* This is one of the most difficult constraints to overcome as few aid agencies (other than USAID) can provide for long-term financial support and many are unable to provide an interrupted funding

  Staff turnover is a major problem and seems certain to increase. Fewer, larger, team projects is probably the best way to overcome this constraint but this has not been achieved, as our nine areas of research indicate.

SYNTHESIS OF THE FIRST WEEK'S PROCEEDINGS

Howard Elliott
Deputy Director General, ISNAR

Introduction

I cannot pretend to have enough knowledge of the South Pacific to present a synthesis of what is actually occurring in the region. The best I can do is to look at the objectives of our first week together and try to synthesize what I learned from listening to you.

Our objective for this first week of the workshop was to bring about an interaction between policy-makers and senior research managers around a common theme: Improving the planning and management of agricultural research in the South Pacific. In the second week we look forward to the development of certain management skills that have been mentioned in this first week and to the identification of needs for future management training.

Objectives of the First Week

In this first week we attempted to do four things:

1. Present agricultural research policy, organization, and management in a systems framework;

2. Describe certain tools and instruments for diagnosing management problems and for improving agricultural research management

3. Learn more about ourselves as managers and how awareness of our behavior can lead to improvement of our management styles.

4. Look at the specific experience of research management in the South Pacific.

In this summary I will report on what I thought I heard as I attempted to learn from your presentations and your discussion of the presentations we made.

A Systems Approach

At the beginning of the week I tried to present the interactions between research, extension, and farmers in a broad systems framework. The system must try to achieve its objective by working within structural constraints imposed by climate and geography as well as within a policy environment influenced by donors and international centers.

Participants seemed to feel that the systems approach is an appropriate way to look at research in the region. Your discussion clearly put concern with the farmers as central to the process but recognized the pervasiveness of the 'environmental' constraints. For the PINs, there was recognition that the national agricultural research systems are part of a broader Pacific Island system. Specifically, we should look at the constraints on the region as a whole and determine what can be done at the national level and what should be done at the regional level. It was also clear that policy decisions take place within a social context, and that failure to understand this context can lead to errors in research direction.

The ISNAR approach to looking at NARS (national agricultural research systems) highlights twelve critical factors falling broadly in the areas of research policy, organization, and management. These are essential components in an overall systems approach.

We found that some of these critical factors drew more attention than others. Within the area of 'policy,' participants showed great interest in strategic planning and the relation of national priorities to regional plans. They were also interested in finding the means of influencing the policy environment within which they work. It was recognized that governments are making a fiscal effort, but that resources are generally limited. There is still a strong dependence on donor funding.

In the areas of organization and structure, the key issues seemed to be (a) the need to achieve a critical mass; (b) the linkage to extension services; (c) the link to external sources of knowledge, and (d) the importance of a strong regional organization. In the area of management, it was the management of human resources that was the focus of discussion.

Let us look at each of these in greater detail.

The Policy Context

Most participants felt that they were constrained by the policy environment. This was made worse by a generalized opinion that economists and planners had come to dominate the process of decision-making. In spite of this, there did not seem to be any attempt to add a strong capacity for social and economic analysis to the research service where it could help them understand farmers better, analyze the policy environment, justify research better as an investment, and influence policy through speaking the language of the planners.

There was also some concern about the level of donor influence over priorities, patterns of collaboration, the nature and focus of research, and the implications for stability of research funding. It was clear that such dependence made the programs unsustainable in the event of a withdrawal of donor support and it did influence the type of research climate that is put in place. In particular, it tended to substitute publication in learned journals for results at the farm level as a criterion of success. Participants felt that there was need for NARS to establish clear plans and priorities both nationally and regionally and to put in place mechanisms to deal with the dependence they experience.

In looking at strategic planning, there were several elements that recurred in the various papers that were discussed:

- As discussed in the ATMS approach, the goal of the system must be determined first so that the functions that need to be performed and the best structures and mechanisms to facilitate the performance of those functions can be determined;
- The process of strategic planning follows a pattern of diagnosis, generation of alternative scenarios, and action planning;
- The process of planning can be facilitated by guidelines, of which Tonga's experience with objective-oriented project planning was a good example;
- Fiji's experience with planning took us through all the steps.

It is important to note that without any attempt to force presentations into a common approach, the four papers spontaneously came to emphasize

- the need for flexible planning responses to changing environments;
- the need for a conscious effort to plan;
- the utility of guidelines as a tool to aid in planning;
- the importance of having a participatory process which includes staff as stakeholders and farmers as clients;
- the need for research to work to clear objectives;
- the fact that planning can be threatening to those who see priorities or influence shifting away from them through the process.

Structure and Organization

Several issues came out as being of primary concern:

- the difficulty of achieving a critical mass of researchers in systems which are small in size;
- the difficulty of managing the research-extension linkage;
- the need to find improved ways to link to the outside world.

It was clear that small systems cannot do research on all crops, ecologies, regions, or farming systems that interest them. Participants agreed that they should concentrate on what helps farmers...and they should have a division of labor with other organizations that recognizes their principal concern with farmers. There is also a need for clear priorities so that this orientation is common throughout the system.

In terms of linkages with extension, it was seen as paradoxical that, even where research and extension are found within the same ministry, they have problems in relating to each other. The problems were seen not as

structural but as managerial. Even within the same ministry there could occur problems of interpretation of mandate and responsibility. The human problems of gaining mutual respect between researchers and extensionists were compounded by differing conditions of service, status, and training. Finally, a need to create mechanisms for the two services to get together was recognized.

An excellent paper described how a management approach -- the T & V System -- was used to deal with national problems. We saw how a structured system provided the following improvements:

a. Mechanisms: for linking research to extension better;

b. Processes: a planning framework, monitoring and evaluation, and management control devices;

c. Resources: training for extensionists and farmers.

In this example, improved mechanisms and processes substituted for changes in organizational structure as a way of dealing with the problems.

Structuring and Managing Regional Activities

The question of structuring and managing regional activities came up in two ways:

- setting priorities at the national and regional levels;
- creating the infrastructure needed for regional cooperation.

Most of the discussion focused on the degree of need for a regional institution. By looking first at the functions that have to be performed and then at the mechanisms that might be best suited to this purpose, we have a framework for discussing the issue. Various participants identified the following functions that require action of a regional nature:

- strengthening national agricultural research systems;
- carrying out basic research in conservation, agroforestry, farming systems, and specialized disciplines;
- providing a concentrated source of support services (e.g. in information science and statistics);
- planning and priority-setting on a regional level to prevent duplication and organize replication;
- creating a critical mass in fields where the national effort does not justify expenditure;
- generating donor interest in and support for the countries as a group.

In an excellent paper on the role of IRETA, we saw its achievements to date and its future possibilities expressed in terms of many of the functions outlined above. It is clearly an organization that merits the confidence of donors and is getting it.

We discussed the structures and mechanisms that are compatible with the functions discussed above and how they relate to the work of IRETA. It seemed that participants recognize IRETA as a 'concept' and not just a place. It is part of a broader research pool for which it provides a mechanism for exchanges on a regional basis. Where national systems are small, networking in commodities depends often on one strong institute taking the lead and providing materials which can be borrowed by other institutes in the region. Since different commodities have leaders located in different countries, the focus of the collaboration is always at the commodity level. The PINs may want to look at the experience of Latin America where PROCISUR, in the Southern Cone; PROCIANDINO, for the Andean countries; and PROCICENTRAL, for Central America, have been set up as networks of national institutes. Such networks of institutes help 'legitimize,' or give political strength to, national agricultural research vis-a-vis its own politicians and helps increase the flow of donor funds to a region. Analysis of the function of PROCISUR shows that there is a growth in the complexity of exchange among the members and that all members are gaining from participating in the network.

Management of Research

The final objective was to learn about ourselves as managers and to identify what is special in managing agricultural research.

Through exercises and formal presentations, we discovered that

- our perceptions are influenced by preconditioning;
- our management behavior can be improved through situational leadership;
- conflict can be managed;

- communication is the key to understanding.

From the survey of our actual and desired time allocation, it was clear that research managers would like to see

- more time for contact with policy makers;
- more time for actual policy formulation;
- more time for gaining feedback from farmers and the government.

Directors of Agriculture, for their part, would like to

- reduce the time for administrative routine;
- escape from excessive visitors,
- devote more time to management of people.

These concerns will be addressed in the following week by the 'frontline managers.'

In the discussions that we did have about the management of human resources, we identified a number of concerns facing most developing countries:

- the need to upgrade staff currently in place;
- the need to create a critical mass in certain disciplines;
- the need to to improve conditions of service and create a career path.

In the South Pacific two additional issues took on prominence:

- the management of expatriate staff and the need to ensure promotion of national staff and the sustainability of the system;
- the recognition that management is more 'face-to-face' than in larger systems and the need to develop the skills for management of human relations.

With respect to the management of information, it was recognized that it was a function that was

- poorly understood and often underappreciated;
- underfunded;
- potentially more important in small systems than in large systems since it underlies the capacity to borrow technology.

In short, we were able to identify areas where improvement in management practices is possible.

WHAT IS GOOD RESEARCH MANAGEMENT?

Leonard H. Fernando
Consultant, Former Director, IRETA

What is Research Management ?

The basis of good research management can be considered in general terms. In the context of this workshop, I would prefer to relate to what prevails in the South Pacific. I will therefore try to draw your attention and your response to what research management should be, within the resources available in the developing countries of the region. Our countries would wish to use the results of research that are applicable to needs or improvements in agriculture that are perceived. For instance, a promising crop variety or livestock breed or an agricultural practice may be adopted even without adaptive research. Or research may be innovative to resolve a special problem or to improve agriculture to achieve higher goals of production and profit. This effort is already in progress, at a pace that is set by the availability of personnel, material, land and labor, and more importantly, funds that are provided in a country's national budget. Every country represented here today would have effected improvements to agriculture to an extent that is related to available resources. The government of a country sets a policy for this purpose and delegates this responsibility to its department of agriculture, with the expectation that implementation would be achieved on farmlands, small or large, through efforts in research and extension.

Speaking on good research management requires me to examine and express views on how research in agriculture may be productive, promoted, and provided for. The title of the subject may imply that not all research is well managed: the reasons for this and the remedy are called for.

Success in research may be slow, seldom spectacular, and realized through sustained efforts, which above all, need encouragement and appreciation.

Research management is dependent on

- a national policy and priorities for research;
- a plan for research, both short-term and long-term;
- a program for research, usually from year to year;
- a budget for research;
- responsibility for research at various levels;
- arrangements for implementation of a research program;
- the conduct of field and laboratory experiments;
- the collection of data and their statistical analyses;
- the interpretation of the results;
- documentation and transfer of information;
- a management information system;
- facilities in the library, laboratory, and in the field, and monitoring and evaluation of research.

These provisions determine the scope, efficiency, and effectiveness of an agricultural research program. Not all countries can provide these requirements. In the South Pacific there is wide variation in research resources. The question therefore is to what extent can research be undertaken in each country, and how can research be managed in relation to scarce resources?

Research Management and Resources

The need for research, its priorities, and the provision of resources are important criteria in research planning, programming, and management. Small countries have limited budgetary provision for undertaking agricultural research. Under these circumstances, there is a preference to channel available funds to agricultural development, extension, and services, relying on information and technology available in the country or elsewhere.

In the South Pacific, with insularity, the small

populations and limited extent of lands that are cultivated, agricultural practices that are traditional and in accord with the life style of the people prevail, with low inputs of labor and material. Research, if any, should be directed to prevailing systems of farming and their improvement, through innovations that are simple and acceptable to farming communities. Those who are engaged in research are generally aware of this and strive to be effective within the confines of these limitations. Nevertheless, inexpensive adaptive research can have an impact even in simple farming systems. Take, for instance, the use of a high yielding crop variety even with low inputs such as no tillage, no fertilizer, no agro-chemicals; it is often presumed that such a variety would fail without higher inputs.

With small populations and the reluctance of youth to be fully engaged in agriculture, less labor-intensive methods of cultivation are sought. Good research management must take account of this and provide an improved technology that is applicable and acceptable. With some success, farmers may be inclined to change and achieve more.

Research managers plan their programs in relation to available resources. Where resources are low, research managers have harder tasks to fulfill in experimental agriculture. They have little in the way of facilities and too small a number of persons trained in research methodology. It is difficult to provide an adequate number of persons at graduate or postgraduate levels, but training is an important goal, and carefully selected persons should be given this opportunity. In the meantime it is necessary for qualified research workers to be supported by technicians and other fieldworkers who can be trained to be useful in experimental agriculture. Those without technical qualifications, but trained on the job for experimental work, have been found to be good, and they should be remunerated and rewarded as an inducement to continue; this category of person is required in sufficient numbers and they are very useful for various tasks that they perform. Without them, scientists and technicians would need to spend time on various operations in the course of conducting experiments. Their need is more in the field than in the laboratory. Research managers agree that an increase in the numbers of this category and their continuous employment would greatly assist scientists and their technicians.

The ratio of support staff to scientists is a useful index of provision of personnel for research. A scientist with a Bachelor's or Master's degree, assisted by two technicians with a diploma or certificate qualification, and four to six trained workers, can handle a good program of research, and good research managers would try to provide this.

The conduct of agricultural research is structured through a head of agriculture, his deputy or assistant, director of research or chief research officer, and then through research managers of stations, heads of research disciplines or project leaders; research programs are expected to be managed well. When a Head of Agriculture delegates research responsibility to his deputy/assistant director or chief research officer, he still retains responsibility for research policy and for provision of adequate funds for research.

The smaller countries of our region, with few scientists and technicians, may be unable to undertake a comprehensive program of research. The manner in which research in some form is undertaken calls for favorable comment. There are countries with very few persons assigned to research that rely on extension staff, particularly in the outer islands, for plots that are used for experiments or demonstrations. This is admirable, cost-effective, and links research and extension. This will divert some time of the extension persons, but it places them in a stronger position to support and extend research results.

This therefore indicates a variable pattern of agricultural research in the countries of the South Pacific, related to the resources of a country, particularly personnel and material, and other research facilities. Improvement in research management is dependent on training at the appropriate level, either in-country or abroad, on a long-term basis. The responsibility that is assigned to research managers is important and difficult. They can be in the embarrassing position that resources are not available for the tasks that are set. They would try to adjust to changes in a program, resulting from inadequate funds. They should budget with care and provide a contingency item. Above all, they should be able to envisage all that is involved in the implementation of a plan and program. They are generally persons with tact and understanding, who maintain morale, encourge staff, and achieve success in spite of difficulties.

