PN-ABJ-657
72620

isnar inform
Information for Agricultural Research Managers

An Overview of INFORM, an Information Management System

Barry Nestel

1 Guidelines

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, the 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 nonprofit autonomous agency, international in character, and nonpolitical in management, staffing, and operations.

Of the 13 centers in the CGIAR network, ISNAR is the only one that focuses primarily on national agricultural research issues. It provides advice to governments, upon request, on research policy, organization, and management issues, thus complementing the activities of other assistance agencies.

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

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

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International Service for National Agricultural Service
with the support of the Asian Development Bank

1 Guidelines March 1991

Citation:

Nestel, B. 1991. An Overview of INFORM, an Information Management System. INFORM Guidelines, Part 1. The Hague: ISNAR.

AGROVOC Descriptors

information systems; management; organization of research; scientists; research projects; resource allocation

CABI Descriptors

agricultural research; management; information systems; organization of research; planning

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Preface

Lack of good information can be a major impediment to effective management of research. Managers need to know exactly what experiments their scientists are doing, with which facilities and at what cost. Without this information, managers cannot perform, or improve, essential functions such as planning, programming, monitoring and evaluation.

- Effective agricultural research policy cannot be set without good information on which to base decisions.

- Sound agricultural research management is impossible without good information on which to base programs.

To help national agricultural research systems (NARS) address their needs for better information and to improve information use for planning and policy setting, ISNAR has developed a management information system called INFORM — *INFO*rmation for agricultural *R*esearch *M*anagers.

INFORM is described in a series of guidelines, which are supported by a set of training manuals. This volume, Part 1 of the guidelines, provides an introduction to INFORM. It is followed by a volume on INFORM methodology (Part 2) and two reference guidelines — Part 3, revenue and cost codes, and Part 4, a minithesaurus of keywords.

Training materials include a brief guide to the computer software (Reflex) used to develop INFORM and several practical exercises for developing skills with INFORM.

This volume shows how INFORM can help improve decision making through better use of information that is usually readily available within NARS.

Examples given in Part 1 are based on actual data from ISNAR research. Many of the figures and tables relate to the program budgeting component of INFORM but examples are also provided to show how INFORM can be used for management of personnel and research facilities and for priority setting.

Acknowledgements

ISNAR acknowledges the support of the Asian Development Bank for funding this study, including workshops in South and Southeast Asia, and the development and testing of the INFORM guidelines.

Much of the field work associated with the collection of data from which the methodology was subsequently developed was carried out in Sri Lanka. This would not have been possible without the support of the Sri Lankan Council for Agricultural Research (CARP), particularly Dr. D. T. Wettasinghe, its Executive Secretary, and the directors of the research institutes associated with the Council, whose assistance is particularly appreciated. Much of the source data collection was carried out by Mr. J. A. P. T. Gunawardena of the Planning Cell of the Department of Agriculture, whose assistance is especially appreciated, as is that of Mrs. A. Basnayake of CARP who helped field-test the methodology.

The cooperation of India's National Academy for Agricultural Research Management (NAARM), the Southeast Asian Ministers of Education Organization Regional Center for Graduate Study and Research in Agriculture (SEARCA), and the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) in planning and running two workshops in the second half of 1990, at which earlier drafts of this document were discussed extensively, is gratefully acknowledged. Feedback from workshop participants was obtained through a structured review process, focusing on the substance, presentation, and applicability of the material. Revised drafts were produced after each of the workshops, and the documents in their present form have benefited considerably from participants' comments and suggestions.

Many colleagues at ISNAR and from national agricultural research organizations contributed ideas and suggestions throughout the development of this volume. The assistance at ISNAR of Byron Mook and Govert Gijsbers is especially acknowledged.

1. The Need for Management Information

It is common to find national agricultural research programs that are out of balance with national priorities. For example, although groundnuts may be given a high priority at the national policy level, the resources devoted to groundnuts at the research station level may rank well below those for other crops. Worse yet, research managers may not even be able to tell national policymakers what resources are devoted to a particular crop at the station level.

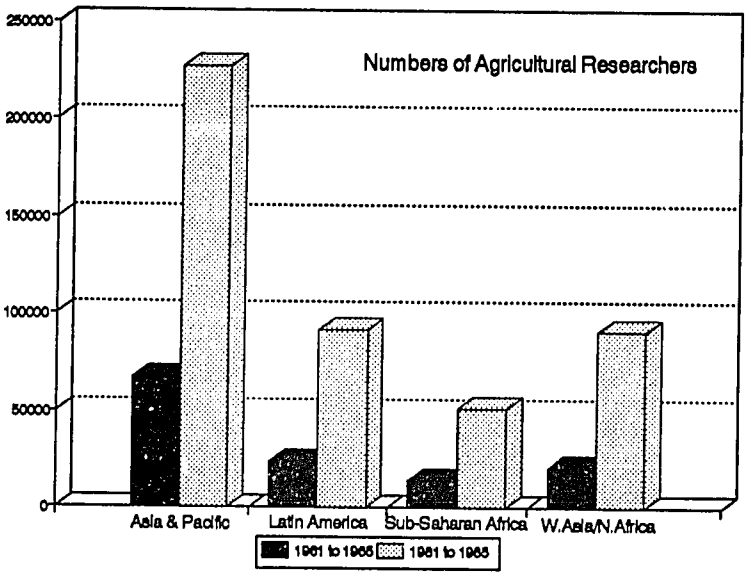
Such shortcomings are usually traced to a lack of good information upon which to base decisions on planning, programming and priority setting within the national agricultural research system (NARS). That lack of information can, in turn, be attributed to a NARS that has grown so fast it has not been able to cope with the needs for information.

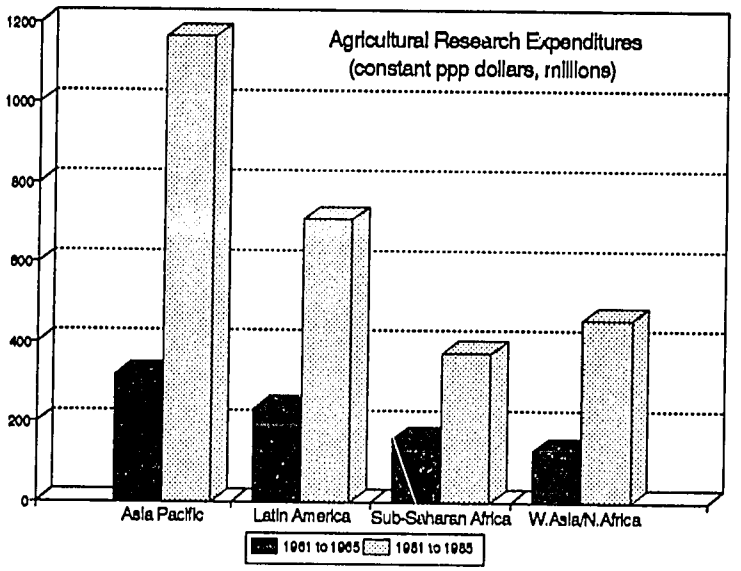
The rapid expansion of a NARS is reflected in an increase in the number of agricultural researchers working in developing countries. They more than tripled between 1961-65 and 1981-85 (Fig. 1.1). Global spending on agricultural research increased at a rate similar to the growth in researcher numbers, although there is evidence that it leveled off in the mid 1980s. By 1990 the global annual cost of agricultural research in developing countries was about US$3 billion.

1.1 Modernizing Management to Cope with Growth

The burgeoning NARS face equally expanding problems with management. Larger-sized research staff in turn generate larger research programs. Managers at all levels within the NARS have found that their budget requirements tend to increase faster than the resources available.

The NARS, as public-sector organizations, also face increasing demands to justify how they use their resources. Such justification is difficult for most NARS because they are part of a traditional budgetary system aimed at financial control rather than indicating what the funding is expected to achieve. In addition, year-to-year changes in the budgets of agricultural research institutes are often biased toward inherited obligations and existing programs.





Source: Pardey, P.G. and G. Roseboom. 1989. ISNAR agricultural research indicator series: A global database on national agricultural systems. Cambridge: Cambridge University Press.

Figure 1.1. Regional changes in numbers of agricultural researchers and in regional expenditures (in millions of US dollars at constant purchasing power parity) in developing countries from 1961 to 1985.

Faced with these circumstances, many NARS managers are turning to the use of microcomputers and modern information management practices, such as those widely used in the private sector. These offer the possibility for improving the management of the research inputs (personnel, finance and facilities) as well as the way those inputs are used (the research program and its output and impact).

1.2 Management Information Systems

Every research organization has to know who is employed, what funds are available and what research is being done. All of this information is recorded in some way in some place, although the records may be kept by different people at different locations and used for totally different purposes.

Research managers have to be concerned about gathering diverse information to help improve their planning, programming, monitoring and evaluation of the research they direct. The product of their information gathering exercise is called a **management information system** (MIS). It puts the various types of information required for research management into one system.

Four principal categories of information are involved in an MIS: three of them deal with the resources available to the research manager; the fourth relates to the way in which those resources are used. Information on the available resources relates to the three principal resources needed for research: facilities, people and money.

Facilities represent the lands, buildings and equipment at the research manager's disposal. **People** comprise the pool of scientists, administrators, technicians and other supporting staff, including farm labor, who do the research. **Money** signifies the core operating budget as well as funds available for capital development and those derived from contract research and from external donors. Information about **resource use** involves knowledge about the research program, including the results that it attains.

Figure 1.2 is a matrix that shows the relationship between information on resources and resource use (vertical axis) and the type of management decisions for which such information is required (horizontal axis).

Thus, personnel (human resources) information used for programming and planning will assist in recruitment, career planning and identifying training needs. Information on research projects (experiments) can be used in the area of monitoring and evaluation. Research output can be assessed and its impact evaluated.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	A STRATEGY TACTICS	E OUTPUT IMPACT
HUMAN RESOURCES	B RECRUITMENT CAREERS TRAINING	F PERFORMANCE
FINANCE	C BUDGETING	G ACCOUNTING AUDITING
EQUIPMENT FACILITIES SUPPLIES	D UTILIZATION PROCUREMENT	H STOCK CONTROL

Figure 1.2. Matrix for INFORM, a management information and program budgeting system for research managers.

