

CHAPTER 4

AGRICULTURAL RESEARCH IN INDONESIA

Introduction

This chapter discusses agricultural research in Indonesia and the various methods by which information flows from research to the extension organization. I first describe the research institutions, focusing on the Agency for Agricultural Research and Development (AARD) and its activities. I then briefly describe the process of developing an agricultural technology recommendation, as prescribed by ministerial decrees. This leads to a discussion of characteristics of the highly centralized recommendation-generation process, and a description of decentralized alternative procedures.

Are research-extension linkages a problem in Indonesia? To answer this question, I next review the literature on linkages in Indonesia, weighing the evidence for and against poor linkages, and describing recent efforts to improve ties.

I then describe the communication activities of AARD research institutes. I look first at the three types of communication departments within AARD. I then briefly discuss the three main audiences of these departments, before turning to their communication activities and the constraints they face.

AARD and agricultural research

Agricultural researchers are one of the largest groups of scientists in Indonesia. Like the extension system, the research system is rather complex, and it is necessary to simplify much in the brief description here. Table 4.1 lists sources of information on the research system, primarily on AARD, its largest component. This section first briefly describes other organizations involved in agricultural research. It then describes in greater detail AARD and the process of planning and performing research.

Table 4.1 References on the Indonesian agricultural research system.

AARD 1984a	• Cook and Wharton 1984
AARD 1984b	* Hadiwigeno 1991
AARD 1985b	• Hussein 1986
AARD 1986	IARDJ 1986
AARD 1987	ISNAR 1981
AARD 1988	Nestel 1985
Abdurachman et al. 1991	Syam and Mundy, in press
* Badan Litbang Pertanian 1991	Ward 1985

- Data-based study
- * In Indonesian

Other research organizations

The bulk of formal agricultural research in Indonesia is conducted by AARD. This section will therefore concentrate on this agency. An incomplete list of other ministries and institutions involved in agricultural research and development work, and a brief summary of their relevant focus areas, are given below.

- Research on estate crops (rubber, oilpalm, coconut, sugarcane, tea, coffee, and cacao) is performed by eleven research institutes under the auspices of the Indonesian Planters Association for Research and Development (IPARD, *Asosiasi Penelitian dan Pengembangan Perkebunan Indonesia, AP3I*). This is the research arm of a group of parastatal and private plantation corporations. The director-general of AARD is a member of the Board of Trustees of IPARD (Figure 4.1).
- The Sugarcane Research Institute at Pasuruan also conducts research on sugar. It is under the direction of the Management Board for Sugarcane.
- Universities combine a wide range of agricultural research with their teaching activities. Major universities with faculties of agriculture include Bogor Agricultural University (*Institut Pertanian Bogor, IPB*) in Bogor, West Java; Gadjah Mada University, in Yogyakarta; Pajajaran University, in Bandung, West Java; Brawijaya University, in Malang, East Java; Hasanuddin University, in Ujung Pandang, South Sulawesi; and Andalas University, in Padang, West Sumatra.

- The National Biology Institute of the Indonesian Institute of Sciences (*Lembaga Biologi Nasional-Lembaga Ilmu Pengetahuan Indonesia, LBN-LIPI*) concentrates on the description and conservation of plant genetic resources and minor crops not covered by AARD. It is located in Bogor.
- The Ministry of Research and Technology conducts research on biotechnology and genetic engineering.
- Research on post-harvest processing and crop use is performed by the Institute for Research and Development of Agro-Based Industries (IRDABI, *Balai Besar Industri Hasil Pertanian, BBIHP*) of the Ministry of Industry. IRDABI is located in Bogor.
- The National Logistics Board (*Bulog*) conducts research on large-scale storage and post-harvest processing of food commodities through its Bureau for Research and Development of Logistic Systems. This is done mainly at the Food Technology Research and Training Center (FTRDC, *Balai Penelitian Teknologi Pangan, BPTP*) at Tambon, West Java.
- The Regional Center for Tropical Biology (Biotrop) of the Southeast Asia Ministers of Education Organization (SEAMEO) implements a program on the biology of tropical agricultural pests. This includes work on storage insects, pre- and post-harvest mycology of food crops, rodents, and weed ecology. Biotrop is sited near Bogor.
- Multilocational field trials of agricultural technologies are performed by provincial *Kanwil* offices and district and provincial technical agricultural services (*Dinas* offices) (SK Mentan 1989).
- Various private agro-chemical and seed companies develop and test products in Indonesia, often in cooperation with AARD research institutes.

Agency for Agricultural Research and Development

After Indonesia achieved independence in 1945, responsibility for research in agriculture was assigned to the various directorates-general of the Ministry of Agriculture: Food Crops, Estate Crops, Forestry, Fisheries, and Animal Husbandry. Recognition that research and development required stronger coordination led in 1974 to a presidential decree reorganizing these institutes under a new body, the Agency for Agricultural Research and Development (AARD, *Badan Penelitian dan Pengembangan Pertanian, Litbang*) (Baharsjah 1985).

The Agency's organizational structure has undergone a number of changes since that date, most notably in the establishment of several central research institutes that coordinate the work of their subordinate research institutes in 1979; the creation of a separate Central Research Institute for Horticulture; the transfer of responsibility for forestry research to the newly created Ministry of Forestry in 1983; and the transfer of research on estate crops to the independent Indonesian Planters' Association for Research and Development (Schumacher et al. 1991:2, AARD 1985b:4).