These are examples of good management and effective use of resources in agricultural research in the region. These will be cited, I hope, as good examples in a separate item of discussion. The point that emerges now is the need to share resources that are not adequate and often scarce. This suggests interdisciplinary and multidisciplinary research. Research persons who opt to

work in a team are the best examples of the promotion of cost-effective research. Their association leads to a team spirit that allows for interaction for a broad-based understanding and interpretation of research results.

Such research is often at the loss of some personal gain but is invariably a saving in time and resources, leading to recommendations that are holistic and transferable with greater confidence. This is an important consideration in research management. More qualified research staff have a stronger obligation to work closely with younger researchers. Highly qualified, efficient, well-remunerated expatriates are most valuable when they work alongside suitable local counterparts, and this is particularly so in the countries of the South Pacific that are fortunate in receiving substantial external aid. Aid donors have provided for capital investment, experts, and operational expenses in the South Pacific, and in this way research facilities have been improved. In response to this, national ministries of agriculture need to secure counterparts and support staff who can derive the full benefit of external assistance and ensure continuity of research programs in the future.

The Importance of National Research Capacity

In the South Pacific, research management is well provided for in the large countries, with responsibility for research assigned to an assistant director of agriculture or chief research officer who can spend sufficient time on research. In the smaller countries, both research and extension are under the head of the agricultural department. Small countries have too few persons trained in research. Larger countries have more trained staff who however do not find enough time for expanding programs of research. Increase in the number of research persons is not accompanied by an increase in facilities for research. In all countries, therefore, difficulties do arise in undertaking research.

In the 1986 ISNAR workshop on Improving Agricultural Research Organization and Management Director-General Alexander von der Osten stated "There is a growing recognition in the donor community that strong national research capacities are the key to success in the global battle against poverty and hunger. Only with strong capacities at the national level will research efforts elsewhere be successful." While poverty and hunger are not encountered among small populations of the South Pacific, the importation of food and adverse trade balances call for a strengthening of national agricultural research systems. Research managers are often constrained by the lack of adequate scientific and support staff, field and laboratory facilities.

Considering the plans, programs, and progress of agricultural research in the South Pacific Region, the indications are that except in a few countries, inadequate provision has been made for agricultural research, and in these latter countries a program of training of persons for research is required. This would include both scientific and support staff. Scientists and technicians already in service need more assistance in the way of facilities to undertake a more meaningful program of work. Aid for research, supplemented by counterpart funds, would be the best way of improving a national agricultural research system (NARS). ISNAR can help NARS and research managers.

National agricultural research can be linked with advantage to research at regional and international institutions, with external aid provided for this purpose.

Similarity in problems and project objectives among South Pacific countries would be a strong reason for this approach. Discussion in-country and between countries in the South Pacific would enable further clarification of the scope and benefits of agricultural research. Heads of agriculture at the national level can usefully assign responsibility for research, planning, and programming to a person chosen for this purpose. Research managers attending this workshop should take action that they consider appropriate as an outcome of the workshop on the premise that an improvement in research management is possible.

INTRODUCTION TO GROUPS

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All of us have spent our lives in groups of various sorts — the family, team, work group, etc. — but rarely have we taken the time to stop and observe what was going on in the group, or why the members were behaving the way they were. One of our main goals here is to become better observers and better participants.

But what do we look for? What is there to see in a group?

1. Content vs Process

When we observe what the group is talking about, we are focusing on the *content*. When we try to observe how the group is handling its communication, i.e., who talks how much or who talks to whom, we are focusing on group *process*.

Most topics about the back-home situation emphasize the content — 'What is good leadership?' 'How can I motivate my subordinate?' 'How can we make meetings more effective?' and concern issues which are *'there and then'* in the sense of being abstract, future- or past-oriented and not involving us directly. In focusing on group process, we are looking at what our group is doing in the *'here and now,'* how it is working in the sense of its present procedure and organization. In fact, the content of the conversation is often the best clue as to what process issue may be on people's minds when they find it difficult to confront the issue directly.

2. Communication

One of the easiest aspects of group process to observe is the pattern of communication:

(a) Who talks? For how long? How often?

(b) Who do people look at when they talk?

1. Single others, possible potential supporters
2. Scanning the group
3. No one

(c) Who talks after whom, or who interrupts whom?

(d) What style of communication is used (assertions, questions, tone of voice, gestures, etc.)?

The kinds of observations we make give us clues to other important things which may be going on in the group, such as who leads whom or who influences whom.

3. Task, Maintenance, Self-Oriented Behavior

Behavior in the group can be viewed from the point of view of what its purpose or function seems to be. When a member says something, is s/he primarily trying to get the group task accomplished (task), or is s/he trying to improve or patch up some relationships among members (maintenance), or is s/he primarily meeting some personal need or goal with regard to the group's problems (self-oriented)?

A list of the kinds of contributions or the group services which are performed by one or more individuals is as follows:

A. Task Roles — Types of behavior relevant to the fulfilment of a task

(1) *Initiative activity*: Proposing solutions, suggesting new ideas, new definitions of the problem, new attack on the problem, or new organization of material.

(2) *Seeking information*: Asking for clarification of suggestions, requesting additional information or facts.

(3) *Seeking opinion*: Looking for an expression of feeling about something from the members, seeking clarification of values, suggestions on ideas.

(4) *Giving information*: Offering facts or generalizations, relating one's experience to a group problem to illustrate points, stating belief, giving opinion.

(5) *Giving opinion*: Stating an opinion or belief concerning a suggestion or one of several suggestions, particularly concerning a value rather than facts.

(6) *Elaborating*: Clarifying, giving examples or developing meanings, trying to envisage how a proposal might work if adopted, defining terms.

(7) *Coordinating*: Showing relationships among various ideas or suggestions, trying to pull ideas and suggestions together, trying to draw together activities of various members.

(8) *Summarizing*: Pulling together related ideas or suggestions, restarting suggestions after the group has discussed them, offering a decision or conclusion for the group to consider.

(9) *Seeking decision*: Testing for readiness to make decision; seeking decision-making procedure.

(10) *Taking decision*: Stating group's views in terms of a group decision; invoking the decision-making procedure.

B. Group Building and Maintenance Roles — Types of behavior relevant to the group's remaining in good working order, having a good climate for task work and permitting maximum use of member resources.

(1) *Encouraging*: Being friendly, warm, responsive to others, praising others and their ideas, agreeing with and accepting the contributions of others.

(2) *Gate-keeping*: Trying to make it possible for another member to make a contribution to the group by saying, 'We haven't heard anything from .....' or suggesting limited talking time for everyone so that all will have a chance to be heard.

(3) *Standard-setting*: Expressing standards for the group to use in choosing to avoid decisions which conflict with group standards.

(4) *Compromising*: When one's own idea or status is involved in a conflict, offering a compromise which yields status, admitting error, modifying in the interest of group cohesion or growth.

(5) *Following*: Going along with the decision of the group though not accepting ideas of the others, serving as an audience during group discussion.

(6) *Expressing group feeling*: Summarizing what group feeling is sensed to be, describing reactions of the group to ideas or solutions.

C. Both Group Task and Maintenance Roles

(1) *Evaluating*: Submitting group decisions or accomplishments to group standards, measuring accomplishments against goals.

(2) *Diagnosing*: Determining sources of difficulties, appropriate steps to take next, analyzing the main blocks to progress.

(3) *Testing for consensus*: Tentatively asking for group opinions in order to find out whether the group is nearing consensus on a decision.

(4) *Mediating*: Harmonizing, conciliating differences in points of view, making compromise solutions.

(5) *Relieving Tension*: Draining off negative feeling by jesting or pouring oil on troubled waters, putting tense situations in a wider context.

From time to time, more often perhaps than anyone likes to admit, people behave in nonfunctional ways that do not help and sometimes actually harm the group and the work it is trying to do. Some of the more common types of such nonfunctional behavior are described below:

D. Types of Nonfunctional Behavior

(1) *Being aggressive*: Working for status by criticising or blaming others, showing hostility against the group or some individual, deflating the ego or status of others.

(2) *Blocking*: Interfering with the progress of the group by going off on a tangent, citing personal experience

unrelated to the problem, arguing too much on a point, rejecting ideas without consideration.

(3) *Self-confessing*: Using a group as a sounding board; expressing personal, nongroup oriented feelings or points of view.

(4) *Seeking sympathy*: Trying to induce other group members to be sympathetic with one's problems or misfortunes, deploring one's own situation, or disparaging one's own ideas to gain support.

(5) *Competing*: Vying with others to produce the best idea, talk the most, play the most roles, gain favor with the leader.

(6) *Special pleading*: Introducing or supporting suggestions related to one's own pet concerns, lobbying.

(7) *Horsing around*: Clowning, joking, disrupting the work of the group.

(8) *Seeking recognition*: Attempting to call attention to oneself by loud or excessive talking, extreme ideas, unusual behaviour.

(9) *Withdrawal*: Acting indifferent or passive, resorting to excessive formality, day-dreaming, doodling, whispering to others, wandering from the subject.

In using a classification such as the one above, people need to guard against this tendency to blame any person who falls into nonfunctional behavior. It is more useful to regard such behavior as a symptom that all is not well with the group's ability to satisfy individual needs through centered activity. People need to be alert to the fact that each person is likely to interpret such behavior differently. For example, what appears as 'blocking' to one person may appear to another as a needed effort to test 'feasibility.' What appears to be nonfunctional behavior may not necessarily be so, for the content and the group conditions must also be taken into account There are times when some forms of being aggressive contribute positively for clearing the air and instilling energy into the group.

4. Decision-Making and Problem-Solving Procedures

Whether we are aware of it or not, groups are making decisions all the time, some of them consciously and in reference to the major tasks in hand, some of them without much awareness and in reference to procedures which are under consideration.

Consider some of the following questions in order to determine whether you are clear about the task in hand.

(1) Are all members of the group involved in the decision-making?

(2) Does the group drift from topic to topic?

(3) Handclasping — who supports other members' suggestions or decisions? Does this support result in two members deciding the activity of the group?

(4) Majority support — is there any evidence of a majority pushing a decision through over other members' objections? Do they call for a vote?

(5) Plop - - does anyone make any contributions which do not receive any kind of response or recognition?

(6) Consensus - is there any attempt to get all members participating in a decision? Genuine exploration to test for opposition and to determine whether opposition feels strongly enough not to be willing to implement decision? Not necessarily unanimity, but essential agreement by all.

A Model of Problem-Solving in Groups

The *starting point* (A) is that the group is given a task to perform in a given time.

The end goal (B) is the completion of the task within the time allowed:

Content

Start		End
(A)	**procedure**	(B)
Point		Point

Interaction

To get from (A) to (B) a group needs to concern itself simultaneously with three streams of activity:

The information content which can be likened to converting raw material (facts and opinions) into finished products (decisions and action plans).

The conscious procedure or problem-solving sequence necessary to complete the task. This includes the answers to such questions as

- How shall we organize ourselves to complete the task?
- Do we need a chair and/or secretary?
- What rules shall we work to in reaching our decisions?
- How should we allocate the time available?
- At what stages should we review our procedure?
- Will we make our data visible (e.g. on a board, flipchart) or not?
- Should we record ideas before we discuss them, or only after they have been discussed and agreed?

The (usually unconscious) interactions between the members of the group, which inevitably take place when human beings are working together. These are often referred to as the 'process factors' and include answers to such questions as

- How do people feel about the way the meeting is being handled?
- Who really has the most influence in this group?
- Who talks (or doesn't talk) to whom, how often, and why?
- What are the unwritten rules of behavior that the group accepts?
- How much real commitment is there to the answers we produce?

Groups which concentrate too much attention on any one of these activity streams to the exclusion of the others are less likely to achieve their end goals than those who maintain an appropriate balance between the three. It is the third stream which is most frequently neglected.

Although the symptoms are apparent to all, not many groups invest sufficient time in discussing them because such discussion is commonly regarded as 'a waste of time,' so the issues get swept under the carpet.

5. Emotional Issues: Causes of Self-Oriented Emotional Behavior

The processes described so far deal with the group's attempts to work, to solve problems of task and maintenance, but there are many forces active in groups which disturb work, which represent a kind of emotional underworld or undercurrent in the stream of group life. These underlying emotional issues produce a variety of emotional behaviors which interfere with or are destructive of effective group functioning. They cannot be ignored or wished away, however. Rather they must be recognized, their causes must be understood, and as the group develops, conditions must be created which permit these same emotional energies to be channeled in the direction of group effort.

What are these issues or basic causes?

(1) *The problem of identity*: Who am I in this group? Where do I fit in? What kind of behavior is acceptable here?

(2) *The problem of goals and needs*: What do I want from the group? Can the group goals be made consistent with my goals? What have I to offer to the group?

(3) *The problem of power, control, and influence*: Who will control what we do? How much power and influence do I have?

(4) *The problem of intimacy*: How close will we get to each other? How personal? How much can we trust each other and how can we achieve a greater level of trust?

What kinds of behavior are produced in response to these problems?

(1) *Dependency and counter-dependency*: Leaning on or resisting any one in the group who represents authority, especially the trainer.

(2) *Fighting and controlling*: Asserting personal dominance, attempting to get one's own way regardless of others.

(3) *Pairing up*: Seeking out one or two supporters and forming a kind of emotional subgroup in which the members protect and support each other.

(4) *Withdrawing*: Trying to remove the sources of uncomfortable feelings by psychologically leaving the group.

These are not the only kinds of things which can be observed in a group. What is important to observe will vary with what the group is doing, the needs of the observer and his or her purposes, and many other factors. The main point, however, is that improving our skills in observing what is going on in the group will provide us with important data for understanding groups and increasing our effectiveness within them.

6. Improving Member Rules

Any group is strengthened and enabled to work more efficiently if its members

(1) become more conscious of the role functions needed at any given time;

(2) become more sensitive to and aware of the degree to which they can help to meet th[illegible]s through what they do;

(3) undertake self-training to improve their range of role functions and skills in performing them.

DESIGNING AGRICULTURAL RESEARCH PROJECTS FOR EXTERNAL ASSISTANCE

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Introduction

It is widely recognized that most developing countries have a lack of soundly conceived and well-prepared projects and this impedes the process of development. International lending and assistance organizations have repeatedly deplored the lack of projects to fund. Reviews of national development plans often show that plans have been drawn up and goals and targets set with no indication of how targets are to be met, in other words, what programs and projects are to be vehicles of plan implementation. Since the aim of planning is to identify and select the combination of measures best suited to attain national objectives, planning which does not make provision for well-prepared projects is in effect no planning at all.