1.3 Program Budgeting Systems

Traditionally, research budgets are based on account codes such as personnel, travel, supplies, etc. Often these are part of a system common to all government institutions and have to serve the needs of departments such as public works, health and education as well as agriculture. It is not customary, particularly in the budgets of public-sector organizations, to present information on the funds allocated to specific problem-oriented objectives such as development of an improved rice variety or the control of a bean disease.

This is where **INFORM** (*INFO*rmation for agricultural *R*esearch *M*anagers) comes in. ISNAR developed INFORM for research managers who wish to combine information management and program budgeting.

- INFORM relates budget and personnel information to research programs, projects or activities. Through two small spreadsheets and two simple databases, it links information on costs and personnel with each research activity.

- For program budgeting, INFORM first breaks a budget into small components and then rebuilds it in a format that answers a range of questions for research managers or policymakers.

- INFORM, in effect, focuses on the information in boxes *A*, *B*, and *C*, and to a lesser extent *D*, in Figure 1.2. INFORM can also act as a powerful tool for monitoring and evaluating research, although that aspect is still under development by ISNAR.

- INFORM provides empirical information on the actual or planned use of resources. Apart from its value in program management, this type of information can serve as a component of planning and priority setting activities. These activities, however, require additional types of information that are not part of INFORM.

Figure 1.3 contains a regional agricultural research station budget in two formats: a traditional budget at top left and an INFORM-generated budget at top right and bottom.

- The budget total is the same for the traditional and program budgets because both account for all the funds.

- The conventional budget shows that salaries, wages and labor comprise more than 60% of total costs.

- The program budget shows that nearly 70% of the budget is used for three programs: rice, farming systems and grain legumes. The program budget involves a large number of experiments whose costs have been aggregated into a format that illustrates the six main program areas. Within each of these program areas, the budget for individual experiments can be isolated as shown for grain legumes in the bottom box of Figure 1.3.

The budget details brought out in Figure 1.3 provide information for research managers to see their program in terms of the costs of each experiment, a far cry from the traditional budget. The key element in the change is that instead of putting all personnel costs in one place, **INFORM translates time into costs and charges those costs to experiments.**

Converting a traditional budget into a program budget seems a formidable task and, indeed, if done on a hand calculator it could be. But a microcomputer and INFORM considerably simplify the task, providing that certain practical guidelines are followed.

Budgeting Formats
(Thousand Local Cost Units)

	Traditional Budget					Program Budget			
	Core	Non-Core	Total	%		Core	Non-Core	Total	%
Salaries and wages	8.6	0.2	8.8	44	Rice	5.5	0.0	5.5	28
Labor	2.5	1.2	3.7	18	Grain legumes	2.3	1.2	3.5	18
Materials and supplies	0.6	1.5	2.1	10	Oilseeds	1.8	0.0	1.8	9
Transport & travel	0.2	0.9	1.1	6	Fruit	1.0	0.0	1.0	5
Maintenance	0.6	0.0	0.6	3	Vegetables	2.2	0.0	2.2	11
Other	1.6	0.2	1.8	9	Farming systems	1.2	2.8	4.0	20
Subtotal	14.1	4.0	18.1	91	Subtotal	14.1	4.0	18.1	91
Capital	0.0	1.9	1.9	9	Capital	0.0	1.9	1.9	9
Grand Total	14.1	5.9	20.0	100	Grand Total	14.1	5.9	20.0	100

Grain Legume Program
(Local Cost Units)

Title	Salaries/ Wages	Labor	Materials	Transport	Mainte-nance	Other	Total Cost
Cowpea germplasm evaluation	660	275	0	180	15	120	1250
Cowpea N-P-K trials	100	40	30	10	0	20	200
Pigeonpea spacing	40	30	20	0	0	10	100
Pigeonpea drought tolerance	250	125	150	30	25	50	630
Soybean breeding	600	330	100	80	60	150	1320
Subtotal, grain legumes	1650	800	300	300	100	350	3500

Figure 1.3. Examples of traditional and program budgets for an agricultural research station

Procedures presented in this volume assume that much of the basic information required for INFORM already exists, although it may be dispersed, out of date and inaccurate. Details on gathering information are covered in Part 2 of the guidelines. The emphasis here is on what sort of product can emanate from INFORM and how it can be used by research managers at different levels.

1.4 The Development of INFORM

Any discussion of information use needs to take account of the fact that the last two decades have seen a revolution in information technology. This has

been brought about largely by the development of computers. It is now easy to handle large volumes of information on relatively inexpensive and widely available microcomputers. Given this situation, however, it is also easy to become lost in a mass of data and to collect information just because it is available. On the other hand, it is possible to be too restrictive and to ignore information that may be important for management purposes.

ISNAR sought to develop a system that falls between the two extremes and is usable at both the institute and the national level. The first step was to assess the type of information that management requires. Existing information systems were studied in a number of NARS and a set of goals for improved information handling were determined. INFORM was developed with the following characteristics in mind:

- The output should be of value to various classes of users, including policymakers, national research managers, station directors, program leaders and individual scientists. It should be possible, from within the same system, to tailor different reports to meet the specific needs of these different types of users.

- Most information collected should already exist in a useable format. **A minimum of new information is needed.**

- The information collected should be selective and well adapted to local conditions. Initially, it should be restricted to that required for specific output reports. **Information for INFORM is collected only if it is essential for a specific management need,** not because it looks **interesting.**

- The approach should be suitable for a wide range of different agricultural systems, commodities and station sizes, and should be such that data from different stations can readily be consolidated at the national level.

- The hardware used should be that which would be reasonable to find on almost any research station. In many cases this will be an IBM-compatible microcomputer with a hard disk.

- The software to be used should be simple, widely available, and easy for middle-grade scientists with limited computer experience to learn and use.

ISNAR used these criteria to develop and test the INFORM system in several NARS. (INFORM includes a number of features, some of which are currently

used by individual NARS, although no system with which ISNAR has worked has used all of these features in an integrated manner prior to the introduction of INFORM.)

The features of INFORM are discussed in detail in Part 2 of these guidelines and include the following:

- integrating all information on projects, personnel and finance;
- including the costs for research provided from all sources of finance;
- budgeting for research at the experiment level, including charging the cost of people's time;
- presenting budgets in the form of a set of cost codes that are relevant in terms of research management;
- developing a keyword system for assisting in the analysis of research program content.

2. How to Set up INFORM

Any senior NARS manager who decides to implement INFORM should start with a pilot exercise at a single institute. That exercise should be followed by presentation of the findings to senior researchers from all institutes in the country. This sets the framework for involving as many research leaders as possible in discussing any issues raised and in tailoring INFORM to the specific needs of an individual country.

2.1 Commitment

Many research institutes are staffed by scientists with little or no training in management other than that acquired on the job. For such people the use of information for management purposes is often a new concept.

INFORM offers an in-depth look into the work that institute directors and individual scientists are doing and provides management with detailed information that, by itself, is a useful tool. But some people may be suspicious of a system that provides such details.

To overcome doubt or suspicion, it is important that top management be fully committed to the concept of INFORM and see it as a tool for increasing the efficiency and effectiveness of their organization. If the prime role of INFORM is seen as one of supervising or policing, or if its main support comes from outside of the NARS, the results may well be disappointing.

The INFORM procedure is bottom-up. It starts with scientists who complete questionnaires and project protocols. It is essential, however, that top management be committed to having information gathered as accurately as possible and to using the end results to strengthen the research role of the institute. Without support from the national research leaders the prospects for the successful implementation of INFORM are likely to be slim.

2.2 Location

Because INFORM represents a continuing service to management, it requires an institutional home in the research system. The most appropriate location for this home will vary according to the structure of the research organization.

ISNAR's experience suggests that to operate INFORM effectively and to meet planning and budgeting deadlines, **a person or persons with INFORM know-how should be located within each research institute.** A possible exception would be small institutes where the task can be done centrally.

However, for policy-making and planning at the national level, there also needs to be a site where the INFORM reports from individual institutes are consolidated into a national format to provide appropriate reports for higher-level decision makers. This site should be associated with the unit most concerned with planning, programming, monitoring and evaluating agricultural research.

At the national level the focal point for programming and planning, and for INFORM, may be in a director general's office or a NARS secretariat, in a planning unit or, more rarely, in an economics or statistics unit. If a NARS encompasses several ministries or agencies, an organization such as a national research council would be the home of choice. INFORM should not be within the biometrics, computer or information departments of a NARS.

2.3 Data Content

The information required to establish INFORM is obtained from five sources, four of which should be available at any institute. The only new information is the following:

- a **questionnaire**, which each scientist completes, or updates annually, which provides information on his, or her, biodata and how he, or she, allocates time to specific activities and projects.

Existing information provides:

- the **staff list**, which givess a complete list of all staff and their job titles;
- the **payroll**, which complements the staff list and provides weekly, monthly or annual costs of salaries, benefits and allowances;
- the **budget**, which provides a varying amount of detail on the proposed or actual budget, broken down into a range of different cost centers;
- the **project list**, which may be a file, a publication or a collection of protocol sheets that describes each actual or proposed experiment and provides some detail on it. A project is the lowest level of research activity, usually an experiment.

Keywords for experiments are derived from the project list by the use of a mini-thesaurus and a series of INFORM checklists based on FAO's AGRIS/CARIS system. Keywords enable analysis of projects within and between institutes and the aggregation of research results at the national level in terms of either common management or scientific factors.

Not all of the information from these sources is necessarily used in INFORM. In initiating it, it is desirable to limit the amount of information put into the computer until the system is operating satisfactorily. As expertise builds up, more information can be incorporated and more detailed analyses made.

A small amount of information collected for each scientist and each experiment permits a wide range of analysis.

2.4 Data Collection

As noted earlier, a minimum of new data is required for INFORM.

Individual scientists should spend less than one hour per year to complete their questionnaire. Completing the project forms and keywords should require no more than two to four person-days per institute. The payroll and budget data are used as is and require little, if any, extra work.

The payroll and budget are obtained from the finance department, the project list from the institute director or program leaders, and the questionnaires from individual scientists.

INFORM involves two databases, one for personnel and one for experiments.

2.4.1 Personnel Database

Data collected for the personnel database will change little from year to year (Fig. 2.1). The major effort in updating, as a component of a planned, actual or past year's activity, is to update the section on activities listed as numbers 23 to 30 in Figure 2.1. Revising the personnel database, even for a large research institute, is not a major undertaking, provided that scientists complete the questionnaires accurately.