The agency now has ten Centers with coordinating, research, or technical functions,

16 research institutes, 43 research sub-institutes, and numerous experiment sites scattered around the country (Departemen Pertanian 1991) (Figure 4.1).

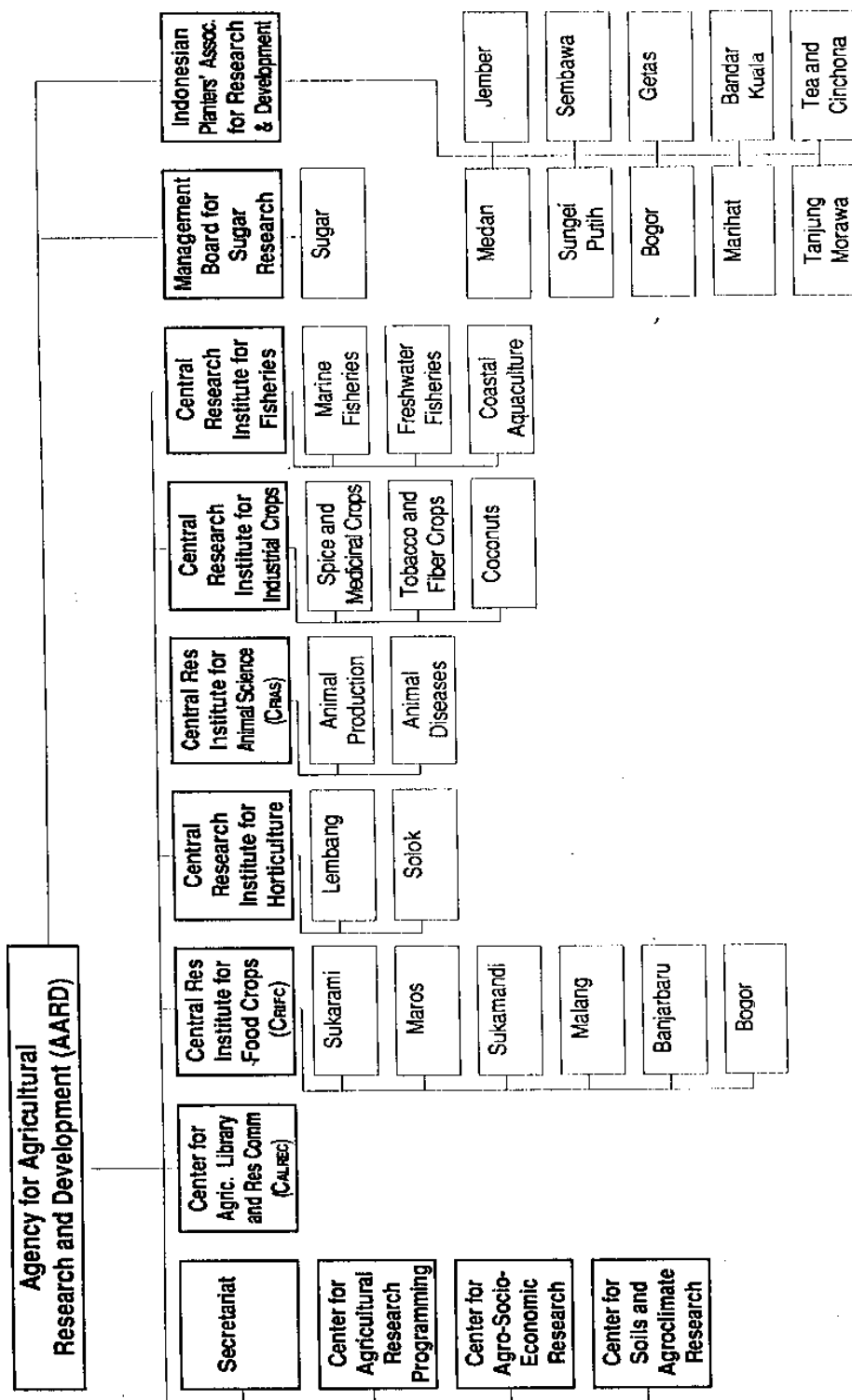


Figure 4.1 Organizational structure of the Agency for Agricultural Research and Development.

Figure 4.1 Organizational structure of the Indonesian Agency for International Research and Development.

The five central research institutes (for food crops, horticulture, industrial crops, livestock, and fisheries) conduct a limited amount of research themselves and manage multi-disciplinary projects involving several lower-level institutes. Each coordinates a number of specialist research institutes working on their particular group of commodities. Each of these subordinate institutes has the national mandate for research on a particular commodity or agro-climatic type. In addition, the centers for soils and agro-meteorology and for agro-socio-economic research conduct research as well as coordinate studies at other AARD units in their topic areas.

AARD has made major strides in developing its physical facilities and human resources. In 1975, shortly after its founding, the agency employed only 16 Ph.D. holders; by 1988, this figure had grown to 179 through an aggressive training program (Jahi 1991:7). The goal was to reach a total of 500 Ph.D.s by 1992 (but note that this total includes estate crops institutes no longer part of AARD) (AARD 1987:106).

Of AARD's units, three concern this study: the food crops and livestock research branches, and the Center for Agricultural Library and Research Communication (CALREC). These are described below.