This paper attempts to shed some light on the designing of agricultural research projects. The paper provides insights into the need for external support for agricultural research in developing countries, the changing perspectives of national and international agricultural research, the elements which constitute a well-designed research project, and some guidelines for preparing research proposals.

External Support for Research

The search for new knowledge and alternative ways of applying what is already known is a vital component of the development process. The contribution that relevant research can make to development has been recognized by Third World countries. The role of research has not always been perceived as clearly as it is today. In the 1950s, in the early days of what has now become the 'economic development field,' dominant theories of economic growth were so capital-centered that they seemed to ignore the effects of everything else. This is itself ironic, as during that period, econometric studies of the source of growth in industrial economies were finding that changes in the quantities of capital and labor explained only small fractions of growth performance. In fact, many of the productivity advances were plainly caused by improving technology that was being generated by ongoing basic and applied research.

This view of the salience of research spread quickly to the Third World. It extended to almost all sectors. Agricultural progress was seen to hinge on supplying new technologies. The green revolution was intensive in research of both a basic and an applied nature. The developing countries were also confronted by a major requirement for economic and policy research. At the same time, it was clear that they could not rely solely on research imported from industrialized countries, but that careful judgement of its usefulness in sometimes radically different circumstances was required. In addition, developing countries were faced with intractable problems that were of little or no importance to the so-called developed world.

The bulk of research undertaken in developed countries has been concentrated in sectors that play little role in the economies of developing countries to build up their capacity both to undertake research and to judge the quality and appropriateness of research undertaken elsewhere. This development of research capacity implied building new institutions and providing training and opportunities for on-the-job experience to individual researchers.

It is very difficult to provide an accurate figure of research and development (R & D) expenditure in developed and developing countries due to the diffuse nature of the information. Most studies indicate, however, that the proportion of R & D expenditure in developed and developing countries has increased substantially in the past two decades. In agriculture, a

study covering the data from 67 developing countries estimated that, in 1980, expenditures on agricultural research at 1975 prices were in the order of $1,082 million, 71% higher than the amount spent in 1975 and 173% higher than the level reached in 1970.[1]

There is nevertheless an enormous imbalance in the amount of money spent on R & D by developing countries. A few major countries account for a very large percentage of overall expenditure, e.g. Argentina, Brazil, China, India, Mexico, and South Korea. UNESCO figures on R & D scientists show that, of the number estimated to be working in the developing countries, 4% are in Africa, 8% in the Middle East, 23% in South America and the Carribean, and 65% in Asia.[2] The R & D industry in developing countries now accounts for about $4 billion per year and yet the broad parameters of this major activity remain largely underresearched and unknown. The equivalent figure for OECD countries was estimated to be $245 billion in 1984 — a further indication of the striking imbalance in this area of global investment.

The Role of External Funding

Although national funding is by far the most important, it can be argued that there are compelling reasons for external sources to provide a significant share of offical development assistance (ODA) to research. First, research is essentially a long-term activity and countries that are faced, as many of the developing countries are, by urgent and pressing problems of poverty and macro-economic balance, both in terms of funding public expenditure and in terms of balance of payments, must find it tempting to regard research as an expendable item in their short-term calculations.

Second, research is characterized by major externalities: most benefits of research in one part of the developing world may well accrue elsewhere and the decisions on research may well require a broad global or regional view of the opportunities and pay-off for research on particular areas. Although this must be first and foremost the responsibility of the national governments within a region, donor funds can also often be used to take account of these externalities. This is particularly important for countries with small populations; it may be difficult to create the necessary critical mass for research on particular topics in some of these countries, even though a research problem may be of significant importance.

Third, research has an important requirement of foreign exchange for equipment and advanced specialized training outside the boundaries of the individual country.

Fourth, donor funding has played a major role in the development of a substantial set of multilateral research institutions in the Third World and some developed countries under the CGIAR system and other affiliated centers. They represent a growing and important new dimension to R & D in and for the Third World and account for a significant share of ODA funding to research.

Donor funds are clearly making a major contribution to research in some parts of the world. For example, a recent report on agricultural research in the Southern African Development Coordination Committee (SADCC) showed that more than 50% of agricultural research being undertaken in those countries was externally funded[3]. The figure for the South Pacific region would be in that order of magnitude as well. Where external funding accounts for such a major proportion of current research, there must be adequate safeguards to ensure that national priorities are really being followed and at the same time there is adequate provision of building research capacity for the future so that the activity under consideration can be continued after external assistance ceases.

Changing Perspectives of National and International Agricultural Research

The International Food Policy Research Institute (IFPRI) projects that the food shortages which the developing countries will face in the year 2000 will be even greater than those in the 1970s, and that the

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[1] *Searching: Partners in Innovation. International Development Research Center. 1987, p.11.*

[2] *It would be pertinent to note that the corresponding figures for overall developing world population distribution are Africa 11%; Middle East 7%; South America and the Caribbean 11%, and Asia 71%.*

[3] *Guidelines for Strengthening National Agricultural Research Systems in Sub-Saharan Africa. SPAAR Working Group for Preparation of Guidelines for National Agricultural Research Strategies in Sub-Saharan Africa. February 1987 (mimeo).*

situation will be more complicated.[4] There will be massive deficits for many countries but for a few there will be surpluses, and for them the problems of procurement, distribution, price support, and income generation to create an effective demand will become equally important. According to IFPRI, a trend scenario of the food situation in the year 2000, based on data from 1961-1980 for production and 1966-1980 for consumption, projects a Third World production shortfall in basic food staples of about 70m tonnes. This gap represents about 5% of the Third World's projected demand for basic food staples in the year 2000 and is one-third larger than the food deficit of developing countries in 1980.

The prognosis for the future raises issues relating to the priorities for agricultural research and also associated questions relating to organization and management.

Scientific Concepts and Systems Relationships

In the 1960s, when the developing countries started to face massive food shortages in the wake of their mounting population pressures, new concepts were evolved to make agriculture more productive to emerging needs. One of these concepts which has been so highly successful was to reconstruct crop plants like wheat and rice. The dwarf wheat and rice varieties grown under improved agronomic management are the result of genetic reconstruction.

How far can we go in taking this route to increasing crop production? Obviously, where crop plants can be grown without much stress, the plant-type concept remains highly valid. It should be possible to develop high-yielding varieties of grain legumes, oilseeds, and other crops in the same way as wheat and rice if agronomic management can be improved. And indeed, agricultural scientists in some countries are already beginning to do so. However, as long as these crops continue to be grown in their traditional habitats of dry lands under conditions of moisture and fertility stress, the breakthroughs may not be easy owing to the diversity of environments.

With regard to adaptation, CIMMYT and IRRI have developed wheat and rice varieties which could be grown in several different countries. In the 1960s when the national agricultural research systems in the developing countries were weak, the approach of developing improved germplasm at the international centers and testing the new varieties widely in the national programs in many different countries was a strategic move which has paid rich dividends. The concept remains useful for countries in the South Pacific and Sub-Saharan Africa which cannot take a great deal of responsibility for research at present. For many other countries, however, the same need no longer exists. The international centers, therefore, are already beginning to reorient their programs to move more and more into areas of upstream research, leaving applied and adaptive research to the national programs. This move is expected to gather momentum in the next decade.

Increasing Genetic Uniformity of World Agriculture

An important implication of widely adapted varieties is the increase in genetic uniformity of world agriculture with consequent threat of disease and pest epidemics. In traditional farming, hundreds of land races and primitive cultivars help to diversify agriculture and to erect genetic barriers against the spread of pests and pathogens. However, traditional agriculture simply cannot help to meet today's vastly increased food needs, much less the needs of tomorrow. High-yielding varieties are required without the loss of too much genetic diversity.

The long-term answer to this problem is decentralized breeding with the international centers developing their gene banks for disease and pest resistance and other important attributes, and the national programs doing much of the hybridization work, using an important part of the parental material from local sources. The future challenge would thus be to combine genes of high productivity into a vast array of new genetic backgrounds. Also, another complicating factor will be the need to develop varieties for widely varying management regimes.

Technology for Stress Environments

In the 1960s, when many developing countries were faced with serious food deficits, the most urgent need was to increase food production in the shortest possible time. The strategy which many of these countries adopted during this period was to concentrate on lands endowed with favorable features -- highly fertile soils having irrigation or assured rainfall. The research approach during this period was to exploit favorable genotype-environment interactions. The plant breeders

[4] *Mellor, J.W. 1986. 'The new global context for agricultural research - implications for policy.' A Paper presented during International Centers Week, 3-6 November, Washington, D.C.*

in addition helped to synthesize genes which could take full advantage of modern farm inputs like chemical fertilizers. It was a highly controlled environment, so most of the stress factors of traditional agriculture did not operate. This strategy has worked well, leading to major increases in crop production in many developing countries. More important, it has helped buy time to organize effective research programs for lands characterized by fertility and moisture stress. It is obvious that many kinds of strategies will be required for these rainfed lands. While genetically improved varieties will continue to have an important role, the emphasis must shift to soil and water management and to agronomic manipulations of various kinds. In other words, manipulation of the environment may well become even more important than the manipulation of genes under harsh conditions.

It has been suggested that agronomic research of this kind is best organized locally as the transferability of results from one location to another is poor. If this is so, then clearly a great deal of work in these priority areas of research will have to be taken up by the national research systems, which must be strengthened for this purpose. The international centers should concentrate on the basic aspects of research in water harvesting and soil management and leave the more applied and adaptive research work to the national systems.

Efficiency of Agricultural Production

Much of the scientific basis of modern agriculture is provided by a very limited number of discoveries: Mendel's work (rediscovered at the turn of the century), studies in the field of mineral nutrition of plants by Liebig in Germany in the last century, the development of agricultural chemicals following the discovery of DDT in the 1940s, and the use of mechanical tractors during the last 50 years. The emphasis has been on high productivity rather than efficiency of resource use. With increasing resource constraints in the short-term the developing countries will have to shift to cost-efficient technology in agriculture.

In the longer term, the scientific challenge of making agriculture both highly productive and efficient must be faced. Recent advances in molecular biology hold out the possibility of such scientific advance. The tools of genetic manipulation and advances in biotechnology to improve genetic potential, enhance soil fertility, and to control pests and diseases with renewable sources of energy hold promise. Clearly, the lead for these studies will have to be taken by the advanced scientific centers of the developed countries. The challenge is to motivate their scientists and to define the problems clearly to them. The international research centers will have to play a key role and would have to serve as the bridge between the developing countries and the laboratories of the developed countries if future agriculture is to become both highly productive and efficient.

Sustainability of Agricultural Production

With increasing population pressures on limited natural resource endowments, the sustainability of agricultural production systems will be a major issue of the future. The degradation of forestry resources, agricultural lands, and fishery resources from overexploitation is well known. Present land use in many parts of the world, particularly in rainfed and hilly areas, is far from optimum and is frequently detrimental to soil fertility and long-term production potential. Restoring the ecological balance and maintaining the long-term capacity of the ecosystem to produce food, feed, and fuel to meet the requirements of a growing population will require changes in type and intensity of land use. Such changes need to take into account not only the inherent potential of the soil but also the aspirations of the rural population and market factors. Research on sustainable production would have to be conducted mainly by the national research systems because of the local specificity of the problems. Clearly, a multidisciplinary approach overstepping the boundaries of conventional disciplines of research will be required.

Improved organization and management help to create the potential for a national agricultural system to be effective. Once the potential for effectiveness has been created, we must build on it through the additional dimension of efficiency, and this is done with the help of the research leaders to perform the various functions considered important. Some of these functions include identification of research priorities and resource allocation, program formulation and implementation, monitoring and evaluation, research coordination, links with the extension service, links with the academic community, staff development, and above all, links with the policy-makers. These topics constitute the subject matter of this workshop.

Project Design and Formulation

A sequence of project types are in use, with each kind of project serving an important function — experimental, pilot, demonstration, and production. While production projects often receive the major share of attention, other project types perform important purposes by furthering the discovery and testing of new approaches to

development and by promoting widespread dissemination of results. The purpose of this section is to provide guidance on the design and formulation of agricultural research projects.

The essence of the process of designing a project is to

- identify and state the objectives and related targets which are to be achieved and the scheduled date(s) for their achievement;
- identify and summarize the program of interrelated efforts to achieve the objectives;
- establish and describe what outputs it should produce to achieve its immediate objectives, what activities it should undertake -- and in what sequence -- in order to produce these outputs, what inputs it should have from different sources and how it should be organized to enable successful and efficient management.

The above process is iterative, calling for the clarification and adjustment of each element in the light of the other elements. One of the more comprehensive design schemes developed is the logical framework first used by the United States Agency for International Aid (USAID). By providing a means of relating systematically the inputs required and the project outputs expected to achieve the project purpose and goals, the logical framework provides a consistent means of planning, formulating, monitoring and evaluating projects. Figure 1 details schematically the way in which the logical framework is intended to operate, and Figure 2 is the worksheet used to summarize the salient aspects of project design. The logical framework worksheet provides a conceptual framework for the project designer, who is forced to think holistically and systematically about all aspects of the project, i.e. from the provision of inputs to the achievement of the goals of the research work and the strengths and weaknesses of the project through an examination of the assumptions of the project and the safeguards that need to be built in. For the decision-maker, the logical framework worksheet provides a convenient summary of the project: for the project designer, an excellent basis for preparing a project proposal; and for the research worker and the project supervisor, a convenient basis for monitoring progress and evaluating results.

Preparing a Proposal

At the outset it would be useful to note that different organizations have their own project proposal formats and it is important to ascertain their requirements when preparing a proposal. However, this section attempts to provide a synthesis of a number of formats used by multilateral and bilateral agencies in the preparation of agricultural research proposals.

Project Title

This should be a short descriptive phrase indicating the subject of the proposal.

Project Summary

A summary statement of about 250 words is useful, particularly in the case of a complex proposal. The project summary could be supplemented by a logical framework worksheet. This would be helpful, not only in examining the design of the project but also for monitoring and evaluation purposes. The summary should contain a *statement of the problem, objectives, output expected, cost, financing plan,* and *implementation arrangements.*

Chapter I: Background

This is an important section of the proposal which should provide the setting for the proposed work. The following information should generally be contained in the background section of the proposal. Any additions or deletions to the checklist indicated may be made, depending on the relevance of the information for the project under consideration.

1. The sector in the national plan

(a) summary of the principal objective of the Plan;
(b) place and importance of research and the proposed project in the development policy and instruments.