2.4.2 Project Database

Information is collected for the project (experiment) database (see Fig. 2.2). Part 2 of these guidelines discusses how costs are derived from the payroll and budget and how information on scientists' time allocations is collected. It defines the methodology used for inputting keywords and relating them to the FAO AGRIS/CARIS system, which is used by most NARS libraries.

(Very Few Year-to-Year Changes)

1. Surname
2. Initials
3. Research organization
4. Research institute
5. Title
6. Class
7. Grade
8. Present appointment (year)
9. Initial appointment (year)
10. Birth year
11. Sex
12. Highest degree (P, M or B)
13. Highest degree — University
14. Highest degree — Country
15. Highest degree — Subject
16. Highest degree — Year

(Limited Year-to-Year Changes)

17. Whether currently studying for higher degree Y/N
18. Degree expected to hold 5 years hence
19. Subject of expected degree if currently on study leave
20. Most recent short-term training
    a. Topic
    b. Institute
    c. No. of weeks
    d. Year
21. Major discipline of research (see check list for choices offered)
22. Major commodity group worked on (see check list for choices offered)

(Frequent Year-to-Year Changes)

Time (%) spent during year on:

23. Research %
24. Management %
25. Training %
26. Extension %
27. Study Leave %

28. Time (%) and project title of Project *A*, e.g., 20% rice germplasm evaluation
29. Time (%) and project title on Project *B*.
30. Time (%) and project title on Project *C*
31. Etc. (list all projects worked on)

Figure 2.1. Sample form for use in collecting personal data from scientists.

1. Research organization (Ministry, Department, etc., . . .)
2. Research institute
3. Title
4. ID number
5. Start year
6. Expected finish year
7. Objectives (brief description)
8. Main crop*
9. Other crops*
10. Commodity group*
11. Main discipline of research*
12. Season
13. Institute department (Name of department within institute)
14. Location (main station, substation, laboratory, on-farm)
15. CARIS code*
16. CARIS 1*
17. CARIS 2*
18. Keywords*
19. Pest Disease (names of PESTS, or DISEASE caused by them)
20. Institutional linkages
21. Names of participating researchers
22. Time inputs of participating researchers
23. Costs of participating researchers
24. Support staff costs
25. Materials and supply costs
26. Travel and transport costs
27. Repairs and maintenance costs
28. Technology transfer costs
29. Management and administration costs
30. Utilities costs
31. Miscellaneous costs

* To facilitate this information being entered in a consistent format ISNAR has proposed a set of checklists. These cover CARIS, keywords, linkages, commodities, crops and disciplines and standardize the terminology and spelling. See Part 4 of the ISNAR guidelines.

Figure 2.2. Database fields for collection of information on individual experiments.

2.5 Resources Required

Implementation of INFORM makes limited demands on the resources of any research organization.

2.5.1 *Staffing*

The staffing demands for INFORM are modest. For an institute of 30 to 40 scientists, the time required to establish INFORM is 10 to 20 working days, with seven to 10 days required for annual updating. If INFORM is developed to do progress reporting and monitoring on a monthly or quarterly basis, the time requirements will be greater.

At the national level, except where very large institutes are involved, the consolidation and reporting time required for building up INFORM to include all of the national research units should be one person-week or less per institute per year. That assumes that reasonably accurate data are received from individual research institutes.

INFORM, therefore, represents only a part-time job at both the institute and the national level. But because training for the work is quite specific, it is desirable to have at least two persons at each institute and in the national unit who are trained to handle INFORM.

Persons working on INFORM should have a basic agricultural degree. Some post-graduate training is desirable in order to provide a background for checking data, and some computer experience is needed. Appropriate training for INFORM work should not exceed two weeks in most cases. Staff members who have a part- or full-time role in planning and programming activities should have little difficulty acquiring the necessary skills.

2.5.2 *Equipment*

ISNAR developed INFORM on an IBM-compatible microcomputer equipped with a hard disk, but other microcomputers can be used.

The data analysis described, and the figures and tables presented, in the ISNAR guidelines were done with software called REFLEX 2, a non-relational database. Either Lotus 1-2-3 or Quattro are used for the budget and payroll spreadsheets.

ISNAR used REFLEX 2 because it is simple, effective and requires no programming. It can be used off the shelf and is easy to use to make reports and graphs. It is one of the more powerful and versatile of various flat-file databases on the market. It can translate files to and from Quattro, Lotus, Symphony, dBASE, Paradox and ASCII text. This makes it practical to use REFLEX 2 at the research institute level and to consolidate nationally using a relational database, such as dBASE or Paradox. However, it is worth noting that REFLEX 2 successfully handled Sri Lanka's national database, which held data from 1,680 projects.

The use of a flat-file database does, however, have limitations. It requires entry of data on scientists' time allocations and names in both the project and the personnel database.

ISNAR has taken the view that for many NARS, and most research institutes, the advantages of simplicity and easy reporting offered by REFLEX 2 outweigh its disadvantages. However, this is an issue on which each NARS can make its own decisions. In doing so, **it is important to recognize that if the bottom-up approach is to be implemented, the software should be selected as much on the basis of its suitability for use at the institute level as on its power and capability when used by national planners.**

2.5.3 Costs

Implementing INFORM will entail costs for staff time, software and disposable supplies, and for the part-time use of a computer.

Staff costs will relate to time inputs but should not add materially to the costs of the planning and programming function, particularly if the work is done by the staff responsible for planning and programming. Indeed, INFORM could lead to time savings in respect to ongoing planning, through the provision of more up-to-date and detailed data.

The costs for software to run INFORM will depend on the program selected but are likely to be in the range of US$250 to US$500 per package. Computer disks and paper are the primary supplies used.

Computer costs will depend on the time the computer is in use. At a typical institute this should not be more than one month per year once INFORM is operational. At the central level, computer usage will depend on the size of the NARS.

3. What Products Can Be Expected from INFORM?

This chapter presents examples of the output obtained from using INFORM in relation to the matrix in Figure 1.2. Some of the figures and tables used could be generated without INFORM in many countries, but a unique feature of INFORM is that it consolidates **all** sources of funds and **interrelates** all financial, personnel and project data. This is particularly important for the type of project analysis shown here and in Chapter 4. Particular emphasis is on the output in terms of programming and planning because these are usually of highest priority in terms of national programs. However, INFORM can also be used to provide a sound information base for monitoring and evaluation.

3.1 Finance

Personnel costs in many NARS represent 60% to 80% of total costs (other than capital), but few NARS attempt to relate those costs to specific activities. Often the only costs allocated directly to experiments are supplies, travel and, perhaps, field labor, which collectively may represent only 5% to 15% of the total costs. This means that resource allocation is seldom really known in terms of financial inputs and their relationship to the research program and its goals.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
HUMAN RESOURCES	RECRUITMENT CAREERS TRAINING	PERFORMANCE
FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

INFORM attempts to cost all resources used at the experiment level. That makes it possible to shift the conventional budget presentation into a program budget. This was shown earlier in Figure 1.3 and is repeated graphically for another research institute in Figures 3.1 and 3.2. The latter provides specific information at the institute level as to how the budget is being, or has been, used (an ex post analysis) or what future uses are proposed (ex ante). In both cases, the presentation can relate costs to any field in the database. In Figure 3.2 this is done in terms of commodities but it could be shown equally well in terms of crop, discipline, location, number of experiments, etc.

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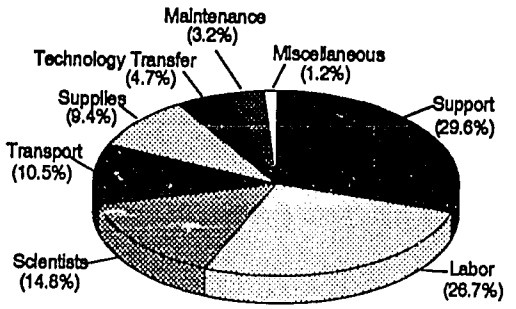

Figure 3.1. Typical budget for a research institute expressed as a percentage of total budget.

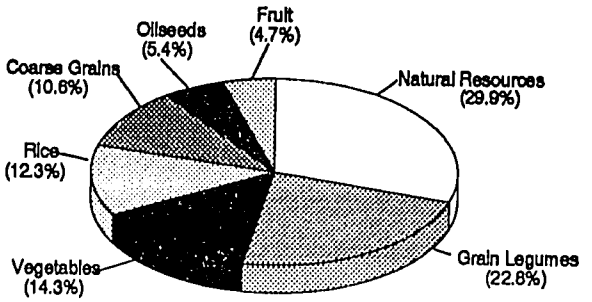

Figure 3.2. The budget of the same research institute expressed as percentages of total program budget.

INFORM is also useful for analyzing financial data at the national level. Because information can be collected on all the financial resources of a research institute, it is possible to assess the source and extent of external funding and to relate this to the program, and also the stability, of the NARS.

Figure 3.3, generated by INFORM, shows the relative magnitude of the research budgets of four ministries in one country and their dependance on external funding. This is negligible for estate crops, whose research has traditionally attracted little foreign aid, but it exceeds the national budget for forestry where conservation is prominent in donor priorities.

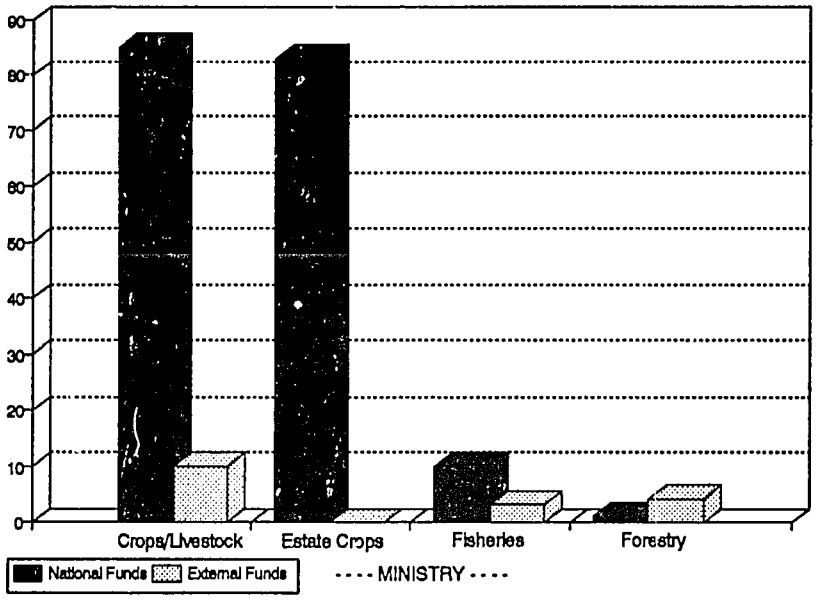

Figure 3.3. A budget of a NARS (in million cost units), where national and donor funds are channeled through four ministries.