Central Research Institute for Food Crops CRIFC (*Pusat Penelitian dan Pengembangan Tanaman Pangan, Puslitbangtan*) is the largest of the central institutes. It coordinates six Research Institutes for Food Crops (AARD 1985b, 1988:18; CRIFC 1986). These manage a total of 13 sub-institutes and 37 experiment farms. CRIFC's six research institutes are:

- Sukarami Research Institute for Food Crops, in the highlands of West Sumatra, performs research on crops grown on dryland under a wet climate, and on high-elevation rice.
- Maros Research Institute for Food Crops, in the coastal lowland of South Sulawesi, studies dryland crops under a dry climate.
- Sukamandi Research Institute for Food Crops, in the northern coastal plain of West Java, focuses on wetland cropping, primarily of rice.
- Malang Research Institute for Food Crops, in the uplands of East Java, researches non-rice food (*palawija*) crops.
- Banjarbaru Research Institute for Food Crops, in the tidal swamps of South Kalimantan, studies cropping in the swamplands that cover much of southern Kalimantan and eastern Sumatra.
- Bogor Research Institute for Food Crops, the largest of the six institutes, has research programs in many of these same areas. It supports the other units through pioneering and fundamental research and commodity analysis.

Central Research Institute for Animal Sciences CRIAS (*Pusat Penelitian dan Pengembangan Peternakan, Puslitbangnak*) coordinates two research institutes, which in turn manage six sub-institutes (AARD 1985b, CRIAS undated):

- The Research Institute for Animal Production (RIAP, *Balai Penelitian Ternak, Balitnak*), located in Bogor, focuses on the production, reproduction, post-harvest handling, and farm system management of livestock and livestock feed.
- The Research Institute for Animal Diseases (RIAD, *Balai Penelitian Veteriner, Balitvet*) is also sited in Bogor. It conducts research in livestock health.

Center for Agricultural Library and Research Communication CALREC (*Pusat Perpustakaan Pertanian dan Komunikasi Penelitian*) houses the 80,000-volume national library for agricultural sciences, a major national asset. It also publishes agricultural journals in English and Indonesian and coordinates the external communication of other AARD units. CALREC is the lead institution in the Research-Extension Linkages project, a major effort to improve AARD's ties with its primary clientele. CALREC communication activities are discussed later in this chapter.

Research planning in AARD

The research process in AARD begins when a scientist proposes a research project to his or her research program coordinator. The coordinator revises the proposal, and passes it on to the institute director for prioritization, and so on up through AARD (AARD 1984a:40, AARD 1984b:25, Badan Litbang Pertanian 1991:45-46).

Review teams have identified several weaknesses in this process (AARD 1984a:40, 1984b:26). These include the difficulty of coordinating research programs conducted at multiple sites and under the control of more than one institute director, and the danger that research topics reflect individual scientists' interests rather than national or AARD priorities. Since these comments were published in 1984, AARD has substantially strengthened its research programming activities, even creating a separate institute (Center for Agricultural Research Programming, CARP, *Pusat Penyiapan Program Penelitian, Pusgram*) to deal with it. Another positive step is that CALREC has begun soliciting ideas from extension personnel and local officials for research topics and information requirements; it passes these on to research institute administrators (Pustakom 1990).

Nonetheless, the task of identifying research problems is a primary responsibility of AARD, in consultation with relevant directorates-general, the national *Bimas* secretariat, and AAET (Abbas, Tjitropranoto, and Yakub 1989:56). There is limited potential for input from extension agents and farmers in the setting of research priorities. Hussein (1986:409) found that extension workers and farmers were the least and second-least important sources of research ideas for scientists at three AARD institutes. The most important sources were research headquarters, informal discussions with colleagues, and the scientific literature.

Researchers do receive requests from local farmers to solve problems, and those outside Bogor come under pressure from the provincial *Kanwil* to tackle immediate needs. Some researchers and administrators (including the members of an external review team [AARD 1984b:41, 43]) seem to regard such requests as distractions from AARD goals

rather than as vital links to its clientele. They saw many such problems as having limited applicability outside the immediate area, and as diverting scientists from addressing urgent national objectives.

The research institutes face an inherent conflict between their nationally mandated research priorities and immediate local needs. There is clearly a need for balance between them if both local credibility and national impact are to be maintained.

Research activities

Because of the size and variety of AARD's research program, I will focus here on the two areas of relevance to this study: food crops and livestock. Readers interested in other areas are referred to AARD's quinquennial report series (AARD 1987).

Food crops research AARD's food crops research activities are organized by commodities and problem areas: rice; *palawija* (non-rice food crops: maize, sorghum, soybean, peanut, mungbean, pigeonpea, cassava, and sweet potato); wheat; problem soils; farming systems; water management; and post-harvest technology and quality (CRIFC 1986). Research is conducted using CRIFC's own facilities, as well as on farmers' fields and special, often inter-institutional, projects such as farming systems research (e.g., SWAMPS-II 1991).

The output of one type of food crops research -- varietal breeding -- is easy to measure. In the period 1981-1986, about 30 new rice varieties were released in Indonesia, most developed by CRIFC breeders. In the same period, breeders released ten new varieties of maize, eight of soybean, five of peanut, and six of mungbean (AARD 1987:8-18). Several of these varieties have proved extremely popular and have been rapidly adopted by farmers.

Livestock research Livestock research is organized into ten program areas: cattle and buffalo production; sheep and goat production; poultry, eggs and pig production; animal nutrition; breeding; farming systems; large ruminant diseases; small ruminant diseases; poultry diseases; and the diseases of other animals (CRIAS undated).