2. The sector in the national economy and performance

(a) place of the 'research' sector in relation to the basic data on the country;
(b) GNP, budget, external trade, employment.

3. Description of the system of research and its component parts

(a) structure of the existing system of research;
(b) personnel: professional and technician grades;
(c) state of research conducted in the country and, where appropriate, the region;
(d) links with the users (advisory/extension services);
(e) needs to be satisfied, such as

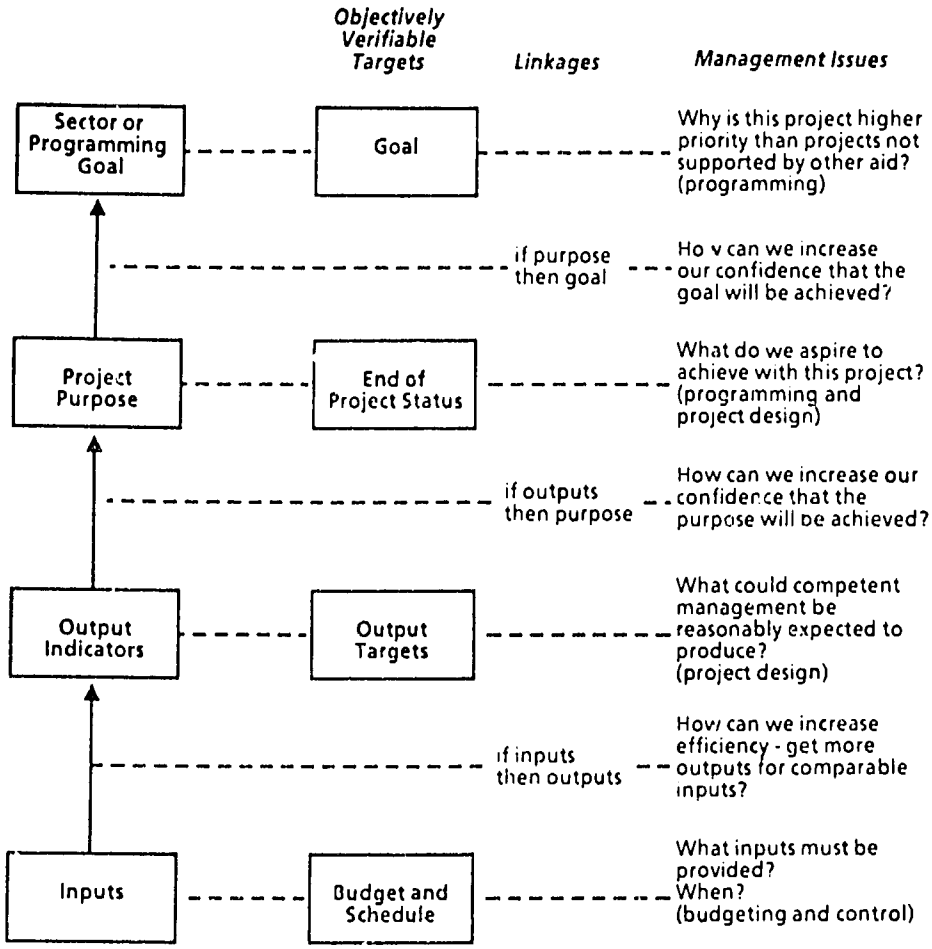


Figure 1: *The Logical Framework of a Project*

- training and retraining of various categories of personnel;
- scientific and technical information;
- promotion of local technologies;
- transfer and adaptation of technologies;
- dissemination of the results of research;

4. Scope for developing research and technology

(a) potential of existing research institutions;
(b) any links with other countries in the region insofar as mutual support is possible because of the existence of (i) common priorities, and (ii) research potential adapted to the region's requirements;
(c) support from the international agricultural research centers and regional centers and bilateral sources;
(d) gaps in research and need for research support.

5. Rationale for choosing project

Here the aim is to describe clearly and precisely how the project fits into the context of sectoral support:

(a) needs to be satisfied, for instance, adaptation of plant varieties to given environmental conditions, establishment of a national research system in a given sector, or merely a network of testing and applications stations;
(b) selecting the region of operation; existence of a major problem specific to the region, existing research or support infrastructures, etc.
(c) selecting the type of operation in the light of the

NARRATIVE SUMMARY	OBJECTIVELY VERIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes (A1)	Measures of Goal (A2)	(A3)	Assumptions for achieving goal targets: (A4)
Project Purpose: (B1)	Conditions that will indicate purpose has been achieved. End of project status (B2)	(B3)	Assumptions for achieving purpose: (B4)
Project Outputs: (C1)	Magnitude of Outputs: (C2)	(C3)	Assumptions for achieving outputs: (C4)
Project Inputs: (D1)	Implementation Target: (Type and Quantity): (D2)	(D3)	Assumptions for achieving inputs: (D4)

Figure 2: *Project Design Summary of the Logical Framework*

earlier considerations: training of scientists and technicians, setting-up of information or documentation facilities, supply of scientific equipment, etc.

6. Description of region chosen

(a) general characteristics: geographical location and areas involved, regional development, administrative infrastructure, and possible relays for disseminating research findings;
(b) physical situation: points of particular interest to the project depending on the circumstances, — climate, geological structure, soil, water resources, etc.;
(c) sociocultural situation: family, village, social structure (organization, power to make decisions, management); traditions in the field in which research is to be developed (knowledge, know-how, tools, and instruments); where appropriate, specific division of responsibilities between men and women (e.g. for food crops);
(d) specific short-, medium-, and long-term problems and requirements: they may be extremely varied, in the light of the socioeconomic, cultural, and ecological environment, ranging from malnutrition to energy-saving, better knowledge, rural food technologies, etc.

Chapter II: Research Institutions

If an international agricultural research center (IARC) or regional center is to undertake the research, it would be necessary to provide a write-up incorporating the history of governance, personnel, research plans and priorities, comparative advantage in undertaking the work, previous linkages with the country/region, budgetary position in the past five years, major activities and accomplishments, and need for financial support. The description should be concise and may be supplemented with appendices providing relevant data.

A brief description should also be provided of the collaborating agencies, their locations, governance, personnel and facilities, budget, research plans and priorities, comparative advantages in undertaking the work, collaborative work undertaken in the past. Indication of the government clearance for the project and collaborative arrangements with international centers need to be spelled out. Appendices with supporting information should be provided. A list of

related research publications in an appendix table would also be useful to indicate the state of the art of the research to be undertaken.

Chapter III: The Proposed Project

1. Objectives and Scope

A clear statement of the overall purpose of the project and a list of the specific objectives should be provided. The work to be undertaken at different locations needs to be clearly stated, e.g. at headquarters and outreach sites.

2. Methodology

The presentation of this section should be organized so as to describe how each objective will be fulfilled. It is important that sufficient detail be provided to enable a scientific assessment of the proposal. The analysis plans and work program for the research to be undertaken should be included.

3. Implementation Arrangements

Duration and timetable. Organization and management measures need to be given, particularly on the responsibilities of the various collaborators. The procedures for the procurement of goods and services also need to be provided. A statement on the capacity to continue with follow-up research on completion of the project would be necessary. A time-phased plan of activities is useful. It is necessary to take into account such matters as time required for staff recruitment and equipment purchases. A bar chart to indicate the implementation schedule would be desirable as an appendix to the proposal.

Costs and Financing Plan

The costs broken down on an annual basis during the project life are necessary. The contributions of the funding sources to support the various discrete categories (cost items) of the project should be provided. Provide for inflation and indicate the percentage used as the contingency factor. The local contribution, if only 'in kind' (salaries, equipment, etc.) should also be costed. A sample budget format is provided for guidance (figure 3) and the following categories are offered as examples:

(a) *Personnel.* List all project personnel including consultants (if necessary) and the approximate time in person-months which they will spend on the project. The terms of reference for the consultants should be included as an appendix.

(b) *Equipment and supplies.* List all equipment requirements. (Indicate specifications and quantities.)

(c) *Travel and per diem.* Indicate reasons and rates. This item should be broken down into foreign and local travel.

(d) *Training.* Local and foreign training activities should be given.

(e) *Data processing.*

(f) *Dissemination of results.* Semiaars/workshops, publications.

Each item included above should be justified in the appendix as a note to the budgetary statement.

(g) *Monitoring.* Information should be provided on how the project is to be monitored and what on-going evaluation and postevaluation will be conducted. Benchmark activities to be undertaken should be stated and the agencies involved indicated.

(h) *Reporting.* The reporting system should be provided, giving the frequency of reports, the responsibility for report preparation, and formats to be used, if applicable.

Chapter IV: Justification

This section should briefly state how the results of the proposed research project will contribute to the solution of the problem identified. No quantitative assessment is required. This statement should in addition indicate how the results would relate to the operational priorities and the short-, medium-, and long- term interests of the concerned sponsoring organizations/agencies.

Suggested Appendixes

I. Supporting data on background section.
II. Supporting information on research institutions.
III. List of research publications on the problem.
IV. Project cost estimates.
V. Work plan and implementation schedule.
VI. Terms of reference of consultants, if applicable.

	XYZ Contribution *			Recipient Contribution			Total
	Year 1	Year 2	etc.	Year 1	Year 2	etc.	
I. PERSONNEL							
List and indicate whether full-time or part-time							
Sub- Total							
II. TRAVEL (International and Local)							
Sub- Total							
III. EQUIPMENT & SUPPLIES (Itemized)							
Sub- Total							
IV. TRAINING (Overseas and Local)							
Sub- Total							
V. DATA PROCESSING (Itemized)							
Sub- Total							
VI. ADMINISTRATION (Itemized)							
Sub- Total							
Contingency (10%)							
GRAND TOTAL							

* *If more than one organization is involved, their respective contributions should be given.*

Figure 3: *Sample Budget Format ('000 US Dollars)*

THE EX POST EVALUATION OF AGRICULTURAL RESEARCH

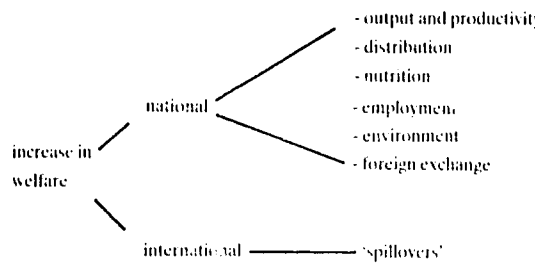
Paul Bennell
Research Officer, ISNAR

P. Bennell led a discussion on why and how research managers in the South Pacific should assess the outcomes of completed agricultural research activities. The discussion was structured around the following key questions:

- What is the scope of the evaluation?
- What are the reasons for the evaluation?
- What activities and outputs are to be assessed?
- How is this to be achieved?

A number of possible types of outputs of agricultural research activity were identified by the group. Whereas in the past most emphasis has generally been placed on the evaluation of research results, research organizations are increasingly concerned to evaluate the actual impact of their research on the economic and social well-being of farmers and other client groups.

In their four working groups, participants then explored the numerous kinds of possible impacts of agricultural research which can take place at national and international levels. The following impact indicators were enumerated:



Finally, P. Bennell reviewed some of the main approaches to ex post research evaluation. These include

- Subjective assessments based on client surveys and/or external evaluators.
- Key event profiles outlining the technological histories for specific agricultural commodities and the role of national research organizations in these events.
- Objective quantitative assessments based on simple productivity indicators (for land, labor, capital, and all factors of production combined) and more sophisticated economic rates of return analysis.

IDENTIFYING FARMERS' NEEDS

Fred A. Opio
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Introduction

Research is a necessary precondition for any system development and technological transfer which involves complex inputs requiring high-level expertise and generally not available at the farm level. In the South Pacific, where farm holdings are small, underdeveloped, poorly planned, and poorly managed because of lack of skills, appropriate research which meets the farmers' needs is absolutely necessary. For most farmers in remote areas, the so-called advanced system of production involving technological innovations arising from research work has not filtered through and, where they have, interpreting the often too-complex designs, understanding the methodologies, and applying them is a wild-goose chase.

Some research information pertaining to farm practices is often so unrealistic and irrelevant to farmers needs, that many farmers have resorted to their own system of production for mere survival. And those farmers who try hard often find that their efforts are not well rewarded because the ordinary commercial economy simply does not work in their favor. Demand for agricultural products is generally low, varied, and undependable; prices are low and unstable; the overall market system is weak and unreliable; and government policies are generally frustrating. It is in this perspective that agricultural researchers who are supposed to be concerned with the welfare and needs of the farmers, should ensure that their research does not become just a whim satisfaction but a liberating and enabling movement (Harris, 1982; Opio and Tielu, 1984).

The objective of this paper is to examine how research workers and information disseminators can identify farmers' needs, with the object of planning, designing, and undertaking research that is realistic and relevant to the farming population. These are considered important because the critical factor in any system development is the existence of sound knowledge about what is to be done and for whom.

Identifying Farmers' Needs

Designing appropriate research that meets farmers' needs requires that researchers identify farmers' needs and isolate farming conditions so that they can design relevant research projects. Needs are basic requirements which satisfy individual/society's preferences. Thus farmers' needs are basic to farming conditions. Identifying farmers' needs can take various forms depending on the prevailing circumstances. Given that most farmers' perceptions of their needs are not clear, but they do seem to be clear about their problems, it is probably better to isolate farmers' problems and identify their needs through problem identification.