A close look at Figure 3.4 reveals that the national budget for forestry is almost totally absorbed by salaries and that virtually all of the operational costs are derived from donor support. Such a dramatic illustration of the fragility of the funding for forestry research would offer forestry research

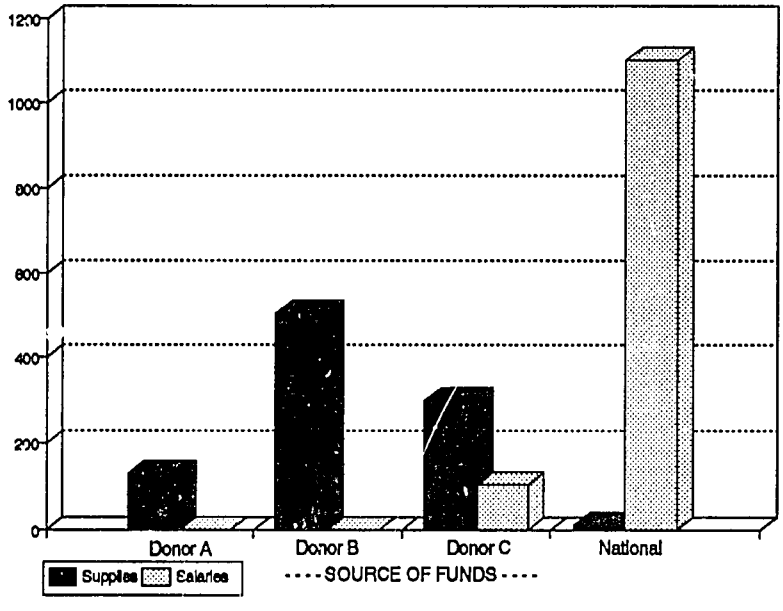

Figure 3.4. National and donor contributions (in thousand cost units) to the forestry ministry budget from figure 3.3.

managers an opportunity to quantify as well as qualify their case for a change in budget structure.

Few countries are consolidating all sources of funds and discussing **total** budgets when resource allocation is discussed. In some countries more than half of the funding for research activities (other than salaries) may be derived from donors. Donors sometimes have their own research agendas and it is often difficult to relate the total resources devoted to research to the total research program. The financial analysis used in INFORM helps to do that.

Outputs provided by INFORM can also be used for financial monitoring and evaluation. For this, INFORM needs to be linked to the financial accounts that each institute keeps for auditing purposes. Financial accounts often have to conform to a standardized government format, which is designed to monitor expenditures rather than programs. Theoretically, the financial accounts needed for auditing, and the program budget used for management purposes could be linked through a computer program that cross-codes all entries. Some NARS are already considering this.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
HUMAN RESOURCES	RECRUITMENT CAREERS TRAINING	PERFORMANCE
FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

It is important to recognize, however, that financial accounting is an exact process, whereas program budgeting is always likely to require some form of subjective judgments as to how to allocate common costs to specific projects. There is, therefore, a difference between financial accounts and management accounts, the latter being a day-to-day tool for the use of managers rather than an exact record for auditing.

An issue that links finance to personnel is the size of the operational budget available per scientist. In many institutes this is relatively small. Figure 3.5 shows data from a country where estate crops research is consistently better funded on a per scientist basis than food crops research. The difference is partly explained by the fact that estate crops research is funded from an export tax. The existence of such a situation obviously raises questions about resource use in terms of the opportunity to conduct an effective research program.

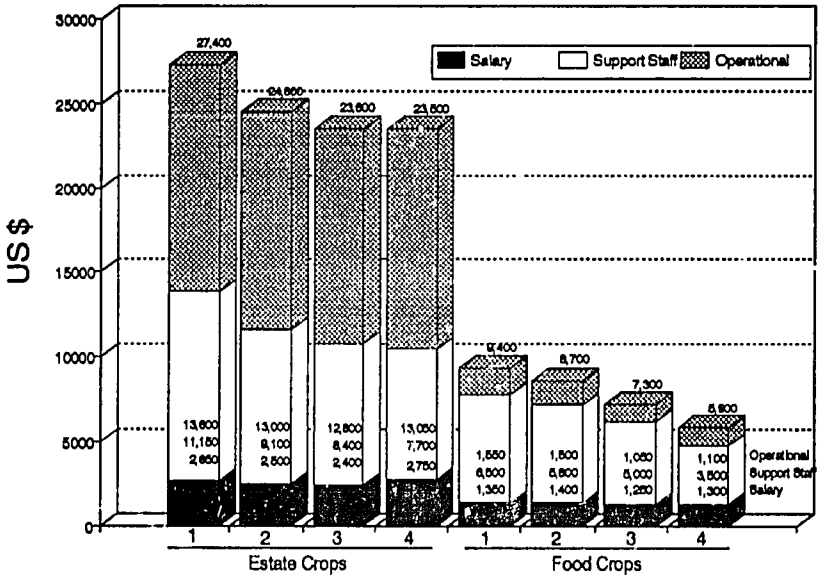

Figure 3.5. Annual budget per scientist for four estate (export) crop and four food crop research institutes.

3.2 Personnel

The scientists on a research station design, analyze and interpret the research. No matter how effective their support staff and labor, it is the scientists who primarily determine what, how and where research is done. They supervise research, analyze results and present the findings. Thus, the management of these scientists is important to the success of a research institute.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
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FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

Two types of management information on scientists are collected: essential **biodata** and information on **how scientists utilize their time.**

The **biodata** provide useful information for manpower planning. For example, Figure 3.6 illustrates the age and the number of people with different levels of education for all scientists at a research institute. It provides a guide

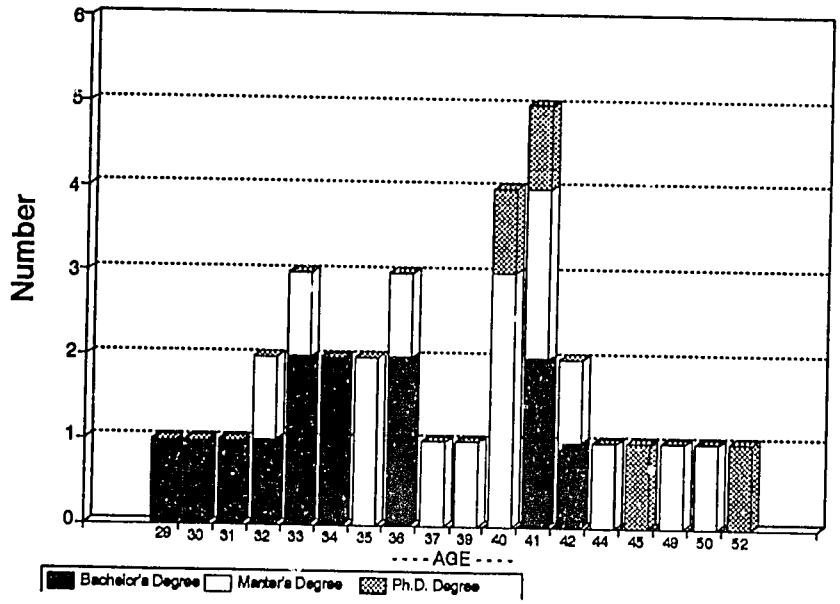

Figure 3.6. Age and highest academic degree for all scientists at a research institute.

for knowing when senior people with specialized expertise will reach retirement age. It is also a source of information for making judgments on future recruitment and needs for advanced training.

Career prospects are an important subject in terms of motivating scientists. Figure 3.7 shows the range of average salaries for different scientist grades in a NARS, and Figure 3.8 numerically records academic degrees and grades. It shows that most scientists are located in grade II. Even if they possess a post-graduate qualification, promotion occurs slowly. Were the NARS to develop a new personnel policy the information from figures such as these would provide a useful input.

The personnel data collected for INFORM can also be used for staff evaluation. Table 3.1 is an extract from a personnel file printout. It shows what the scientist claims his, or her, research program to be and provides management an opportunity to make some form of evaluation of the progress made on the scientist's projects.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
HUMAN RESOURCES	RECRUITMENT CAREERS TRAINING	PERFORMANCE
FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

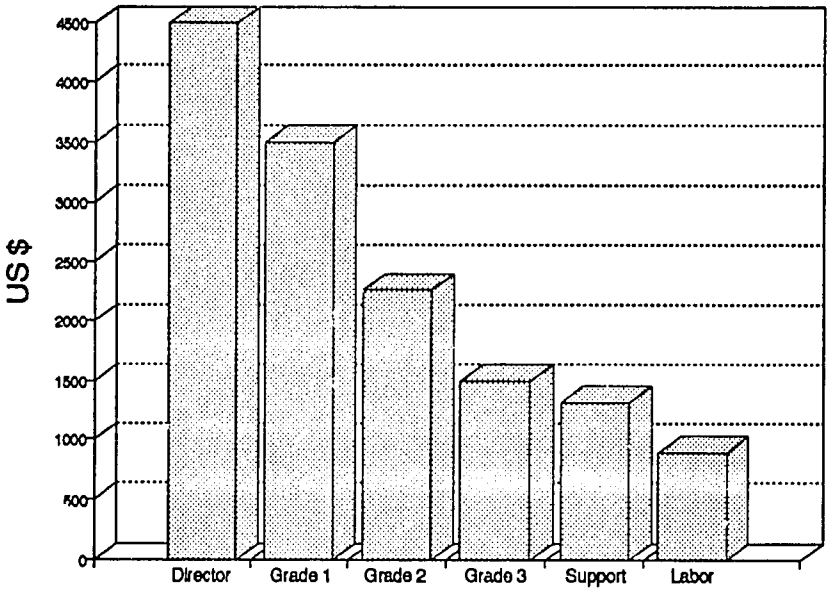

Figure 3.7. Average salary for different staff grades in a NARS.