A good example of the type of livestock research performed is the Small Ruminant-Collaborative Research Support Program (SR-CRSP). Funded by USAID and the Indonesian government, SR-CRSP researchers have studied the genetics and breeding of goats and sheep, their feeding and nutrition, labor needs and marketing. They developed methods for raising sheep under rubber trees, and established pilot projects to demonstrate the benefits of the improved methods to farmers, extension workers, and policy makers (SR-CRSP 1990).

Technology recommendations

The process of turning a research finding into a recommendation and disseminating it to farmers is a complex one. The following discussion is based on the most recent relevant ministerial decree (SK Mentan 1989), an interpretation of this (Abbas, Tjitropranoto, and Yakub 1989), and discussions with numerous AARD researchers and administrators. The dashed lines in Figure 4.2 summarize the main communication channels prescribed by these sources.

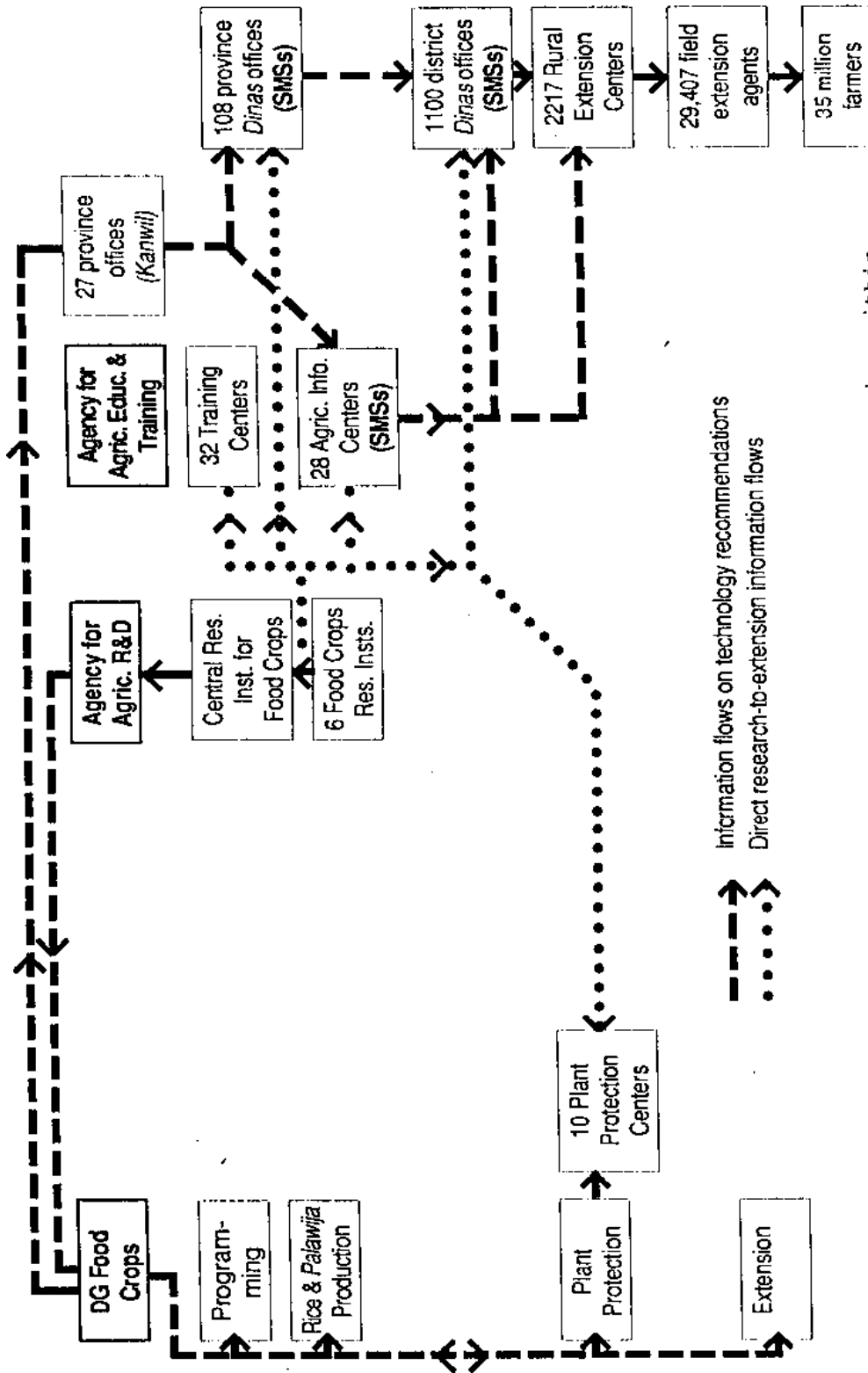


Figure 4.2 Simplified information flows from research to extension within the Ministry of Agriculture for a hypothetical food-crop pest-control technology.

AARD's task is broadly defined as agricultural research. The agency is not allowed to make technology *recommendations*: this is the prerogative of the relevant directorate-general at the national level and the *Dinas* offices at the local levels. Instead, researchers are to provide *information* that these other units can evaluate and base recommendations upon.

Briefly, AARD researchers identify research problems, perform research, and inform the relevant directorate-general in Jakarta of the findings. Senior AARD administrators and directorate-general officials together divide research findings into three groups:

1. Results that can be used in formulating technology recommendations.
2. Findings that need to be subjected to local verification trials.
3. Results that still need to be adapted so as to fit local agroecological conditions.