Figure 1 shows a systematic process of problem identification, which can progressively lead to identification of farmers' needs. It shows three related options which researchers can adopt. These include

- General observations (GOB)
- Farming system research (FSR)
- Past information and experiences (PIE)

General Observations

General observations (GOB) is the most practical approach to information gathering. It is based on visual observation involving regular field visits, on-farm trials, and sometimes panel discussions with farmers, extension workers, and other researchers. Where farming communities are inward-looking and therefore likely to respond negatively or give false information, farming system research (FSR) may be preferable. FSR is useful in identifying farmers' problems and needs,

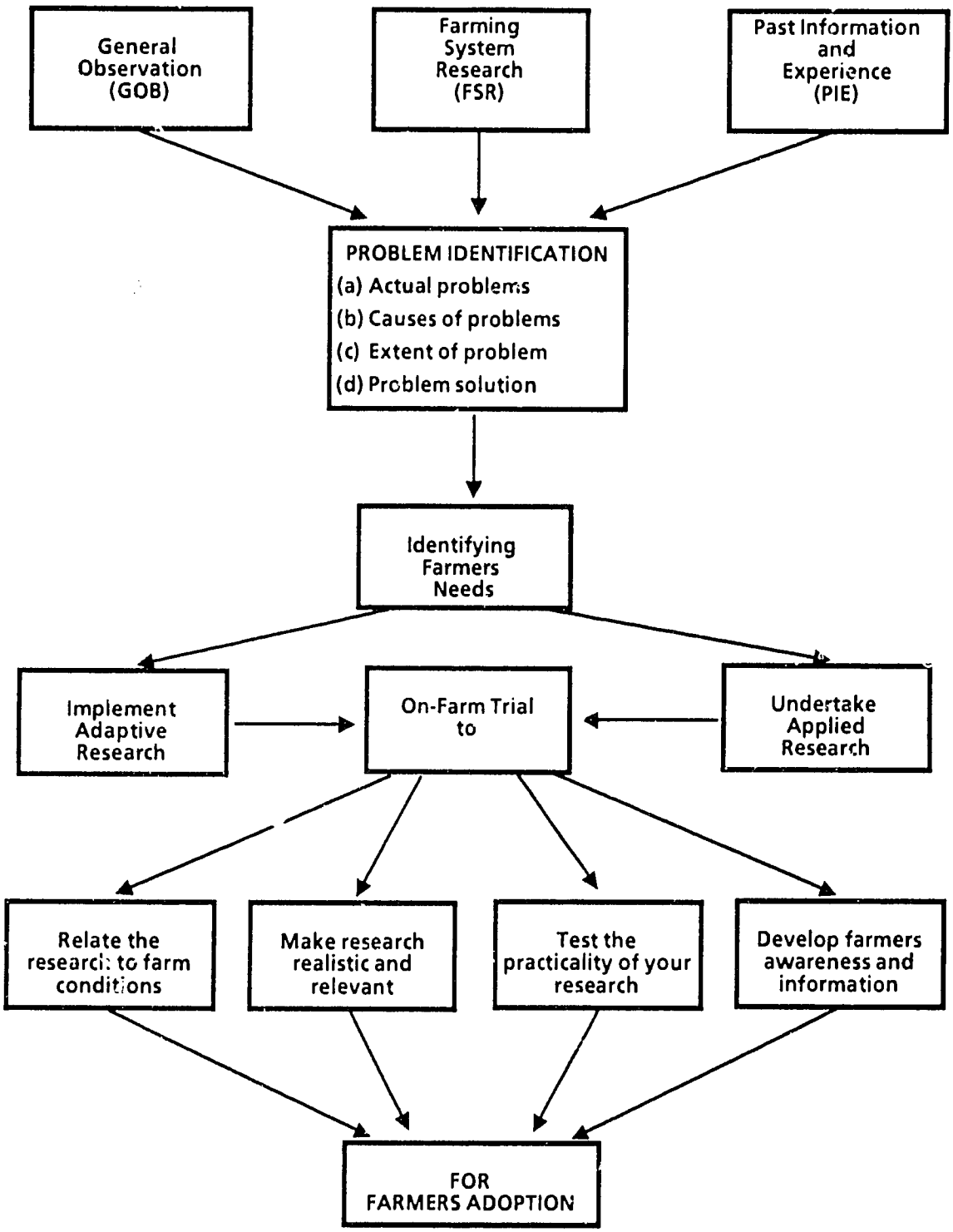

Figure 1: *A Module for Identifying Farmers' Needs*

especially if accompanied with documented information. However, it may be less reliable if the observations are not based on real farm conditions. It requires some local knowledge of the environment, socioeconomic and political factors, and the behavior of the local community. An effective GOB involves assessment of the farm situation and discussing with farmers and local field officers the general problems related to farmers' needs. Any information obtained should be carefully documented and used to identify farmers' needs and plan research that is relevant.

Farming System Research (FSR)

FSR is a relatively new approach used mainly by social scientists to identify farmers' problems and needs. It is an iterative and continuous process involving evaluation and feedback based on diagnostic procedures, assembling and analyzing information about general characteristics of the farming situation. It allows for classification of farms into relatively homogeneous groupings which can be diagnosed, thus leading to the identification of farmers' problems and needs. It can also help to strengthen the link between researchers and farmers' which can lead to some realization of the basic farm problems and farmers' needs. FSR techniques include

- using published materials about the farm situation;
- conducting exploratory surveys including GOB techniques or other methods;
- conducting formal surveys using standard statistical procedures based on sampling or case studies.

These techniques can provide the researcher with information which can be used to analyze farm problems and identify farmers' needs. Hildebrand (1981) introduced a structured FSR known as the 'sondeo' technique in South America using multidisciplinary teams working in small groups. They conducted exploratory surveys in one week and produced mixed results. But whether the technique can work elsewhere is still debatable. Dillon et al. (1980) suggested that where exploratory technique works, formal surveys should be abandoned, but many social scientists do not hold the same opinion. Maxwell (1984) argued that a formal FSR using case studies may prove inexpensive and less time-consuming, subject to achieving required minimum levels of accuracy, coverage, and statistical validity. If the population and farm conditions are relatively homogeneous, the observations and measurements require technical skills or a high level of accuracy. Chambers (1983) suggested that case studies are appropriate especially where detailed farm management information is needed, including cash flows, labor profiles, etc.

But the use of formal FSR, especially case studies, is limited. Since certain farm problems are 'location-specific,' there is a great risk of misrepresentation unless the case study gives representative results. FSR also suffers from generalization, which many research scientists dislike. In the first place, it involves multidisciplinary expertise which many research institutions do not have. Secondly, it is time-consuming, expensive, and too formal for scientists to be bothered with. However, where data are difficult to collect because information is too subjective or sensitive for farmers to give easily, FSR, especially a case study approach, could achieve the desired goal. In effect, case study is one of the best ways for multidisciplinary teamwork, involving research scientists to work side by side to collect data and get acquainted with farm families, isolate their problems, and identify their needs.

Past Information and Experience (PIE)

PIE is one of the oldest unstructured procedures regularly used by researchers to identify farmers' needs. It is based on long-term experiences, unorganized learning, observation, local knowledge, and documentation of past information. It is inexpensive but time-consuming and generally less reliable unless the information is properly quantified and documented. It is also limited in scope, given that general knowledge about human behavior is variable and constantly changing with time. Past information about a given farming condition is useful but limited, unless used in combination with current information.

Many researchers in the South Pacific have acquired local knowledge but are generally unable to plan and design research projects that are relevant to farmers' needs because the past information and experiences they have acquired do not all relate to the farmers' needs. Borrows (1981) suggested a conceptual model for problem/need identification and a management information system (MIS). He argued that problem identification depends on motivation and interest to find out and meet somebody's needs, as well as the way the information about the situation is managed. The onus in this regard seems to lie on the researcher and the extension officer.

Use of Formalized System in Identifying Farmers' Needs

The appropriateness of formalized system is dependent on

- the selection of representative farmers/farms;
- collection of accurate data;
- analysis and reporting.

The general assumption made here is that in most situations research programs are concerned with farm improvements and therefore related conditions must be identified.

Selection of Representative Farm

Representativeness is very important in any FSR because it determines the validity of the results. It is also important because the credibility of any research to be undertaken will depend on how realistic the research appears to the public. Thus the farms selected for gathering information must be representative enough so that information is obtained from all the different groups. There is a minimum number which can give reasonable representation depending on the homogeneity of the farm population. A satisfactory approach is to cover each group adequately while minimizing the cost of data collection. Although there is no real magic number, a statistically representative sample should contain at least 10% of the total population. Where case study technique is used, the targeted population should be relatively homogeneous.

Maxwell (1984) argued that whatever the number of samples in a particular category, case study surveys should have an overall limit of around ten farms. He argues that there are sharply diminishing returns to larger numbers because of less intensive or less frequent contact and sharply increased costs because of increased time for both data collection and processing. A satisfactory case study survey with three or four different domains or farm groups can be run with five to ten farms.

Data Collection

It is important to decide on what type of data to collect. It is appropriate to begin with physical, biological, and socioeconomic data requirements both within the farming system and at the research station. For FSR, opinions on data collection differ. There are those who believe that the researcher should formulate specific hypotheses to be tested and therefore data should be collected only to make such tests. And there are others who argue that FSR study provides an opportunity to describe farm conditions so that every facet of the farm should be observed, weighed, or measured, and therefore every sort of information should be collected. It may be appropriate to adopt a midway approach where minimum data are collected for overall description and analysis of the farm problems and/or identification of farmers' needs.

In view of these arguments, data collection for farming system research should include

(i) physical description of each farm;
(ii) socioeconomic factors of the farm family, such as relation, title, family size, age, sex, and other relevant factors;
(ii) the farm enterprise status and accounts;
(iv) information on development during the year focussing on problems and farmers' needs.

This information forms the data base which research scientists could use when attempting to identify farmers' needs. It is a generalized information collection tool which should be adopted whenever GOB, FSR, or PIE techniques are being used.

Table 1 shows essential information tools and survey programs.

Farm address/area should identify the location of the farm and related information about the farm, including farm size, size of fields to be estimated using appropriate methods, distance from main road and/or main town, and description of certain special features.

Household composition should show up-to-date lists of household members and the main occupation or activities each member is regularly involved in.

Farm household consumption should identify household food intake, allowing for detailed analysis of household food consumption and dietary requirements. It should show household consumption preferences (habits).

Farm inventory should cover farm assets, land improvements, crops and livestock under production, and produce in the store. Asset valuations and rates of depreciation may be required for bookkeeping purposes, but cumbersome information should be kept to minimum levels.

Cash flow records should include all daily receipts and payments. The recording interval will depend on the level of operation, but it may be necessary to provide

Table 1: *Information-Tools and Survey Programs*

Essential Information/Tool	Frequency Conditions	Frequency (No.)	General Comments
1. Address/Farm Area			To show access, land use, and address
2. Household Composition	Beginning of Survey	1	To show major activities carried out by household members
3. Household Composition	Regularly, depending on crop seasons	3 - 4 times	To identify household food intake and food consumption requirements
4. Farm Inventory	Beginning of each season	3 - 4 times	To identify and value all farm assets and working capital
5. Cash Flow Records	Every month	9 - 12 times	To examine cash transactions and transfers
6. Labor Use and Activities Requirements	Every season	3 - 4 times	To determine labor use for various activities
7. Field Register and Record of Events	Regularly, at least once a month	12 - 15 times	To analyze on-farm and off-farm activities gifts, payments, etc.

more detailed information at this stage because most commercial farm problems are related to cash flow.

Family labor record is probably the most important input record required for various farm activities. Because of the seasonal nature of farm operation, household labor may be very mobile: therefore, it is necessary to record labor availability and labor requirements for different activities regularly. The frequency of recording will vary at least once per season. Information on hired labor should also be included.

Field register and records of events is very important because it provides an informal report of discussion and observation which complements formal data. It is the most important source of information, if the GOB or PIE techniques are used. The register should include all members of the research team who visited the farm and give their observations. It should include vital information on such matters as husbandry practices, improvements, pest and disease problems, harvesting and marketing problems, and any visible operations worth noting.

Field registers are necessary where complex systems are practiced, for example intercropping, rotation, minimum tillage, multiple cropping, alley cropping/farming, etc., which make it difficult to assess the viability of an operation.

These lists are by no means complete, but the important factor is data collection and it must be remembered that only realistic data are useful. Undesirable information will complicate the analysis of farmers' problems and make identifying their needs difficult. If unrealistic data are used, the results will also be unrealistic: 'garbage in/garbage out.'

Analysis and Reporting

Where GOB or PIE techniques have been used, the data collected would generally be informal. This may create credibility problems, thus requiring other complementary formal information. To minimize these problems, it may be necessary to

(i) encourage multidisciplinary discussions/seminars to discuss, evaluate, and substantiate the report;

(ii) make on-site visits by interdisciplinary groups at regular intervals and document each group's observations;

(iii) organize meetings with farmers, especially those in the problem areas and discuss their needs with them.

If the main emphasis in data analysis is to determine farmers' needs, the idea of a dynamic multidisciplinary approach must be adopted to provide a way by which everyone concerned with the welfare of the farmers is involved.

The Role of Social Scientists in Identifying Farmers' Needs

Within agricultural research, there has been very little exposition of the role of the social scientist. Social scientists, especially agricultural extension professionals, have not been adequately involved in the research process. They have remained research messengers and not usually fully involved from the very beginning of the research. They should provide information and support for relevant research to be planned, developed, and undertaken. They need to debate the relevance of research by relating it to farmers' needs. Both research scientists and social scientists should make a coordinated effort to inform each other of what can and should be done under given circumstances. Insofar as the two groups (social and research scientists) do not relate to one another, the flow of information to and from the farmer will be inhibited.

The discovery of new ideas does not come easily. Modern agricultural research should be mission-oriented and multidisciplinary, requiring the commitment of all groups. Critics of agricultural scientists and social scientists point out the fact that, while in other disciplines (e.g. medicine, engineering, etc.) there seems to be significant cooperative work, in agriculture there is hardly any cooperation (Day, 1981; Hildreth and Armbuster, 1981). In fact with the exception of ad hoc and sporadic meetings, there is no coordinating mechanism for planning and designing multidisciplinary research, nor is there any attempt to work together to identify farmers' needs.

Extension is regarded as the link between research and the farmers. Extension professionals thus need to be able to understand and adapt the new knowledge developed by researchers and communicate the needs of the users for new research. Extensionists cannot be divorced from new research developments and expect to understand them well enough to be able to communicate them to end users. The challenges presented to such social scientists by changing clientele needs and new research developments call for careful evaluation of the role of social scientists relative to research scientists. Extension professionals must take an active role in agricultural research, just as they must maintain contact with the farmers.

Research Development and Management in the South Pacific

Agricultural research development and management is a complex operation which requires systematic determination of research priorities. Therefore, some research needs must be given higher priority than others. In many South Pacific countries, a lot of planning efforts are made but very few address the total spectrum of agricultural research as a unit and identify their clientele needs beforehand.

Long-term research planning can be accomplished by an intensive and comprehensive study involving all participants. Research management must be organized in such a manner that all participants to feel involved and develop a process for priority identifications. The impression one gets in the South Pacific and elsewhere is that research management appears to be so concerned with self-esteem and satisfaction that they do not often bother to identify research priorities and farmers' needs. Goldschmidt (1978) attributed farm problems to lack of interest in the small man.

Lack of interest has limited the scope of designing and developing meaningful research that meets farmers' needs. At the farmer level, researchers seem to have failed to address themselves to the real farm problems. They have failed to appreciate farmers' needs and do not seem to be at all concerned. Many are rightly concerned with increases in productivity and efficiency in the farm sector, yet the farmers' needs are never properly identified. Working closely with the farmers, observing their behavior, and participating in activity at various levels could provide clues to farmers' needs.