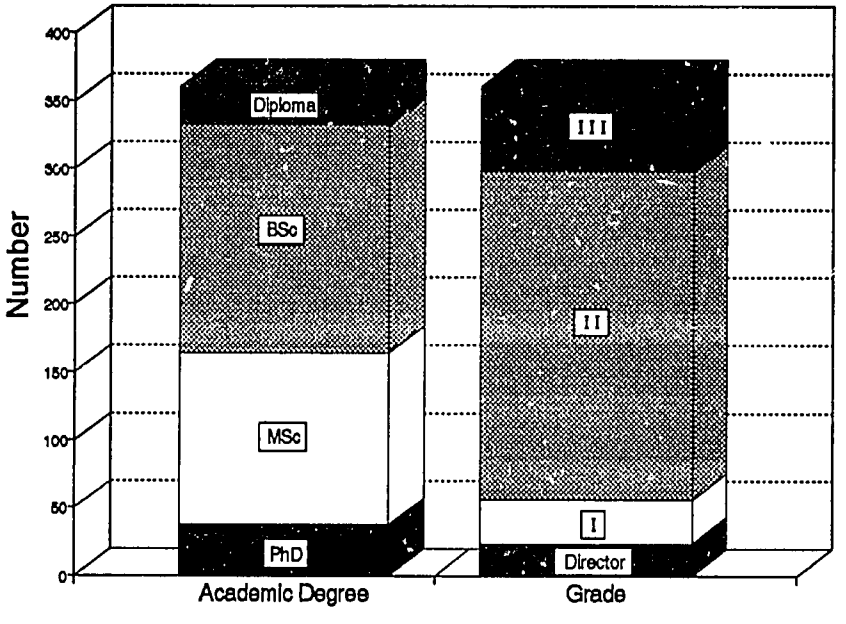

Figure 3.8. Grade and degree of all scientists in a NARS.

Table 3.1. Information from a personnel database printout indicates that this scientist spends 90% of his, or her, time on research.

Research					
PROJ1	:	ALLEY CROPPING	TIME 1	:	30%
PROJ2	:	FUELWOOD TREES	TIME 2	:	10%
PROJ3	:	HOME GARDEN AGROFORESTRY	TIME 3	:	40%
PROJ4	:	NITROGEN FIXATION BY LEUCAENA	TIME 4	:	10%
PROJ5	:		TIME 5	:	
PROJ6	:		TIME 6	:	
PROJ7	:		TIME 7	:	
PROJ8	:		TIME 8	:	
PROJ9	:		TIME 9	:	
PROJ10	:		TIME10	:	

3.3 Facilities

Good facilities management means that appropriate inventories should be available for each facility so that replacement and maintenance can be budgeted as support for research. It is not uncommon for the growth in maintenance and repair budgets to fail to keep pace with new capital facilities provided by donors. Being able to quantify this situation can help a research manager make a case for greater funds.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
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FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

Most agricultural research institutes have land that is used for field experiments. It is important for the research manager to know how this resource is used, which means having information on the extent to which the land is used for research. Data are required to determine the costs for land used in the experiments recorded in the database. If information on specific cultivation activities is deemed to be useful, it can also be recorded, e.g., the cost or area completed per hour of plowing. Such cost information is useful for comparing the costs of research done at different sites and also for budgeting research projects.

Where a research institute has a main station and several substations, a knowledge of the precise location of the experimental program is useful in terms of assessing (a) whether its agroecological spread is appropriate and (b) the intensity of use of substations. For example, for the institute related to Figure 3.9, little research appears to be underway in substations 5, 6 and

7; 69% of the research is at the main station. With information of this nature, the research manager is in a position to assess the justification for continuing activities at substations 5, 6 and 7 and can then decide whether it is appropriate to have as much as 69% of the experiments at the main station.

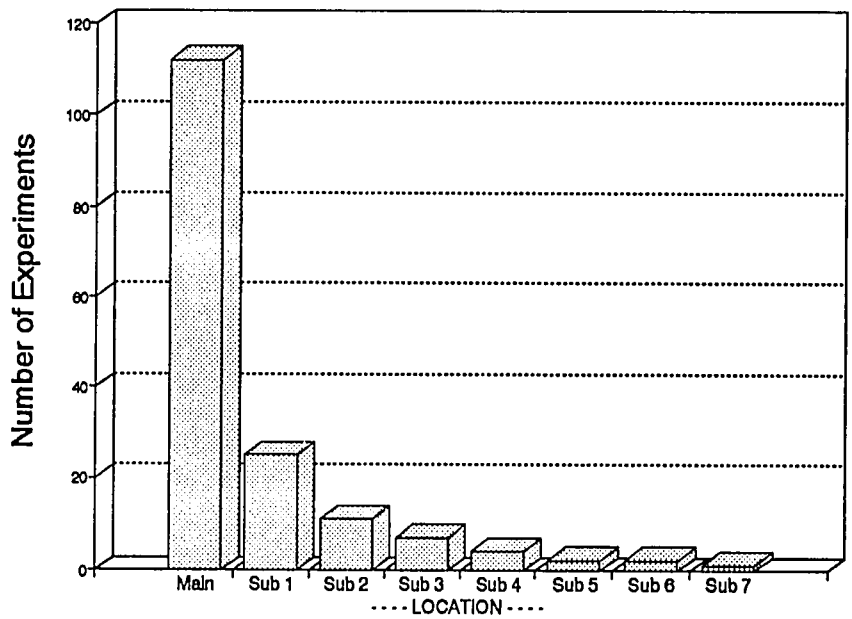

Figure 3.9. Number of experiments at the main station and at seven substations of one research institute in a NARS.

The establishment of equipment maintenance and replacement schedules is also important. Research institutes may have a wide range of different types of equipment, including that used in the office, laboratory and farm. Some items need to be renewed on a planned and regular basis, and certain equipment needs a readily available supply of spare parts to keep it operating efficiently. ISNAR is developing an appropriate database for research facilities. This will be included in INFORM and will be published as a future ISNAR guideline.

3.4 Programs

The financial, personnel and physical resources discussed above are used collectively to implement a research program. INFORM permits a program to be analyzed at the national, institute, department or division, and individual experiment level. Each of the various fields in a program database can be examined in terms of costs, number of experiments, or scientists' time inputs.

This can be done for past, present or future research according to the type of analysis being done.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
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FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

In addition to basic descriptors such as discipline, crop, etc., INFORM uses the FAO AGRIS/CARIS descriptor system as the basis for its analysis of research programs. At the macro level, research is divided into 12 main CARIS (Current Agricultural Research Information System) programs (Fig. 3.10). The results at such a level of analysis will be of prime interest to senior research managers in indicating the allocation of financial (or human) resources among the 12 major themes.

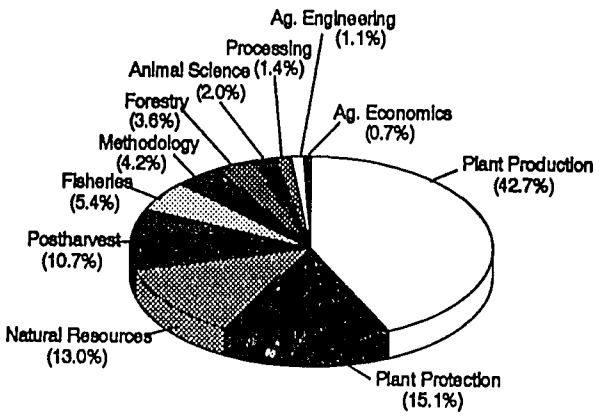

Figure 3.10. For analysis of research budgets at this agricultural research institute, budgets were divided into CARIS 1 (program) codes and illustrated in a pie chart.

At a more detailed level of analysis, CARIS introduces more than 70 thematic areas (CARIS 2). In Figure 3.11 the descriptors relating to crop production and crop protection are used on the data in those two fields (from Figure 3.10) to show how the information can be further disaggregated. In this case the analysis is based on scientists' time rather than total costs.

The primary clients for such an analysis are likely to be the leaders of national programs in crop production and protection. Figure 3.11 can be used to raise questions about the balance of a program, such as whether there is sufficient

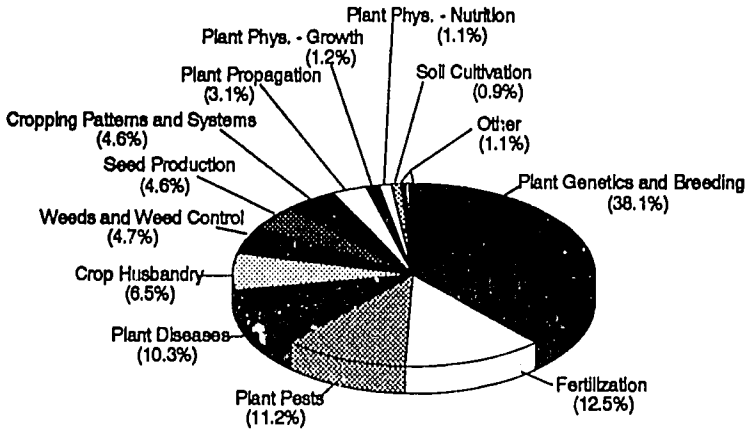

Figure 3.11. This pie chart, created using CARIS thematic codes, allows a crop-research program leader to see where scientists are spending their time.

effort in cropping systems research or too much time devoted to genetics and breeding.

INFORM can provide the information needed for a manager to form judgments on this sort of issue.

At a lower level of analysis, a research manager can use keywords to screen an entire institute or national program for research related to a specific topic. This type of analysis can determine whether there is any activity at all on a specific crop or whether it can bring together all activities related to keywords. Table 3.2 shows the results of a search for a specific group of keywords relating to microbiology. It indicates that 14 experiments in nine different institutes were concerned with this topic. Such a screening offers research managers the opportunity to decide whether their overall program meets national needs and priorities in a particular research area.

The type of analysis that can be done with INFORM is versatile. For example, the same sub-set of the database used to prepare Figure 3.11 was used to generate Table 3.3, which relates food crop research to disciplinary activities at 11 separate institutes. Interpretation of this material obviously requires considerable local knowledge to evaluate the rationale for the spread of activities. But the availability of this sort of data enables research managers to examine how their resources are allocated across commodities and disciplines.

The role of INFORM is not so much to pass judgment on the status quo as to provide information that will generate questions that management needs to ask in order to develop the most appropriate research program to meet national needs.