From here on, AARD is in a merely supportive role.

Technologies in the first group are deemed suitable for immediate release. The directorate-general informs provincial *Kanwils*, *Dinas* offices, and other relevant local bodies of the technology. These bodies then include it in local recommendations where relevant.

Technologies in the third group are returned to AARD for further adaptation and testing.

The directorate-general chooses technologies from the second group to subject to local verification trials. The directorate-general, AARD, *Bimas*, and AAET cooperate in managing such tests. The tests themselves are performed by extension subject-matter specialists on government or farmers' land. The results are communicated via workshops held by the managing institution in cooperation with the provincial *Bimas* secretary and AIC. If necessary, local testing can be conducted at the provincial and district levels by the provincial *Dinas* office.

The provincial AIC staff select findings from the AARD research and local trials for inclusion in a technology packet (see the discussion at the end of this chapter). The AIC then produces and distributes these packets. District *Dinas* offices select those packets suited to their areas, and run technology demonstrations and field days in conjunction with field extension agents and farmers. Farmers are then expected to disseminate the technology autonomously (curiously, Abbas, Tjitropranoto, and Yakub 1989 make no mention of how the training-and-visit system is integrated into this process). Ensuring feedback is the primary responsibility of provincial and district *Dinas* offices and the program extension agents.

Characteristics of the recommendation process

While the above brief description obviously grossly oversimplifies reality, several things are clear. (I will discuss two exceptions allowed by the model later.)

- **Gatekeepers** Most obviously, an item of information must pass through a large number of gatekeepers if it is to reach its destination. It is expected to rise from the individual researcher up through a series of research administrators to the AARD leadership. It must then cross over into another bureaucracy, and descend through another series of gatekeepers and across institutional boundaries to the end users.
- **Delay and distortion** At each stage, the information must be processed to suit the needs of recipients in the next stage: summarized and translated from research language to policy language, converted into guides for verification trials, and translated and reproduced to form extension training materials. The possibilities for delay, loss and distortion are legion.
- **System size** A large number of people and organizations, at various levels of government and scattered throughout the country, are involved throughout this process. Smooth communication, including personal consultations, regular distribution of publications, and systematized flows of messages are vital to the process. This communication is sometimes not as smooth as could be wished, given the lack of telecommunications and the formidable geographic and organizational barriers that must be surmounted.
- **Centralization** The information flow is extraordinarily centralized. In theory at least, all relevant information must pass through the hands of a few key policy makers in Jakarta -- and they must discuss it at a meeting. It is unrealistic to expect them to understand all the nuances of the technology or appreciate all the possible local ramifications of its use.
- **Responsibility** The direct responsibility of AARD ceases when technologies are identified for local testing. Even this is done by senior administrators rather than individual researchers. The individual researchers and senior administrators thus have little opportunity or incentive to ensure that technology practices are in fact tested adequately or disseminated to farmers. In fact, no one in the whole system appears to have any stake in the successful adoption of a technology.
- **Overlap** There is considerable fear within the research and extension system of invading the "turf" of another institution, or having one's own turf invaded. Thus researchers are extremely wary about being seen to perform extension work, and many in extension agencies are sensitive to AARD attempting to take over such a role. Similarly, AARD scientists resent attempts by extension to perform research. This is despite the desirability of overlapping research and extension involvement in all aspects of technology generation and dissemination (e.g., Abbas 1991:13, Siwi and Mundy 1986).

- **Feedback** Despite the inclusion of "feedback" in the model, there is little opportunity for local involvement. There is little scope for local initiative in the process, and limited possibility for good, or bad, news to filter up the chain of institutions to the national level and then down again to AARD researchers (Widjono 1986:62).
- **Horizontal links** There are few opportunities built into the model for horizontal communication among, say, farmers, extension personnel and researchers working in the same area. While such communication does of course occur in practice, especially in field research projects such as AARD's farming systems research activities, the majority of communication remains vertical.

Alternative information routes

The ministerial decree (SK Mentan 1989) allows two exceptions that give sufficient flexibility for it to be workable. These are as follows:

- If a technology is locally applicable and is not in conflict with directorate-general guidelines, it may be adopted as a local recommendation while awaiting a decision by the directorate-general (SK Mentan 1989:§7.3). This allows local extensionists to tell farmers to do what works locally rather than what a bureaucrat in an office in Jakarta thinks ought to work.
- Two-way information flows between research and extension are encouraged (SK Mentan 1989:§12). This opens up numerous possibilities for horizontal communication. For instance, it encourages researchers to visit farmers' fields to identify problems, allows research institutes to publish materials with an extension audience in mind, and permits them to send publications directly to extensionists instead of having to go through the bureaucracy.

These two sections in the ministerial decree effectively create a fourth category of research finding: technology that is not important enough nationally to pass through the directorate-general. Technologies with a major potential national impact (for instance, a new rice variety or a vaccine against Newcastle disease) must pass through the directorate-general. This is because they may greatly increase requirements for inputs such as seed, agro-chemicals, or pharmaceuticals, or may have a major effect on farmer incomes or marketing arrangements. Other technologies (for instance, changing the materials from which chicken nesting boxes are made) have a much smaller potential impact but still may be valuable. Such technologies are likely to be communicated through the horizontal channels. These are denoted by dotted lines in Figure 4.2.