Sjo and Biere (1980) advocated participation and motivation as the 'hidden magic' for identifying farmers' needs. It involves participating in various action-oriented activities, suggesting solutions to given problems, and responding to farmers' needs positively and rapidly.

In societies where individual farmer's needs are varied, developing research programs that meet the needs of the majority of the farm population is preferable. It is important that research be designed in such a manner that

(i) it relates to farm conditions;
(ii) it is practical and realistic;
(iii) it is adoptable.

It also requires that all relevant information be communicated to the farmers to ensure that they understand and follow all the prescriptions, which would ensure some success for the new ideas.

Conclusion

Identification of farmers' needs is a necessary precondition for any agricultural research because much research undertaken is so unrealistic and irrelevant that many farmers resort to their own system of production for survival. Research designs are often too complex to be understood by many extension officers, let alone farmers. Farmers often fail to adopt new ideas either because they do not receive the message or they do not find any relevance in them.

Identifying farmers' needs can take various forms, depending on circumstances and convenience, but the most highly advocated technique is the formalized farming system research (FSR). This is a diagnostic procedure involving assembling and analyzing the information about the farm situation.

But the FSR suffers from generalization problems which many research scientists dislike. It is also time-consuming and expensive. However, it is the most comprehensive technique that can lead to proper identification of farmers' needs. But where FSR is not fully applicable, use of GOB or PHE techniques may also achieve the desired goals.

The use of formalized systems in identifying farmers' needs requires selection of representative farms, collection of accurate data, and proper analysis of the data. Selection of representative farms depends on the extent to which the elements within each group are defined as homogeneous and the representative sample size is chosen from the total population. Where case studies are used, the problem of representation may become acute, but this could be minimized by selecting a minimum number that is large enough to give credible results.

The types of data to be collected depend on the research objective, but opinions differ significantly on hypothesis setting and broad observation. It is perhaps advisable to adopt a midway approach and collect relevant information for overall description and analysis of farm problems. An information tool and survey program may be developed to guide in the information-gathering process. The information should be documented and all the views of observers involved should be considered.

When farmers' needs have been identified, research programs should be formulated according to priorities. Sometimes research projects with low priorities may have to wait. Research management should ensure that their research involves multidisciplinary groups as much as possible and that their programs address the broad spectrum of agriculture while ensuring that clientele needs are satisfied. It is very important that research designs relate to farm conditions and remain practical if farmers are to be expected to adopt them.

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THE EX ANTE EVALUATION OF AGRICULTURAL RESEARCH

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In an open group discussion, P. Bennell outlined some of the main considerations in the assessment of the probable outcomes of future agricultural research activities.

Most agricultural research organizations, even in relatively large countries, do not have comprehensive, formal ex ante evaluation procedures. In practice, most of this evaluation is informal, undertaken mainly by individual scientists with few guidelines from senior management. There is general aversion to utilizing quantitative data and techniques, with most reliance therefore placed on individual intuition.

P. Bennell argued that there is a need for greater rigor and objectivity in the ex ante evaluation of agricultural research, which is even more crucial in the small country context given the limited resources available and thus high opportunity costs.

In relation to strategic planning, figure 1 outlines the main questions and types of priority assessment that need to be addressed in comprehensive ex ante evaluations.

Congruence indices allocate the resources available for agricultural research activities according to the relative production values of each commodity (or group of commodities) covered by the mandate of the research organization. If there is a perfect congruence, all these estimates would lie along the congruence vector. The rationale for using congruence indices as a research investment criterion is based on the key assumption that the probabilities of success and the sizes of the productivity gains from agricultural research are equal across all commodities. If this assumption holds, then the payoffs from the research on a specific commodity will be directly proportionate to its relative value in overall production.

Relevance indicators can be developed in order to assess what possible future research is desirable. These normally include all or some of the following:

Importance of the commodity in aggregate terms

- value of production (national, regional);
- area harvested;
- agroecological suitability;
- trends in total production;
- yield trends.

Relevance to target producer and employment groups

- numbers directly and indirectly involved;
- nutritional factors (protein, calorie and contributions);
- on-farm consumption and monetary income;
- food security;
- regional balance.

Relevance to target consumer groups

- numbers;
- consumption (percent household budget);
- future consumption patterns (demand elasticities);
- nutritional factors (protein, calorie contributions).

Relevance to the nation's foreign exchange position

- current and potential export earnings;
- current and potential expenditures on imports.

Relevance to national food self-sufficiency

- current [illegible] ts;
- future growth in national consumption.

What research could be done? Productivity indicators

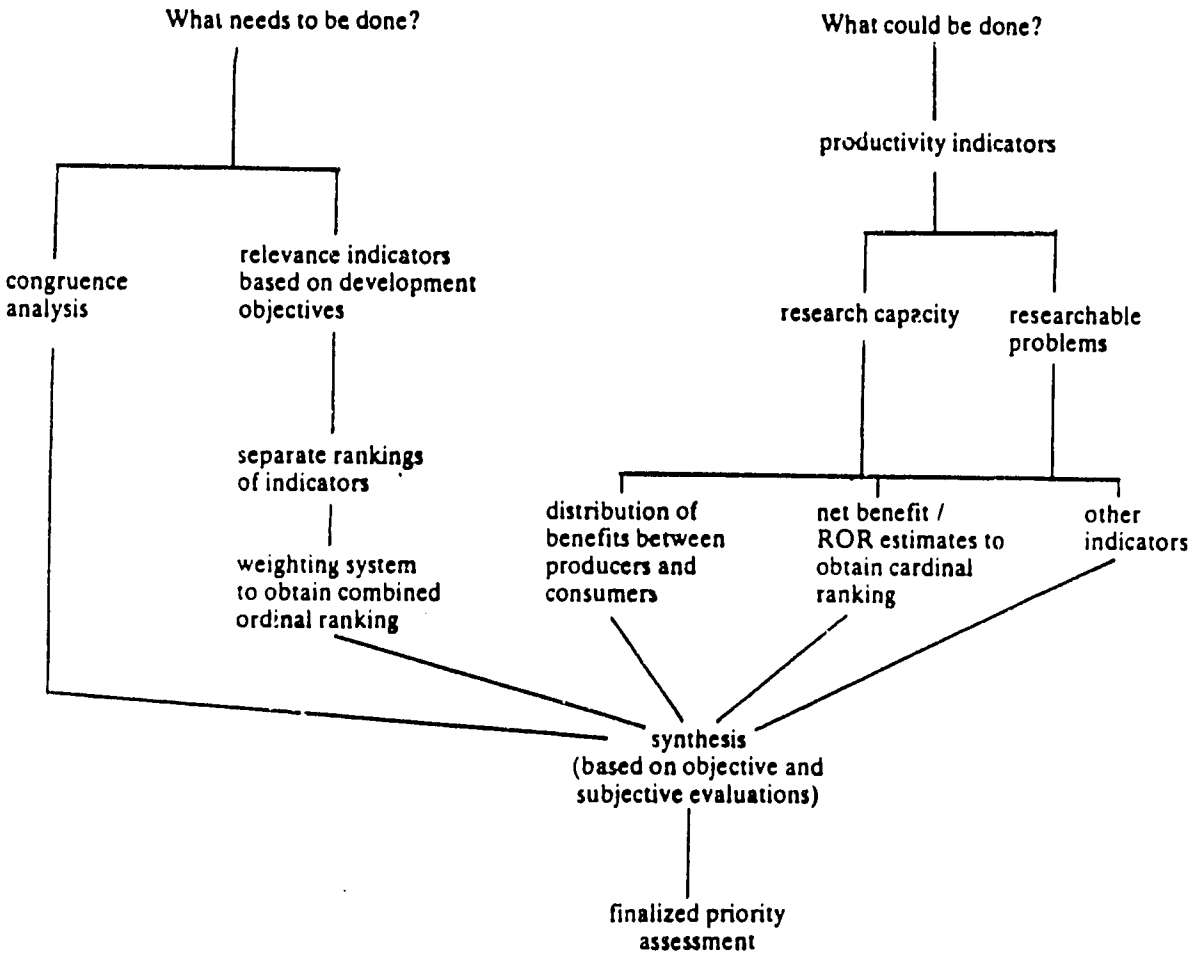

Figure 1: *Ex ante Evaluation for Strategic Planning*

can be subdivided into two types: institutional research capacities and researchable problems. Fairly sophisticated cost-benefit models have been developed which attempt to measure the probable net benefits to be desired from alternative agricultural research investments. The key factors which are typically included in these types of studies are

- impact on productivity (supply-side effects);
- probability of success of the research;
- expected rate of adoption of the research results;
- research costs;
- the discount rate;
- price distortions;
- supply-and-demand conditions of the commodity.

While the research manager in the small island context is unlikely ever to use such models, he should be aware of the concepts which underpin these models as this will help him to make better qualitative judgments about future research priorities and resource allocations.

CONSTRAINTS ANALYSIS: THE HAWAII INDUSTRY ANALYSIS PROGRAM

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Here in the Pacific, national agricultural research institutions are responsible for adapting and generating improved technologies needed for agricultural development. A regional research institution, the Institute for Research, Extension and Training in Agriculture (IRETA) of the University of the South Pacific is assisting in this effort.

In all these institution's resources are limited. Funding for staff, research facilities and operating costs is not adequate to support research on all the agricultural commodities grown by our farmers. Decision-makers in these institutions must, therefore, have a process for assessing their research needs and setting clear priorities for allocating these scarce resources. This process must be both effective and efficient in identifying relevant research which will lead to significant progress towards national development objectives in areas of agricultural development. Priority setting is also necessary for requesting donor contributions and effectively integrating donor-assisted projects into national or regional research plans.

One model developed to assist agricultural research resource allocation is the Hawaii Industry Analysis Program. In this model, commodity industries are analyzed, key constraints limiting their growth are identified and assigned priorities, and relevant research lending to appropriate solutions to high-priority constraints is identified. This Hawaii Industry Analysis Program has been developed primarily for agricultural commodity industries in which most of the product produced is processed and marketed. However, the process can be adapted to our needs of planning research relevant to subsistence farming and smaller scale marketing and processing.

The Hawaiian Industry Analysis Program

The Industry Analysis Program has been successfuly used for agricultural research planning by the state of Hawaii in the United States of America. This Industry Analysis Program assists planners and policy-makers to set priorities for the allocation of resources to solve identified agricultural problems. It does this by systematically assessing the present status and growth potential of an agricultural industry, the most significant problems of bottlenecks restraining its growth, the relative priorities of actions needed to overcome these bottlenecks, and the probability that each action will succeed. This Industry Analysis Program was developed for use by the Hawaii Governor's Agricultural Coordinating Committee (GACC) and, beginning in 1976, has been administered by the College of Tropical Agriculture and Human Resources (CTAHR) of the University of Hawaii. CTAHR carries out the analysis in collaboration with representatives from the industry, including farmers', and from appropriate state, county, and national government agencies (Marks and Lucas, 1983).

To date, analyses have been carried out on marketable commodities for which data are easily available and the producers and markets are known, including agroforestry, forests and natural resources, anthuriums, dendrobiums, ornamental potted plants, protea, bananas, guavas, macadamia nuts, papayas, passion fruits, pineapples, sugarcane, taro, leafy vegetables, solanaceous and cucurbit crops, beef and pasture, dairy, and swine (Mark and Lucas, 1983).

There are eight steps followed for each Industry Analysis Program:

(1) An industry spokesman requests CTAHR to carry out an industry analysis.
(2) CTAHR appoints a group leader.
(3) The group leader requested individuals with relevant expertise to assist with the analysis.
(4) This analysis group drafts the industry analysis and worksheet.
(5) An industry meeting is convened to produce the final draft of the industry analysis and an action sheet.
(6) The analysis group finalizes the analysis and action sheet and submits it to the industry for endorsement.
(7) The industry submits the analysis and action sheet to GACC.
(8) GACC uses the analysis and action sheet when allocating resources for agricultural research in department budgets.

Contributors to the Agricultural Planning Process

The Department of Agriculture (DOA) of the State of Hawaii has responsibility for leading agricultural planning for the state. In the past it has shared the administration of the agriculture planning process with GACC, although in the future DOA may assume full responsibility. In carrying out its responsibilities, the DOA is guided by the Hawaii State Agricultural Plan which was enacted in 1979 with the aim of increasing the viability of the sugarcane and pineapple industries and encouraging diversification of agriculture in the state, while at the same time working towards the broader public goals of a strong, viable economy, a desirable physical environment, and the physical, social and economic well-being of the state's residents.

The Governor's Agricultural Coodinating Committee (GACC) is responsible for preparing a state agricultural policy for submission to the governor, and it coordinates and reviews the preparation of departmental budgets related to agriculture for submission to the state legislature, which allocates funds. It then monitors the implementation of funded programs. GACC is made up of the Director of the State Department of Planning and Economic Development, chairpersons of the Board of Land and Natural Resources and Hawaii Homes Commission, the Dean of CTAHR, three farmers, one of whom represents a nonprofit farmers' association, and the GACC chairperson, who is an assistant from the governor's office.

The College of Tropical Agriculture and Human Resources (CTAHR) is one college in the University of Hawaii, a state institution. It is the major agricultural research institution in Hawaii and also has education and extension functions. CTAHR administers the Industry Analysis Program.

Industry refers to an agricultural commodity industry considering all its components of production, distribution, processing, marketing, and consumption. The banana industry, taro industry, poultry and egg industry, and coffee industry are examples.

The Industry Analysis Process

To initiate an analysis, the industry indicates to CTAHR that they desire to have an analysis carried out. CTAHR then appoints a group leader for the analysis, usually a senior staff member in CTAHR having expertise for the commodity being analyzed. This group leader asks individual representatives with relevant expertise to contribute to the industry analysis. This analysis group is comprised of about 20 to 40 individuals including farmers, other industry members, staff members from CTAHR, and other state, local, and national government agencies.

Worksheet

Under the direction of the group leader, this analysis group prepares a draft of the industry worksheet. This draft is prepared as a discussion paper and includes a narrative about (1) the industry's current status, (2) its potential based on stated assumptions, and (3) all components of the industry.