Table 3.2. Experiments Involving Nitrogen Fixation, Mycorrhizae or Rhizobium

Institute/ID#	Project Title	Keywords
1.1	Studies on use of *Sesbania rostrata* as a supplementary source of N for lowland rice culture	Nitrogen fixation, alley cropping, agroforestry
1.2	Use of meda season legume as a nitrogen fertilizer substitute	Nitrogen fixation, cover plants
2.1	Azolla N fixation	Nitrogen fixation, azolla
3.1	Occurrence of vesicular-arbuscular mycorrhizae (VAM)	Mycorrhizae, phosphorus
3.2	Effects of VAM on growth and uptake of P	Mycorrhizae, phosphorus, plant nutrients
4.1	Continuation study of nitrogen-fixing trees	Nitrogen fixation, intercropping
5.1	*Gliricidia maculata* as a source of nitrogen for lowland rice	Nitrogen fixation, agroforestry
6.1	Nitrogen-fixing trees	Nitrogen fixation, agroforestry
6.2	Survival and persistence of cowpea rhizobia	Rhizobium, drought tolerance
6.3	Mungbean — N-fixing ability of indigenous rhizobia	Rhizobium, nitrogen fixation
7.1	VA-mycorrhizae in nutrient uptake	Mycorrhizae, soil microbiology, phosphorus
7.2	Biological N fixation	Nitrogen fixation, cover plants, rhizobium
8.1	Role of VA-mycorrhizae in nutrient uptake	Mycorrhizae, plant nutrition, phosphorus
9.1	Study of non-symbiotic N fixation by guinea grass	Nitrogen fixation

Note: Keywords were used to screen a 1680-title national research database to find experiments involving microbiology and plant nutrition. The keywords used were *nitrogen fixation*, *mycorrhizae* and *rhizobium*.

Table 3.3. INFORM identified budgets (%) by discipline for food crop research at 11 institutes in a national agricultural research system.

	Cereals	Fruit	Oilseeds	Grain Legumes	Rice	Roots Tubers	Vegetables	All
Agronomy	26	45	20	27	22	35	20	25
Breeding	50	23	40	47	32	43	35	35
Chemistry	5				1		1	1
Engineering	7	1			2		1	2
Food technology		2	16					3
Nutrition		3			3		4	2
Parasitology	4	13	13	12	11	5	12	11
Pathology		6	5	4	8	6	15	8
Physiology		6	2		2			2
Soils		1		3	15	9	6	7
Service	8	1	4	7	5		6	4
All	100	100	100	100	100	100	100	100

Note: Information such as that shown here allows a research manager to examine how resources are being allocated across commodities and research disciplines.

A commodity research program can be examined in terms of its specific crop components. Figure 3.12 presents the scientists' time allocation on grain legume research for a multi-institute NARS. The figure raises questions about the rationale for research on 19 grain legumes when only five of them received sufficient funding for work in any depth.

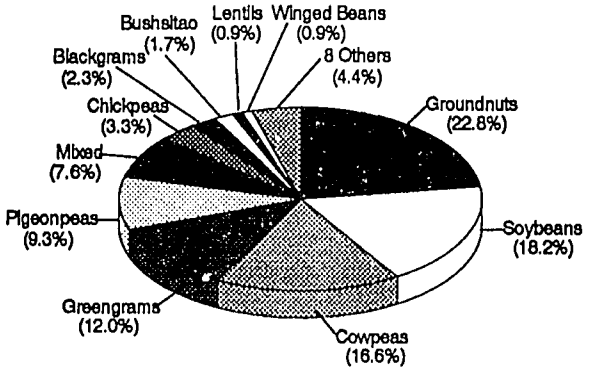

Figure 3.12. INFORM was used to determine scientist time spent on grain legume research at 10 institutes in a NARS. A question might be raised about spreading research time over 19 grain legumes while only five had time enough for in-depth research.

3.5 Program Evaluation

As with the personnel database, a project database can be used as a tool for monitoring and evaluation. It can provide, on one sheet of paper, information about the objectives and the human and financial resources allocated to any one project. Such information can be used as a benchmark for measuring progress. To date, ISNAR has done only limited work in this area.

DECISIONS / INFORMATION	PLANNING AND PROGRAMMING	MONITORING AND EVALUATION
PROJECTS OR EXPERIMENTS	STRATEGY TACTICS	OUTPUT IMPACT
HUMAN RESOURCES	RECRUITMENT CAREERS TRAINING	PERFORMANCE
FINANCE	BUDGETING	ACCOUNTING AUDITING
EQUIPMENT AND FACILITIES	UTILIZATION PROCUREMENT	STOCK CONTROL

Several NARS have indicated an interest in using INFORM for evaluating the planning, progress and results of their research. ISNAR's work in these areas is still at an early stage of development and has not been adequately field-tested. There are, however, no major problems in incor-

porating into INFORM specific fields relating to the planning and priority setting as well as the monitoring and evaluation processes. For the purposes of quantitative analysis, these additional fields could be recorded using a series of indicators, each with a score or value on a 0-4 scale.

For planning and priority setting, the INFORM fields could cover topics related to the urgency of the problem, probability of success and likely time before results. For program monitoring, the scored fields could be the status of budget use, status of work, status of reporting and technical quality of the research. Finally, the evaluation criteria used could be the technical quality of the research, appropriateness of output to users' needs and rate of adoption by potential users.

A fuller treatment of this subject is given in Part 2 of these guidelines, and a later volume in this series will present the results of ISNAR's preliminary work in this area.

4. How Can Managers Use INFORM?

Chapter 3 illustrated the output from INFORM in relation to the matrix presented in Figure 1.2. This chapter provides further examples of INFORM outputs, but they are presented in the context of management at different levels in the system — planners and policymakers, national research managers, research institute managers and program department heads. A number of examples spill over from one level to another.

4.1 Policy-Making and Planning

At the highest level of policy-making and planning, the information required from INFORM is likely to be at the macro level. A key question at that level relates to the setting of research priorities in terms of major food or export crops. But it is seldom possible to relate such priorities to actual or proposed resource use because most countries, lacking a system such as INFORM, have no detailed basis on which to quantify resource use.

Figure 4.1 shows such a comparison for a country where research priorities on a commodity basis were tentatively listed and compared with an analysis of actual research expenditures by commodity for 1989.

The results show a good fit (except for milk) at the top of the list but poorer fits for the middle and lower priorities. The analysis offers prospects for shifts in resource allocations. For example, in the NARS in Figure 4.1, the resources allocated for milk were depressed by the large part of the livestock research budget that was used for nonresearch activities, such as vaccine production and diagnostic services. In contrast, resources used for potato and soybean research were substantial. Those crops received significant donor support as well as extra national resources that were counterparts for donor aid.

Most countries are able to cite a figure relating the value of their agricultural research expenditure to the value of the agricultural component of their GDP. But because a system such as INFORM is needed to derive expenditures on a crop or commodity basis, it is rarely possible to disaggregate the national figures to show the relationship between research expenditure and GDP contribution at the crop or commodity level. In Figure 4.2 this is done for the 11 major commodities into which research was classified in a country where ISNAR has worked. At the national level, research represented 0.4% of the agricultural GDP, but for many commodities it was less than 0.25%, whereas

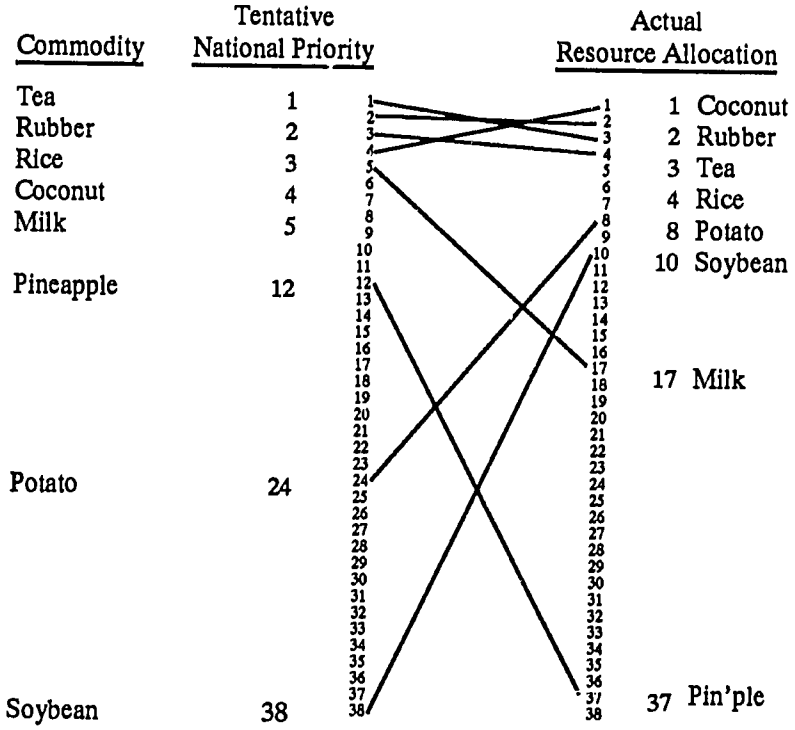

Figure 4.1. A comparison of the ranking of actual resource allocations for research with tentative national priorities in a NARS. Only eight of 45 commodities are shown.

for rubber (the major export) it reached 1.2% and for sugar (thc major food import) it rose to nearly 2.2%.

From the viewpoint of national planners, who may find it difficult to increase the total funds available for agricultural research (in order to increase the 0.4% national figure), it is clearly of interest to examine the possibilities for resource shifts. This can be done by examining current resource allocations in terms of their shares of the total time scientists devoted to research (Fig. 4.3).

Suppose that the government decided that it wished to raise the amount of time scientists allocated to export agriculture (spices, cocoa and coffee) from its present level of 0.2% of the value of these crops (Fig. 4.2) to, say, 0.6%. Because about 70% of total costs are for personnel and other costs are built around this core, it implies that scientists' time inputs would increase about threefold. To do this, research in export agriculture would need to increase its share of total research time from 6.7% to 20.1%. The increase of 13.4% would have to come from other slices of the pie shown in Figure 4.3.