The literature on linkages

The linkages between research and extension in Indonesia have been subject to a wide range of comment. Table 4.2 lists publications that have dealt with this topic in the last decade. With few exceptions (most notably Wardoyo 1990, see below), authors either note that research-extension linkages are poor, or accept this implicitly in seeking to improve them (e.g., Baharsjah 1985:30, Padmanagara 1985:137, Hadiwigeno 1991:22, Widjono et al. 1989).

Table 4.2 References on research-extension linkages in Indonesia.

<p>Research communication, research-extension links</p> <p>AARD 1985a</p> <p>* Abbas et al. 1989</p> <p>Andyantoro et al. 1989</p> <p>Baharsjah 1985</p> <p>Eriyatno 1988</p> <p>Ewell 1989</p> <p>• Hussein 1986</p> <p>* Jahi 1991</p> <p>* Kanwil Deptan Sulsel 1990</p> <p>• * Mansur 1989</p> <p>MORIF/AARP undated</p> <p>• Mundy et al. 1991</p> <p>• Mundy et al. 1992</p> <p>NIA and DGRD 1982</p> <p>Padmanagara 1985</p> <p>* Pustaka 1990a</p> <p>* Pustaka 1990b</p> <p>* Pustakom 1991a</p> <p>* Pustakom 1991b</p> <p>Sadikin 1982</p> <p>Schumacher et al. 1991</p> <p>* Sejati 1991</p>	<p>• * Simandjuntak 1988</p> <p>Siwi and Mundy 1986</p> <p>* SK Mentan 1989</p> <p>• * Sophia 1988</p> <p>• Sunarno 1983</p> <p>* Sunarno et al. 1989a</p> <p>* Sunarno et al. 1989b</p> <p>* Sunarno et al. 1989c</p> <p>* Syam and Widjono undated</p> <p>SYGAP 1989</p> <p>• Tjitropranoto 1991</p> <p>Tjitropranoto and Syam 1989</p> <p>* Wardojo 1990</p> <p>• * Widjono et al. 1989</p> <p>* Widjono 1990</p>
	<p>Technology adoption</p> <p>• IDRC 1986</p> <p>• Ludgate and Priyanti 1988</p> <p>• Thomas 1989</p> <p>• Wahyuni et al. 1990</p> <p>* Widjono 1989</p>

• Data-based study

* In Indonesian.

Evidence against poor linkages

The comments by Wardoyo (1990:10-12), the current Minister of Agriculture, merit attention. At a seminar at Bogor Agricultural University in 1990, he stated that poor research-extension linkages are not a problem in Indonesia,

"because if they were, we [Indonesia] would never have achieved the self-sufficiency in foodstuffs that we have maintained since 1984, and in the spread of new crop varieties, we would not be able to disseminate new varieties to every corner of Indonesia in a space of only three seasons" [my translation].

Wardoyo admits that research-extension linkages were a problem before the First Five Year Plan (pre-1967), but that this had been overcome by increasing the number of SMSs to bridge the research-extension linkage, boosting the number of field agents, building Agricultural Information Centers in each province, using researchers as instructors in training courses, and encouraging private companies and farmers to multiply new varieties.

Indonesia's attainment of rice self-sufficiency was indeed impressive, as are the speed with which new rice varieties are made available and farmers' willingness to adopt them. In wetland rice, at least, research-extension links seem to work. But production gains for most other commodities have been less spectacular (Table 3.1).

Why this difference? One possible reason is the importance of rice to Indonesia and Indonesians. Rice has a high political profile, an enormous amount of resources have been poured into boosting its production, and the crop receives the lion's share of attention from research, extension agencies, and farmers. Other commodities enjoy much less attention, though soybeans and chickens have more recently attained a high political profile and have been given a large amount of extension resources through *Bimas* programs.

A second reason relates to the physical environment. Wetland rice is grown under unique conditions: in a shallow, artificial swamp. The land is flat, physical soil characteristics are relatively unimportant as a determinant of yields because of the ameliorating effect of flooding (De Datta 1981:48, Grist 1986:24), the standing water suppresses weeds and precludes drought stress, and the rice is typically monocropped. Growing conditions are relatively uniform from one end of a rice field to the other, and even from one end of Indonesia to the other. This means that it is relatively easy to develop rice varieties and fertilizer and pest control recommendations that apply to large areas.

Such conditions do not apply to other crops and livestock. (I am indebted to an anonymous interviewee for pointing this out.) They are grown on sloping land with a wide range of soil types and climatic regimes, and are subject to a wider range of weeds, pests, diseases, and environmental stresses at any stage of their growth cycle. They are typically grown together with numerous other species. Conditions may vary markedly from one end of a plot or barn to another, and from one day to the next. The job of researchers and extension personnel is far more difficult in such situations, and the requirements for communication among them are more complex.

While possibly valid for wetland rice, Wardoyo's explanation may thus not apply other commodities. Let us now turn to the evidence supporting the contention that linkages are poor.

Evidence for poor linkages

Despite the attention given to the topic, most of the evidence for poor research-extension linkages remains anecdotal. There have been relatively few empirical evaluations; AARD institutes have conducted few such studies themselves, though this is being planned by CALREC (Schumacher et al. 1991:46). An exception is the study of a farming systems research project in West Java (Widjono et al. 1989), which looked at interpersonal communication among project researchers (mostly junior scientists) and extension personnel. It concluded that while the two groups worked and socialized together, the scientists rarely discussed research findings with their extension colleagues because they felt they had no right to do so. They saw this as the prerogative of their senior research colleagues, who were based outside the project area.