To complete the worksheet, the industry must be broken down into its components. All components of the system must be considered, including production, distribution, marketing, processing, and consumption. For example, 13 components of the banana industry were identified: (1) land and water, (2) labor, (3) capital, (4) cultivars, (5) insect control, (6) disease control, (7) weed control, (8) culture and management, (9) post-harvest handling, (10) transportation, (11) marketing, (12) cost of production, profitability, and (13) industry organization. Similarly, the swine industry was broken down into 11 components: (1) land, (2) labor for production, (3) credit and finance, (4) breeding stock availability and breeding systems, (5) herd health, (6) feeding practices and management, (7) waste management, (8) slaughterhouse, (9) marketing and merchandising, (10) business management through computer programs, and (11) public policies, rules, and regulations affecting the industry (CTAHR, 1984).

The narrative discussion about each industry component is followed by a table in which spaces are allocated for

(1) priority, (2) bottlenecks, (3) action required, (4) agency responsible, (5) possibility of success, (6) duration, (7) resources (required, allocated, and supplement required), and (8) impact if the bottleneck is (or is not) eliminated. Some, but not all, spaces can be filled in at this stage (see table 1 for example of banana action plan for the first three priority areas identified).

Industry meeting

After the analysis and worksheet have been drafted by the analysis group, CTAHR invites all known members of the industry to a day-long meeting with members of the analysis group. Members of the industry invited include farmers, cooperative and association members, members of relevant government agencies, processors, etc.

The specific aims of this industry meeting are (1) to reach a consensus on the industry's potential and the bottlenecks which prevent it from achieving its potential, (2) to rank each bottleneck in terms of priority, with 1 as the highest priority, (3) to revise the worksheet based on new information from meeting members on the significance or definition of industry components, bottlenecks, and action required to remove bottlenecks, and finally (4) to produce final drafts of the industry analysis and action sheet which reflect the industry's point of view.

To rank bottlenecks in terms of priority, members of the industry at the meeting cluster the bottlenecks into three categories of high, medium, and low priority, then cluster them the same way within each of these, and vote on the relative priority ranking of each bottleneck.

In some instances, the action required to relieve a bottleneck may be obvious and research is not needed. However, in many instances, before specific actions can be recommended, research must be carried out to identify solutions which directly affect the bottleneck. In these latter cases, the action required is stated in a general way.

Analysis and Action Sheet

Using the priority ratings and additional information generated during the industry meeting, the analysis group prepares two documents: (1) the final industry analysis and (2) the action sheet. The analysis is a narrative report which includes a concise preface explaining the purpose of the industry analysis and the fact that it was jointly prepared by industry, government, and CTAHR but represents the industry's point of view; how the analysis is structured; and all individuals in the analysis group who contributed to the analysis.

The next selection is an assessment of the current status and potential of the industry, supported by relevant data. This is followed by the main thrust of the report which is the analysis of each component of the industry. This analysis begins with a discussion of what is known about that component, supported by relevant data and detail. Then the identified bottlenecks are described. For example, in the banana analysis, for the component *insect control*, four bottlenecks are listed:

(1) Uninfested green Hawaiian bananas are denied entry to US mainland by out-dated regulations;
(2) Lack of new chemicals to control insect pests (borers and thrips);
(3) Lack of proven method for disinfesting root borer in banana corms;
(4) Lack of coordinated effort to prevent new banana pests from entering Hawaii.

The description of each bottleneck is followed by the priority rating and succinct statements about (1) the impact on the industry if this bottleneck is (or is not) removed, (2) the actions required to remove it, and (3) which agency(ies) is/are responsible for removing it. For example in the banana analysis, the bottleneck, 'Lack of proven method for disinfesting root borers in corms,' has been assigned priority 13. The impact to the industry if this bottleneck is not eliminated is: 'Current treatment required by quarantine regulations is based on nematode control and is unproven for root borers. Pest can spread more easily if new method is not found.' The action required to eliminate this bottleneck is to 'develop a technique to disinfest root borers from banana corms' and CTAHR is the agency responsible for eliminating this bottleneck (CTAHR, 1983). The analysis concludes with a flow chart and summary sheet.

The action sheet is presented in the same format as the worksheet except that bottlenecks are now listed in order of priority rather than by industry component and most or all of the spaces are filled (appendix 4).

Using Analysis for Research Planning and Resource Allocation

After the industry analysis report and action sheet have been completed, they are reviewed by industry spokesmen. If these spokesmen are satisfied that the views of the industry are accurately represented, they endorse the analysis report and action sheet and submit them to GACC. GACC reviews the analysis, requests revisions if necessary, then agrees to take certain actions in support of the industry. Since funds are limited, GACC can usually budget resources to support actions affecting only high-priority bottlenecks.

Table 1 : BANANA ACTION PLAN

Priority	Bottleneck	Action Required	Agency Responsible	Possibility	Duration	Required	Allocated	Supplement Source	Impact if bottleneck not eliminated
1	Lack of sufficient land on Oahu, Maui, and Kauai for banana production.	1) Provide 200 additional acres in Waimanalo Agricultural Park for banana production.	DLNR*	Fair	Waimanalo (II - V) to 1987	$8,978,000	$1,320,000	$7,158,000	If sufficient land for banana production is not made available, the industry will not have the opportunity to make Hawaii self-sufficient. (The Statewide Agricultural Park Action Plan, Phase II, will recommend sites for future agricultural park development.) The possibility of increasing production from low-yielding orchards is not good because many are on very poor lands.
			DOA*	Fair	Kahuku to 1985	$3,500,000	$3,500,000	--	
		2) Develop agricultural parks on Kauai for banana production. Investigate the leasing of private lands on Kauai for banana production.	DLNR	Fair	-	--	--	--	
			DOA	Unknown					
			County of Kauai	Fair	--	--	--	--	
			Industry						
		3) Make available State lands with long-term leases (20 years or more) at reasonable cost.	DLNR	Fair	--	--	--	--	

* DLNR = Department of Land and Natural Resources, State of Hawaii
DOA = Department of Agriculture, State of Hawaii

Table 1 : BANANA ACTION PLAN cont

Priority	Bottleneck	Action Required	Agency Responsible	Possibility (continued)	Duration	Required	Allocated	Supplement Source	Impact if bottleneck not eliminated
2	Lack of new chemicals to control insect pests (borers and thrips).	1) Survey of insect problem.	CTAHR	Good	3 years	$15,000/ year for 1/2 APT, supplies	0	$15,000/ year from GACC	Insects will be difficult to control and will cause damage in more banana areas.
		2) Study efficacy of insecticides.	CTAHR	Good	3 years	(Adequately covered in above)			
		3) Obtain insecticide	CTAHR	Good	3 years	(Adequately covered in above)			
3	Inadequate barge service from Kauai to Honolulu and Big Island to Honolulu.	1) Improve inter-island barge service to assure at least two Shipments per week, preferably Tuesdays and Thursdays.	Young Brothers	Fair to Good	--	--	--	--	If the inter-island barge service is cut back, farmers on the Big Island and Kauai will have difficulty in sending their products to Honolulu.
			DOT* & PUC*	Uncertain	--	--	--	--	
		2) Protect bananas from damage due overheating.	Young Brothers	Fair to Good	--	--	--	--	

* DOT = Department of Transportation, State of Hawaii
PUC = Public Utilities Commission

The industry analysis can also be used by CTAHR to plan research and seek funding from external donors.

Strength of the Industry Analysis Program

Mark and Lucas (1983) have pointed out a number of strengths of the Hawaii Industry Analysis Program:

(1) The program facilitates farmer-industry-researcher-government linkages and takes into consideration opinions of farmers and industry. It helps therefore, to avoid policies and technological solutions which are inappropriate from the point of view of farmers and industry because they are unprofitable, too risky, or in other ways not suitable.

(2) It facilitates coordination between a number of agencies and institutions which have responsibilities for agriculture in the state.

(3) It facilitates identification of bottlenecks, needs, and priorities in a given industry.

(4) It also helps to identify resource bottlenecks which constrain more than one industry.

(5) The attention of planners, researchers, and officials is directed to relevant planning variables such as industry potential, production factors, production technology, prices, marketing, distribution, etc.

(6) The analysis encourages identification and collection of relevant data, both for the industry analysis itself and for other development planning uses.

Limitations of the Industry Analysis Program

In contrast to these strengths, a number of limitations of the Hawaiian Industry Analysis Program have been enumerated by Mark and Lucas (1983):

(1) Objectives stated in the Agriculture Plan are not specific enough for planning, nor are they expressed in terms which make it possible to establish benchmark data and measure progress.

(2) The program does not provide a formal mechanism for setting priorities among industries. For example, it does not provide a means for deciding whether a bottleneck rated priority 6 in the banana industry should be supported with funding rather than a bottleneck rated priority 8 in the passion fruit industry.

(3) The program sets priorities based on goals of the agricultural sector but not necessarily on the overall development objectives of the state.

(4) The larger public interest, including environmental, economic, and social effects on the nonagricultural residents, is not always represented in the analysis process.

(5) The diversity of farm size, location, access to capital, education, ethnic background, etc. may not be represented during the analysis and this may affect the distribution of benefits within the society.

(6) In the analyses, bottlenecks related to consumption, marketing, export potential, distribution, transportation, extension, and infrastructure are not treated as comprehensively as biological and techical bottlenecks related to production, harvesting, and processing.

(7) Analyses are carried out only in organized commodity industries which are already in commercial production but not new, unexploited commodities.

(8) The program has an informal status within CTAHR. Participation in the analysis group is voluntary and funding is not specially budgeted for carrying out the analysis. As a consequence, any one industry many take a year or more to analyze, thus limiting the number of industries which can be done.

(9) The exact manner in which industry analyses guide decision-making about resource allocation is not systematic.

Improving the Industry Analysis Program

Given the strengths and limitations discussed above, Mark and Lucas (1983) proposed the following modifications to the Industry Analysis Program:

(1) Establish specific objectives for the agricultural sector which are consistent with the state development objectives, including

(a) to identify and promote commodities which can successfully compete with imports in the Hawaii market;
(b) to obtain more state income from export sales of agricultural commodities;
(c) to increase farm income and employment, with emphasis on supporting smallholder farmers;

(d) to seek increases in the growth rate of income derived from diversified agriculture;
(e) to increase state income and employment from agricultural processing and supply industries and agribusiness with emphasis on new activities, small businesses, and exporters.

(2) Establish criteria for evaluating expected benefits of alternate research proposals which are consistent with socioeconomic and resource conditions of Hawaii, including

a) increased exports to overcome inelastic demand condition of local market;
b) increased farm income;
c) increased primary and secondary employment;
d) increased local sales including import substitution;
e) increased labor productivity by adopting labor-saving technologies which frequently result in increased production, which will offset the bias against labor and result in net employment increase.

(3) Modify priority-setting process to take into account evaluation criteria in (2) above.

(4) Augment the industry perspective by including group's in the analysis process which have been unrepresented in the past, including consumer and environmental groups.

(5) In terms of organization, the Industry Analysis Program should be given formal rather than informal status and be allocated the necessary budget, personnel, and funds. Personnel of CTAHR and other state agencies should have formal time commitments and responsibilities for participating in the Industry Analysis Program.

(6) Nonquantitative or small-scale quantitative planning models should gradually be developed to assist in the analytical process.

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RESEARCH PLANNING: PROGRAM AND BUDGET FORMULATION

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The main purpose of program and budget formulation is to set out the immediate tasks to be done and translate these into resource needs, based mainly on current staff and facilities. The current program of work and budget conforms to the direction and priorities of the strategic and operational plans.

Annual calendar. For an agricultural research organization, the preparation of the program of work and budget is usually coupled to an annual cycle of crops. It is part of an annual review process that is best timed to begin on a date that allows time for the results of last season's research to be analyzed. In environments where there is a single crop season, this is not usually difficult to arrange. Where there are two or more crop seasons each year and therefore less time between seasons, there tends to be a conflict between the needs of the review and the planning process so that the date has to be chosen carefully. Where time is short it is important to ensure that planning does not suffer. It is better to limit reporting to significant findings (whether they be positive or negative) that have a bearing on next season's plans than to allow inadequate time for plans to be prepared. To the extent that the review process, like the planning process, is an ongoing activity, it can be continued during the preparation of the annual reports of research. During the review and planning process as we shall see, the documents generated by the previous season's program and budget process are an important reference.

To the extent that the immediate program is determined by work in progress, the changes associated with the preparation of an annual budget tend to be confined to changes at the margin.

Program preparation is a responsibility mainly of the scientists and it is a continuation of the process of interaction among scientists of different disciplines that takes place as part of the preparation of longer term operational plans. The research activities proposed are defined with increasing specificity of objective, in time-bound projects that match approximately the capacity and the capability determined by the human, physical, and financial resources that are expected to be available. The scientist's role is to identify the needs and the most promising opportunities for research to progress towards the main objectives and goals laid down in the strategic and operational plans.

The first step is descriptive and aims to provide the following information for each element in the research proposals: a clear statement of the objective, evidence that constraints have been correctly identified, its relation to previous work and current knowledge on the topic; relation to other current research (the programs or projects to which it contributes), capacity to do the work and any special resources needed, the probability of success, and the proposed timetable for monitoring progress.

A simple form that contains space for the following is useful: a brief statement of the goal (which when attained would indicate completion of the project), a statement of intermediate objectives that serve as milestones towards attaining the goal, a list of the tasks to be completed in the coming season, and finally a note of any special equipment or facilities needed that are not currently available.

The logical framework analysis is an even more complete and rigorous tool for this task. It shows the relation between the work proposed and broader objectives. It also shows how the success expected can be measured and what conditions are necessary for success. These features introduce an important element for accountability and greatly facilitate subsequent monitoring and evaluation.

The individual proposals are assembled, and with summaries of related work completed previously, they form the basic documentation for the formulation of the program for the coming season. At this stage they would probably be reviewed by an internal program committee consisting of senior scientists and management. Proposals for work of low priority might be dropped at this point.

Budget preparation. The next step is to prepare projections of the resources needed for each element and individual component of the research program proposed for the next budget period. There are three main parts to this task:

- estimate the staff time (professional and support) needed to complete the work, with fractions of time where the effort of individuals is divided between projects;
- list operational needs, in terms of travel, supplies, labor, and any other category that is involved:
- list the additional equipment needed.

The preparation of the budget is then, in the simplest terms, the result of assigning a monetary value to each of these resource needs and aggregating them.

The form in which this is done will depend on the structure and organization of the research. Some research organizations will consist of several separate, and maybe autonomous, institutes; in others there may be only a single institute, and some will be departments of a government ministry. The research may be organized by structural units (e.g., commodity programs, or groups of staff with the same scientific discipline) or according to projects with a finite life, designed to tackle a particular topic or problem. Or it may be a combination, with the members of structural units contributing to time-bound projects. The latter has the advantage that as research progresses and plans are updated to reflect changes in priorities, funding, staff, and new knowledge, it is easier to redirect resources to new and higher priority work. The main divisions in the budget will usually correspond with the way the research is organized.