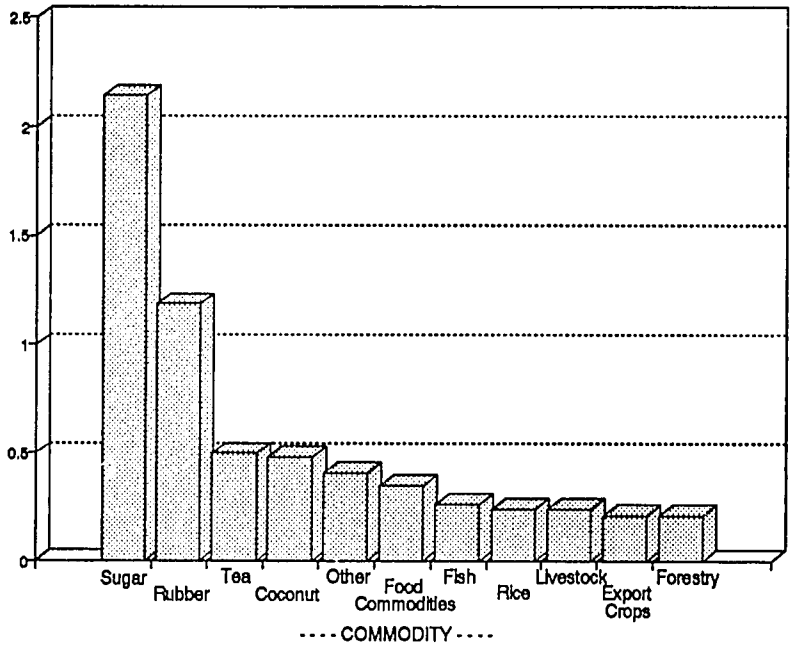

Figure 4.2. Research for 11 major commodities as a percentage of the commodity's contribution to agricultural GDP in 1989.

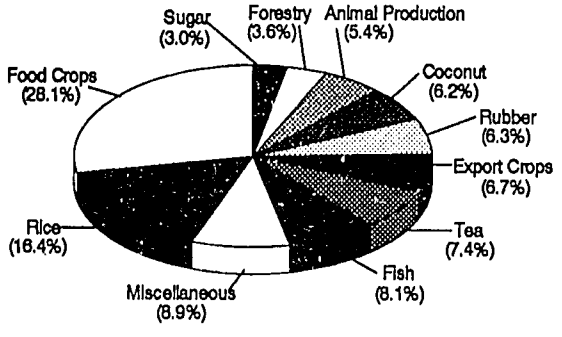

Figure 4.3. Total scientists' time (percent) in a national agricultural research system devoted to research on the specific commodities illustrated in Figure 4.2.

The easiest choice might be food crops, but few governments would be prepared to reduce food crop research by nearly half in order to promote exports. Similarly, a drastic reduction in sugar research would make little in the way of funds available for other commodities. An alternative, and perhaps more rational, approach would be for a smaller increase in export-agriculture

research funded either by modest reductions elsewhere or by an overall research budget increase.

The approach is for the planners and policymakers to decide, but, hopefully, if armed with INFORM, they will be in a better position to make more informed judgments and decisions.

4.2 National Research Management

One useful piece of information for a director general of research or the chairman or president of a research council is how the total resources from all sources available to the NARS are divided among its research institutes. Many NARS contain a mix of large (sometimes commodity-oriented) institutes and smaller regional ones (often with a multicrop adaptive research role). Figure 4.4 illustrates an INFORM analysis for a 19-institute NARS. It differs from information usually available in that each of the institute budgets includes all of its sources of funding.

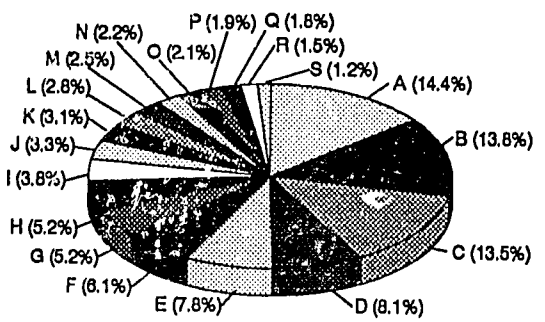

Figure 4.4. The individual budget share of 19 institutes (A-S) in a NARS.

NARS leaders may, from time to time, wish to examine the disciplinary focus of the research program. Figure 4.5 does this. For the sake of completeness, it includes support research (biometrics, computer and information science) and services (publications, extension, teaching and other technology-transfer activities) as disciplines. In the case illustrated, economics research was conducted by a unit outside the NARS. Such information can be used by national leaders to discuss whether the balance of disciplines meets their targets and aspirations.

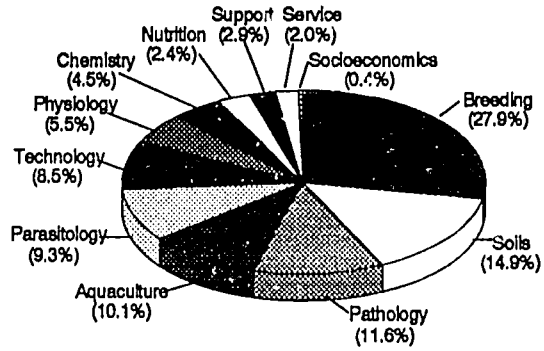

Figure 4.5. Scientists' time by discipline for a 19-institute NARS.

Because human resources are the major cost item at most NARS, and the scientist is at the heart of that, NARS managers may wish to examine how scientists are being utilized. Figure 4.6 illustrates how scientists at one institute (with a big postgraduate study program) reported their time allocation. Of particular interest is the relationship between the time used for management purposes and that used for research. For every person-year devoted to management, there were 4.2 person-years of research undertaken. This ratio varied widely from institute to institute. In a study covering several Asian countries, it ranged from 7.4 to 3.1 (Fig. 4.7)

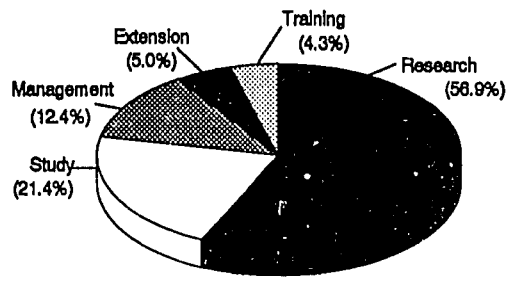

Figure 4.6. Time allocation of scientists in one research institute.

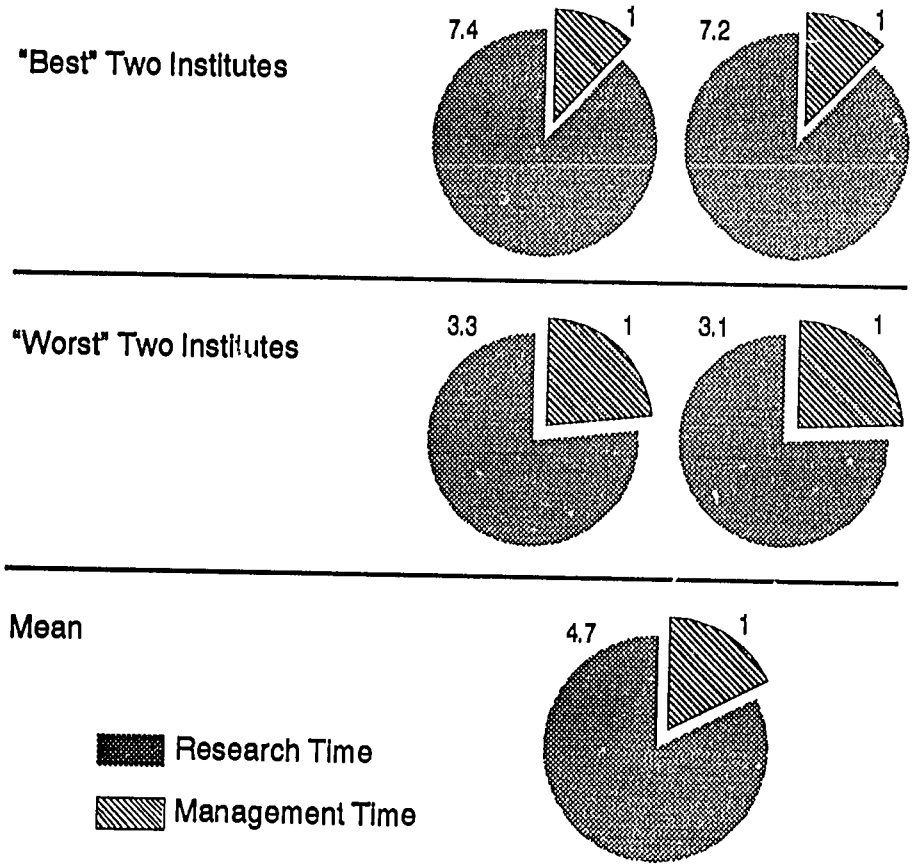

Figure 4.7. The ratio between time allocated to research and to management at agricultural research institutes in several Asian countries.

In some cases there may be valid reasons for a high or low ratio, but, for example, were the mean ratio shown in Figure 4.7 to be increased from 4.2 to 7.4 in a NARS with 200 scientists and an initial time-allocation pattern similar to Figure 4.6, then the number of person-years per annum doing research would rise from 114 to 123. This would represent **an 8% increase in the number of scientists available for research**, and could be obtained **at zero direct cost** by modifying the organizational and management structure to reduce the time involved in research administration. Obviously the ratio can be reduced too much, but one management year per seven or eight research years may be a useful target.

In terms of the use of scientists' time, INFORM can provide additional information. Figure 4.8 shows how many experiments each scientist claimed to be working on in one institute. The number ranged from one to 35. There can be no hard-and-fast rule here, because a major experiment may occupy a scientist full time, whereas a senior scientist may provide limited special-

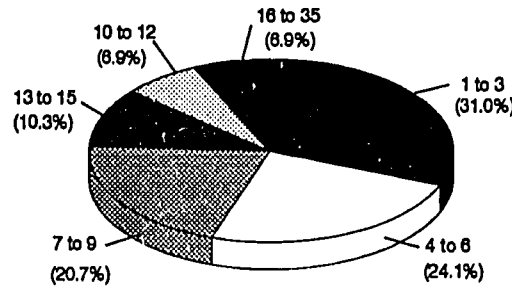

Figure 4.8. Number of experiments that individual scientists worked on at one research institute.

ized inputs to a number of experiments. Nevertheless, some people may wish to query the effectiveness of a scientist working on 20 or 30 experiments. This raises questions about the way in which research is conducted and managed at the institute level.