AARD scientists have conducted several evaluations of technology adoption, mostly associated with farming systems research projects (e.g., IDRC 1986, Ludgate and Priyanto 1988, Wahyuni et al. 1990). The findings from these have been mixed; perhaps the main lesson to be drawn from them is the importance of government support in the form of credit and timely input supplies if farmers are to adopt new agricultural technologies.

Two external reviews have been completed of AARD's communication activities (AARD 1985a, Schumacher et al. 1991), pointing out the need to strengthen links. External reviews of other AARD activities (e.g., of horticultural and non-rice food crops research) have also commented on this need (AARD 1984a, 1984b).

Most of the published evaluations are theses; however, some have been of questionable quality, for instance testing uninteresting hypotheses, using poorly worded questionnaires, or applying inappropriate statistical tests.

Mansur's (1989) survey of SMSs in South Sulawesi found no consistent relationships between the SMSs' personal characteristics and their use of three AARD publications. Simandjuntak's (1988) findings on the readership of a veterinary scientific journal by field extension agents must be treated with caution because of data and statistical validity problems: his questionnaire did not ask whether the respondents had ever received the journal (they are not sent it directly), and his analysis uses inappropriate statistical tests.

Sunarno (1983) studied the reactions of SMSs in three provinces to various AARD publications: CALREC's well-illustrated, color publications, written in easily understood language; and technical reports and scientific journals published by the food crops research institutes. She found that the semi-popular publications were more readable and important for extension purposes than the scientific publications.

While Hussein (1986:415-422) focussed mainly on the extension-farmer link, he also questioned researchers and SMSs about their communication behavior. He found that mutual visits were extremely infrequent: researchers made a mean of 0.5 visits to SMSs per year, while SMSs made 1.5 visits per year to researchers. More than half the researchers questioned never met with SMSs informally. Other types of interaction, such as producing written materials, conducting field days, making farm visits, and making and receiving visits

to or from other extension personnel, were also infrequent.

Sophia's survey of food crops SMSs in West Java is probably the most useful study of this important group of AARD clients to date. Among her findings are (page references are to Sophia 1988):

- SMSs rarely read information on agricultural research findings (pp. 52, 117).
- Visits to information sources are infrequent: only one-third visited a research institute, university, AIC, or other institutional information source more than once every six weeks (p. 56).
- An informal network among SMSs was their most important information source. Training, AICs, libraries, and research institutes were also relatively important; the mass media and universities were not (p. 58).
- Major information needs were in extension methods, marketing, most aspects of legume cropping, and irrigation (p. 66).
- SMSs wanted adaptive and applied research results rather than findings from basic studies (p. 72).
- By an overwhelming majority, they preferred research information to be sent directly to them or to their home *Dinas* offices rather than to be made available only at AICs or research institutes (pp. 64, 73).

Attempts to improve linkages

Three notable recent developments are opening the way to improved linkages. One is farming systems research, in which AARD has been a world leader. Such projects allow researchers, extension personnel, and farmers to interact and solve problems together. They can be highly effective at communicating improved technologies to other farmers, extensionists and government officials (e.g., SYGAP 1989:12), though this is not always the case (Widjono et al. 1989). Some of these projects are managed jointly by AARD and extension agencies (Ewell 1989:22).

Second, the Research-Extension Linkages Project, led by CALREC, is a major attempt to improve the two-way exchange of information among research and extension institutions (Tjitropranoto 1991). It includes workshops, publications, and research activities to identify and remove communication bottlenecks. It has prompted a spate of writing on linkages (e.g., Abbas 1991, Hadiwigeno 1991, Jahi 1991, Pustaka 1990a, Pustakom 1991a-b, Sejati 1991, Sunarno et al. 1989a-c, Widjono 1990). Much of this writing has resulted from a series of meetings to discuss linkages held in various locations around Indonesia (West Java, South Kalimantan, South and North Sulawesi, North and West Sumatra, and Bogor) attended by researchers, extension personnel, local government officials, and farmers.

Third, and on a smaller scale, several individual research institutes have begun publishing materials aimed specifically at extension agents. These include:

- Illustrated manuals on sheep and goat management published by the Research Institute for Animal Production (Ludgate 1989).
- Single-page research fact sheets called *Sambung Litluh* ("Research-Extension Link", Figure 4.3) published jointly by AARD institutes and projects and local agricultural authorities. Examples are those produced by Maros Research Institute for Food Crops in South Sulawesi and by the Upland Agriculture Conservation Project in Central Java, in cooperation with extension institutions and local governments (James H. French 1991, personal communication; Kanwil Deptan Sulsel 1990, MORIF/AARP undated).

Penggunaan Tempat Pakan Untuk Meningkatkan Konsumsi Ransum Sapi

Darwinsyah Lubis

Ransum merupakan faktor utama yang menentukan produktivitas ternak. Oleh karenanya, untuk memperbaiki mutu dan konsumsi ransum perlu mendapat perhatian khusus. Di pedesaan, pada umumnya ransum sapi ditetakkan di lantai kandang.