A computerized system. Separate documentation will be available at the workshop on a current project being conducted by ISNAR to illustrate how the process can be put onto a computer. The account contains details of the components of the system, its current limitations, and what will be expected of a fully serviceable system.

A computerized program and budget system is a project-based management tool that will

- help to keep track of the division of resources between fixed and operating expenditures;
- make for more efficient management of resources;
- provide information on how staff time is used;
- show how resources are allocated between projects;
- help monitor progress.

Summary. The result of this process, if it is conducted in the context of the earlier stages of strategic and operational planning, will be a well-defined program with documentation for its justification, design, and cost. It should also contain clear proposals for adjusting the scope of the work in the event of additional resources being available and for contracting it in the event of a reduction in resources.

Planning Research Exercise 1:

Formulation of the GOAL statement for an organization:

(a) What essential pieces of information do we want to convey in the GOAL statement?

(b) Try to formulate in less than 100 words (10 lines) a statement that describes the GOAL of your organization.

Planning Research: Exercise 2

1. The GOAL statement makes the overall purpose clear.
   In this next step the overall purpose is partitioned into main OBJECTIVES, or in other words the main areas of business the organization intends to be in.

   (a) What are the main areas of business of your organization?

   (b) Are there other areas of business you think it should be in?

2. To formulate the operational goals, each main OBJECTIVE has to be divided into a number of

APPROACHES. This is a further diversion of the overall GOAL and of the main areas of business (main OBJECTIVES) into more detailed operational goals.

Planning Research: Exercise 3

Further division of GOAL and OBJECTIVES:

To formulate the operational goals, each main OBJECTIVE has to be divided into a number of APPROACHES. This is a further division of the overall GOAL and the main areas of business (main OBJECTIVES) into more detailed operational goals.

Formulate operational goals for one of the main OBJECTIVES you listed for your organization in exercise 2.

MOTIVATION

John Marjoribanks
Commonwealth Development Corporation

J. Marjoribanks structured his presentation around an exercize entitled 'Developing your own concept of motivation.'

1. What makes me work hard?

   Reflect on your own job over the past few months. Pick out one activity that you remember putting a lot of effort into. Now think deeply about how you felt at that time. Can you remember what the things were that made you put a lot of effort into that activity? List as many as you can in the space below. Then try to put them in order of importance.

2. What makes me feel like not working?

   Again, please reflect on your job over the past few months. This time pick out an activity that you remember putting as little effort as possible into. Now think about how you felt at that time. Can you remember what the things were that made you feel like putting as little effort as possible into that activity? List as many as you can in the space below. Then try to put them in order of importance.

3. How can I get my subordinates to work hard?

   Once again, reflect on your job over the past few months. This time pick out an occasion on which you wanted to get a special effort put into an activity by one or more of your subordinates. (For those of you who do not have a direct relationship with any subordinates, think of an attempt to get a special effort from somebody outside your work organization, for example a family member, a farmer or other client.) What actions did you take to try to get your subordinate(s) to put special effort into the activity? List as many as you can in the space below. Then try to put them in order to effectiveness.

4. Your concept of motivation

   You have now looked back at three particular incidents and developed lists of factors which reflect your approaches to motivation in those cases. Are there any other ideas that you have about motivation that you would like to add to the lists you have already drawn up in order to express, in general terms, your own concept of motivation?

5. Research-based motivation theories

   Now that you have developed some of your own ideas on motivation, let us take a brief look at some of the motivation theories that have been developed by organizational psychologists over the past few decades.

   Marjoribanks briefly reviewed the following well-known theories of motivation: Maslow's hierarchy of needs, Herzberg's two-factor theory; McClelland's theory of need achievement; equity theory; and expectancy theory.

6. Group project

   Using your individual theory of motivation as a starting point, and incorporating those ideas from the organizational psychologists that you think may be useful, join the rest of your group in discussion with the objective of developing an overall concept of motivation which you think will be of practical use to the members of the group in their jobs as managers.

   Each group should be prepared to present its concept of motivation to the rest of the course and defend it in discussion. You may find some of the following questions helpful in stimulating discussion.

1. What are the influences most likely to make you yourselves work hard at any particular time?

2. What are the influences most likely to make you minimize the effort you put into your work at any particular time?

3. Do these same influencing factors affect the way your subordinates work?

4. Do you think any of the ideas put forward by the organizational psychologists are likely to be useful to you in motivating your subordinates? If you do, say which ones and why you think so.

5. Can you combine the group members' views on influencing factors and any of the theories described to come up with a brief statement that summarizes the members' views on motivation?

COMMUNICATING WITH EXTENSION PERSONNEL AND FARMERS IN THE SOUTH PACIFIC

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Introduction

The predominant model for technology development and dissemination in use in the South Pacific is one where an entity, through the work of research scientists either at research stations or institutions, undertakes research and development activity on problems and needs from whence arise knowledge, skills, and technologies. These are then passed on through different communication channels to diffusers of information — generally extension workers — whose role is to pass these on to the ultimate users — the farmers. This paper addresses the communication of outputs of agricultural research activity from the perspective of this model. For purposes of this paper, the assumption has been made that appropriate information and technologies already exist but that communicating these to extension workers and farmers is the main concern.

Who are the researcher's audience?

The first question in communicating research findings is one of deciding on the target audience. According to Mosher's (1982) list of critical requirements for productive agricultural research, researchers should report research results in ways and means that can be understood and used by four categories of people. These include

- Policy-makers
- Research workers
- Extension workers
- Farmers

How do researchers of the South Pacific fare in this regard?

Although beyond the scope of this paper, the need to communicate with policy-makers, including politicians, is an area quite lacking in current research communications. As to the other three audiences, it is safe to say that it is other researchers that scientists are most concerned with, less with extension workers and least with farmers. Or, as Kern and Jones (1984: p 7) point out: 'Persons doing research are usually most interested in reporting to other researchers; they prepare a technical report and feel that they have met their responsibility.'

There is great importance in the proper definition of audiences in the communication process, for many people have interest in what scientists do, but for their own ways. Different people are interested in different things. There is a need therefore to ensure that the information needs of these different audiences are met.

This is attempt to summarize what these different needs are, given the different audiences. The purposes and the channels for the communication between researchers and their respective audiences are detailed in the table annexed as table 1.

Why should researchers communicate with extension workers and farmers?

Aside from the more obvious reasons relating to the creation of awareness and the sharing of information regarding new or improved technology, researchers in the South Pacific are obliged to do so given the limited number & trained communications personnel available in most countries who can take researcher-oriented reports and repackage these to suit extension and farmer audiences. This luxury, generally found in more developed countries, is unavailable to most island nations. Given this situation, it is imperative that researchers be involved in the process of communication with extension and farmers. Failure to do so leaves too

Table 1:

Components for Research Communications with Various Audiences

Audiences	Communication Channels	Reasons for Communications	Opportunities for Communications
Policy-Makers	1. Summary reports 2. Annual reports	1. Create awareness 2. Aid in decision-making 3. Solicit support	1. Informal occasion 2. Organized tours 3. Field days
Researchers	1. National research reports 2. Research journals 3. Annual reports	1. Peer acceptance 2. Share findings 3. Solicit support 4. Seek promotion	1. Publications 2. Meetings, seminars, etc. 3. Committees 4. Research collaboration 5. Personal communication 6. Professional associations
Extensionists	1. National research reports 2. Report for diffusers 3. Popular reports	1. Create awareness 2. Share findings 3. Teach skills 4. Solicit support	1. Training efforts 2. Meetings, seminars, etc. 3. Field days 4. Organized tours 5. Demonstrations 6. Committees 7. Research collaboration 8. Publications 9. Liaison Officer 10. Displays 11. Personal communication
Farmers	1. Popular reports	1. Stimulate interest and create awareness of improved technology 2. Learn farmer technology 3. Solicit support	1. Training efforts 2. Meetings 3. Field days 4. Organized tours 5. Demonstrations 6. Committees 7. Research collaboration 8. Displays 9. Personal communication

much to chance and in my view is bound to lead to wasted effort and resources spent on research.

What channels are there for communication?

Kern and Jones (1984) have identified four main types of communications output used by small national agricultural research systems in the South Pacific for reporting research findings. These include

- *Research Reports:* Typically technical annual reports used with various audiences; they often provide something to give in exchange for reports from other sources of research.
- *National Research Reports:* A technical periodical in which research is reported and technological topics are treated.
- *Reports for the Diffusers of Information:* Which include the extension service, educators, input suppliers, development banks, etc.
- *Popular Reports:* Some are produced within the research system but more typically by writers or broadcasters from the agricultural ministry or government information ministry.

Of these four channels, the research-type reports were found to hold the most allure for people in research, followed closely by the research report format. The main drawback of both these formats is the all-too-frequent situation that such reports become the only means for communicating with the various audience types identified previously. Where this is so, the impact will be most doubtful. Furthermore, both reporting formats are often subject to production problems, both human and technological, the consequence usually being long delays between production periods. This brings its own set of problems. Where the reporting is done via international journals, the likelihood of extension staff becoming aware of their existence and the question of whether they can understand them is rather remote. The same might also be said of many indigenous researchers. Unless these reports are repackaged by the researchers themselves or by someone competent in this area, there is little or no transmission of this information to thew extension workers and farmers of that country or the South Pacific region in general. The role of regional institutions like the University of the South Pacific in such 'repackaging' efforts is slowly becoming better known and refined with still much scope for improvement.

In regards to reports for the diffusers of information, the authors point out that it is only in a few instances that researchers attempt to produce such reports. Those that have emerged come more from the initiative of individual researchers than from a rational decision about the need for such information. Popular reports also tend to suffer similar problems. In the main, such reports are the prerogative of information staff, who are generally insufficiently trained and supported in their work. In addition, the formats used (either radio or newspapers) are often inaccessible to many, while the language used is often not the reading or listening language of farmers. The all-too-frequent use of very technical content and language in such reports reduces their likely impact on their intended audiences.

What opportunities exist for communication?

The existence of weak linkages between research, extension, and farmers is closely related to communication gaps between these three entities. This has been proven by studies reported by Beal and Kern (1987). Recommendations for overcoming these include a wide range of approaches and opportunities that may or may not be currently available or practiced in all South Pacific countries. Since it is beyond the scope of this paper to deal with each one in detail, it must suffice to note that there exists a range of possibilities available. These might include any of the following:

A. Administrative Opportunities

1. Developing appropriate policy guidelines;
2. Merging research and extension;
3. Mixed participation in commodity groups;
4. Joint planning meetings;
5. Committee meetings;
6. Use of liaison officers;
7. Use of district committees;
8. Development and use of councils.

B. Research Opportunities

1. Collaborative field work;
2. Collaborative on-farm trials;
3. Field days;
4. Demonstrations.

C. Extension Opportunities

1. Extension and farmer training workshops;
2. Field days;
3. Joint field tours;

4. Use of the training and visit system;
5. Mass media activities;
6. Publications such as newsletters, fact sheets, manuals, etc. produced jointly by extensionists and researchers;
7. Joint involvement in campaigns;
8. Informal social activities such as social or staff clubs.

Conclusions

There are weaknesses in the patterns of communication currently operating between research, extension, and farmer entities in the South Pacific. Opportunities for improving on this situation exist but will require systematic analysis of several important questions. These relate to audience type, communications content, and communication channels. The need to ensure fullest understanding and skills in how to utilize opportunities available is likewise a necessity. Final suggestions include

1. The need for proper training of researchers and extensionists alike, in aspects of communications such as

   a. Audience analysis,
   b. Writing skills for specific audience;
   c. Interpersonal skills;
   d. Group skills;
   e. Teaching skills;
   f. Use of communication methods;
   g. Communication planning.

2. Need for adequate attention to personnel planning and development to enable professional and more competent support via information services.

3. Need to ensure adequate financial support to enable the fullest use of communications opportunities.

References

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ACTION PLANNING

1. Introduction

Many of the activities in this workshop have been designed to help you to think about the way in which you work as a manager of agricultural research. Thinking about the way you perform your job is the first stage in the process of personal change which is involved in developing your management style towards the most effective level you can achieve.

2. Practical Use of Learning

But change of managerial behavior does not come about merely by thinking about your job. It is necessary to take the process further through the following stages:

(a) Think about the main problems you face as a manager;

(b) Analyze your ability to deal with these problems;

(c) Pick out skills, techniques, or attitudes to which you have been exposed during this workshop which might help you to enhance your problem-solving ability;

(d) Develop *action plans* to bring these new ideas into practice when you get back to your job;

(e) Set yourself targets for implementing your action on plans;

(f) Identify the means by which you can evaluate personally the degree to which you put your action plans into effect.

3. Problem Identification

Before lunchtime on Thursday identify the one or two problems which cause you the greatest concern in your job as a manager. Write a description of the problem in as much detail as you think useful.

4. Thinking through Problems

During the last session on Thursday share your problems with the other members of your group and seek their assistance in exploring new ways of looking at the problem in order to help you identify for yourself the most suitable problem-solving strategies.

5. Helping Others

When you are assisting your fellow group members to look at their problems, try not to provide answers:

'If I were you, I would...'

Rather try, by asking relevant questions, to stimulate the 'owner' of the problem to examine his situation from an angle he may not have thought of before:

'What do *you* think would happen if you ...'

6. Action Planning

After Thursday's session, use the evening to draw up an action plan for yourself, as follows:

(a) A brief statement of the problem with reasons why it is so important;

(b) New strategies which you propose to follow after the course to solve the problem;

(c) Implementation plan for putting new strategies into effect — things to do, people to contact, behavioral changes needed, etc;

(d) Timetable for implementation;

(e) Condition which you aim to achieve by the end of plan implementation;

(f) Measures of achievement of plan objectives.

7. Refining the Action Plan

In the first session on Friday, share your action plan with the rest of your group and help each other to improve the plans if possible.

8. Summary

(a) The purpose of any workshop on management is to share knowledge, experience, skills, and altitudes which may assist you actually to do your job better.

(b) The workshop only achieves its goal if your behavior as a manager is actually changed by the experience.

(c) The action plan is a means by which you can bring the parts of the workshop which have been relevant to you to bear on the real-life problems you face as a manager.

(d) In addition it provides concrete targets for you to strive for in applying the workshop learning to your job.