A second issue on the conduct of research relates to the number (and discipline) of scientists working on individual experiments. Figure 4.9 illustrates this from one research institute. For experiments involving two or

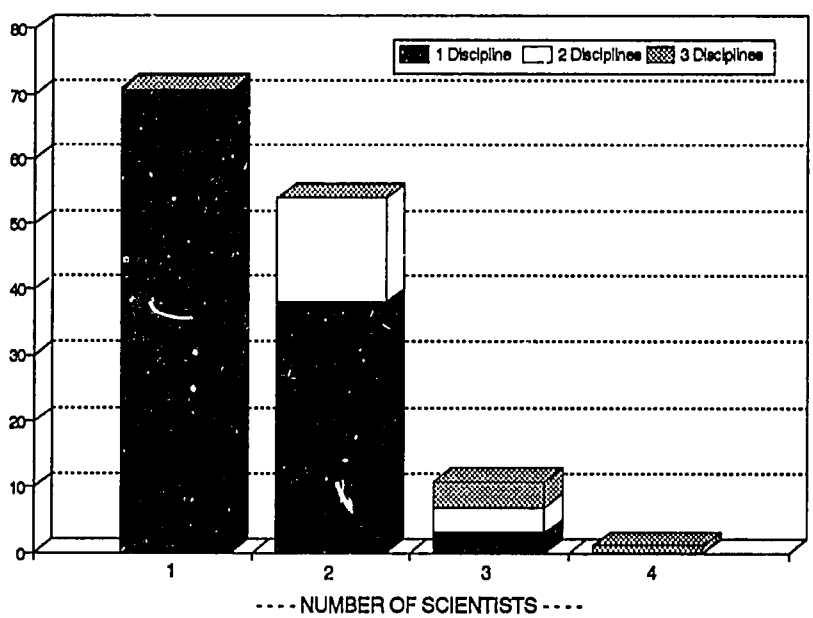

Figure 4.9. Total number of scientists and disciplines involved in each experiment at one research institute.

more scientists, it also shows whether the scientists were from the same or different disciplines. Figure 4.9 thus illustrates the amount of teamwork at the institute and also the extent to which it is multidisciplinary in nature. Such information can be helpful to a senior manager in assessing the research culture of an institute and the degree to which its director is utilizing human resources. For the institute director, too, it is a useful indication of the extent to which his, or her, program and disciplinary units are interacting. Such information may be particularly useful at both the NARS and the institute level when the performance of different units is compared. It offers a range of information for personnel and program evaluation.

4.3 Research Institute Management

Much of the INFORM material of use to NARS leaders is built up from aggregating information provided by separate institutes to present both the national picture and interinstitute comparisons. At the institute level, this information is also of value to the director and research managers.

In addition, INFORM can provide an institute director with information specifically designed to meet his, or her, needs. For example, an institute may structure its program in a format that does not lend itself to a straightforward analysis by commodity or discipline. By including a field for program title in INFORM, the program can be analyzed in the form in which it is structured. This may be by commodity, discipline or location, or a mix of all three.

Within a program, a director may also wish to list experiments in order of size to see which experiments cost the most or the least. Or a director may want to look into a specific program to assess the balance of activities and to review them in the context of national plans and priorities.

A director may also wish to examine how his, or her, program is divided among main station, substation and on-farm research in order to reassess the policy and program with respect to location (Fig. 4.10).

In the human resource field, INFORM can be used to examine scientific staffing in terms of postgraduate staff, both currently and after existing trainees return. Figure 4.11 shows the buildup in staff with higher-degree training that was taking place at one institute examined. The figure shows that when current trainees return, the number of PhDs and MScs will be relatively high. But it also shows that there is a disproportionate buildup in agronomy and breeding at the expense of other disciplines.

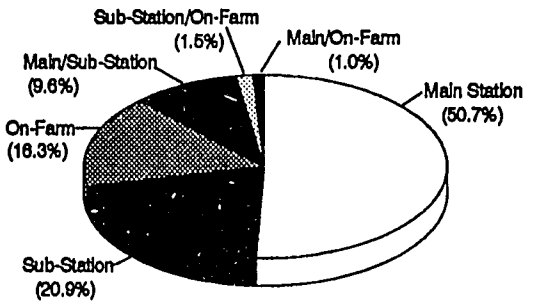

Figure 4.10. An example of budget by location in a multistation institute.

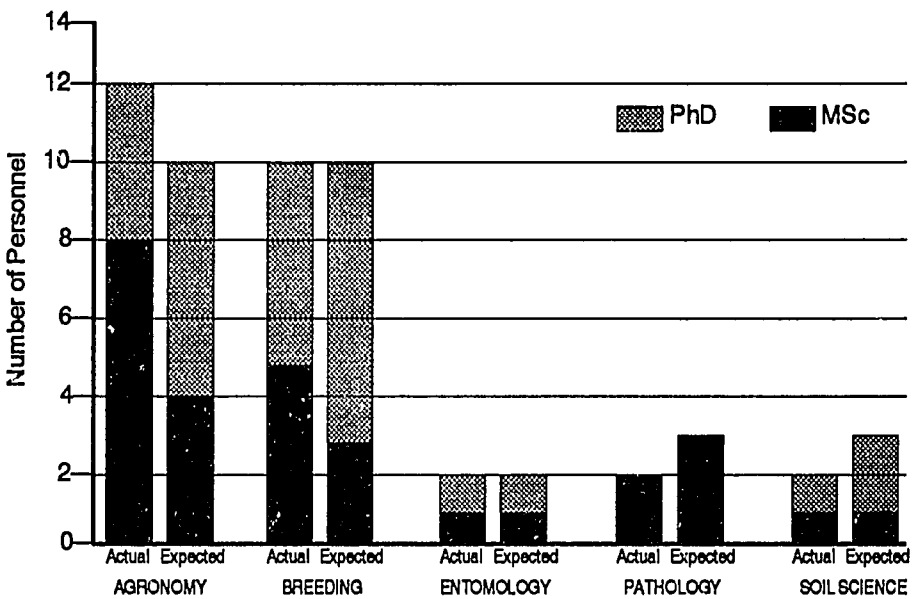

Figure 4.11. Comparison of actual and expected highest academic qualifications of scientists in a research institute.

4.4 Multiple-User Information

Chapter 1 stressed the multiple-user nature of INFORM. Figure 4.12 and Table 4.1, which conclude this report, illustrate this feature of INFORM in relation to research in an organization dealing with an export crop.

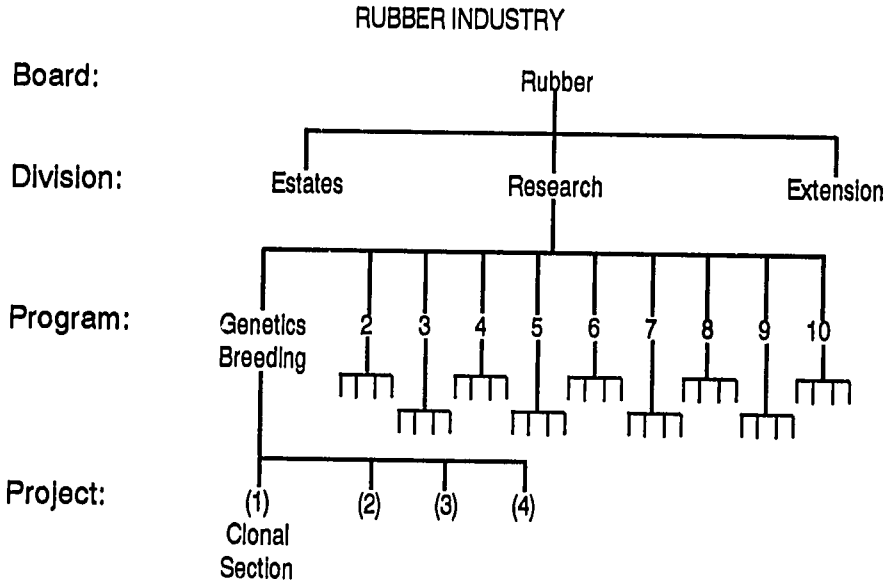

Figure 4.12. Organizational structure of rubber research — this is common to several Asian NARS.

The Rubber Board (Fig. 4.12) allocated 27.6 million cost units for research. The research budget was presented to the Board as a conventional budget in the form seen on the left of Table 4.1. On the right of the table the budget has been reorganized by the Institute Director as a program budget.

Within the breeding and genetics program, the program leader allocated his budget of 1.746 million cost units, as shown in the middle box of Table 4.1.

The scientist in charge of the clonal selection project was assigned 1.048 million cost units and used it as shown in the bottom box of Table 4.1.

The table shows how the same source data at different levels of aggregation can serve the information needs of the Board, the director, the program leader and the scientist. At each level of presentation, opportunities exist to use the data for planning, programmimg, monitoring and evaluation. INFORM is a tool that helps managers to perform these tasks easily and efficiently.

Table 4.1. INFORM helps research managers transform conventional budgets into program budgets to provide detailed information at different levels. The box at top right would serve an institute director's needs. The middle box gives the program leader a program budget; the bottom box gives a scientist a budget for an experiment.

CONVENTIONAL BUDGET	('000 units)
1. Recurrent	
• Personnel	14,407
• Supplies	3,081
• Transport	1,549
• Maintenance	430
Subtotal	19,467
2. Utilities/Vehicles	
• Electricity	1,513
• Vehicles	1,500
• Other	324
3. Administration	5,824
TOTAL	27,629

PROGRAM BUDGET	('000 units)
1. Breeding and Genetics	1,746
2. Plant Physiology	3,121
3. Soils and Nutrition	4,750
4. Plant Pathology	2,320
5. Rubber Chemistry	4,133
6. Rubber Technology	2,261
7. Raw Rubber Development	1,532
8. Specification and Analysis	2,127
9. Rubber Biochemistry	2,634
10. Support Services (biometrics, economics, instrumentation)	3,005
TOTAL	27,629

Program: Rubber Breeding and Genetics

Activities	Cost ('000)
1. Breeding, selection and testing of Hevea clones for commercial planting	1047.6
2. Genotype-environment interaction studies in Hevea	349.2
3. Evaluation of 1981 germplasm collection	232.8
4. Diallel analysis in Hevea	116.4
Total program cost	1,745.9

Activity: Breeding, selection and testing of Hevea clones for commercial planting

Item	Cost ('000)
• Scientists and support staff	289.7
• Labor	106.8
• Supplies	170.4
• Travel	153.8
• Maintenance	38.2
• Overhead	288.8
	1,047.6