Kadaan demikian akan menyebabkan ransum menjadi berserakan, mudah tercemar air seni dan tinja sapi serta kotoran lainnya. Kondisi ini diperburuk dengan kurang baiknya kualitas gizi dari ransum yang tersedia, sehingga hal tersebut akan menyebabkan selera ternak untuk makan (palatabilitas) menjadi menurun, yang pada gilirannya akan mengakibatkan lambatnya laju pertumbuhan serta rendahnya produktivitas ternak.

Penggunaan tempat pakan yang sederhana, tetapi memadai, merupakan usaha ke arah itu dan sejalan dengan rencana peningkatan produksi ternak dengan menggunakan teknologi sederhana di tingkat pedesaan.

Salah satu kendala penggunaan tempat pakan sapi tersebut adalah daya tahannya yang sangat tergantung dari tindakan perawatannya, yaitu harus dijaga kebersihannya, antara lain harus tetap kering dan tidak ada sisa ransum, sehingga perlu tenaga dan biaya tambahan. Kandang harus beratap agar tidak kena hujan. Tetapi tambahan biaya tersebut akan dibayar dengan nilai tambah yang lebih besar dalam jangka waktu tertentu, yaitu berupa pertam-



Gambar 2. Tempat Pakan di Kandang

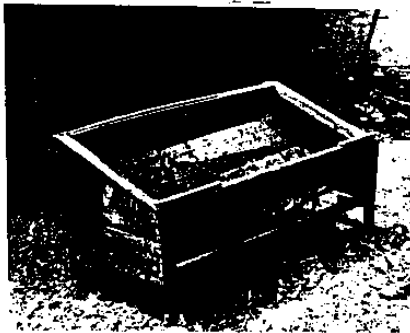
bahan konsumsi ransum yang diikuti dengan penambahan berat badan ternak yang pasti lebih baik. Efisiensi ini disertai dengan adanya penghematan biaya ransum sebanyak Rp 19.000,- sampai Rp 28.000,-/tahun untuk 1 - 2 ekor sapi.

Perkembangan Penelitian

Tempat ransum (pakan) ini dibuat dengan bentuk yang sederhana dari bahan yang banyak tersedia di pedesaan, serta cukup murah.

Bahan dan persyaratan pembuatan tempat pakan :

- Kayu dari pohon (k. Se-ngon/k. Sono) yang ada di lokasi atau dari bahan bambu;
- Bahan dari kayu harus diserut sehalus mungkin;
- Hindari sekecil mungkin adanya celah pada sambungan;
- Gunakan pasak kayu untuk menyambung. Jika menggunakan paku usaha kan agar ujungnya tidak menonjol keluar;
- Pertautan di bagian dalam usahakan tidak lancip (membentuk sudut tajam), kulit bambu berada di bagian dalam tempat pakan;



Gambar 1. Contoh Tempat Pakan di Gunungsari

Badan Penelitian dan Pengembangan Pertanian
Proyek Penelitian Penyelamatan Hutan Tarah dan Air

Sambung Litluh

Sambung Litluh memuat hasil-hasil penelitian sebagai informasi untuk penyuluh

Front side of a 1991 issue on using fodder troughs for livestock. Printed in black and white, with the masthead in red. Distributed by Ungaran Agricultural Information Center, Central Java.

Figure 4.1 *Sambung Litluh* research fact sheet, produced by the Upland Agriculture Conservation Project, Central Java.

- Technical guides on individual crops published by the food crops research institutes.

AARD research communication departments

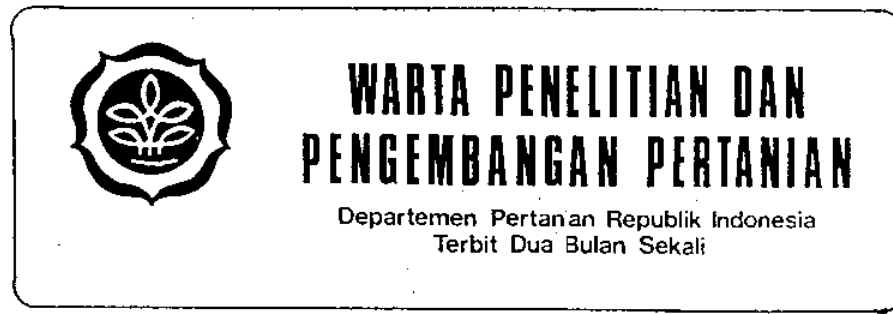
Each AARD central institute or research institute has a unit charged with the communication of research findings. The units' duties include managing the institute's library, providing in-house services such as producing slides for scientists' presentations, and managing communications with clients. They are coordinated by CALREC.

CALREC

Recognition of the importance of communication and the need to coordinate AARD's communication efforts (e.g., ISNAR 1981:5) led the National Library for Agricultural Sciences in 1990 to add the coordination of research communication to its mandate. It was renamed the Center for Agricultural Library and Research Communication (CALREC).

CALREC produces a number of monographs and journals in both English and Indonesian, including the prestigious semiannual scientific journal *Indonesian Journal of Crop Science*. Serials intended for more general audiences include the quarterly *Indonesian Agricultural Research and Development Journal* in English, and its Indonesian equivalent, *Jurnal Penelitian dan Pengembangan Pertanian*. CALREC also publishes a bimonthly biological index and a semiannual list of abstracts of Indonesian agricultural research results. This publication effort is large and publication often lags several years behind schedule (Schumacher et al. 1991:12).

Of particular note for this study is CALREC's bimonthly newsletter, *Warta Penelitian dan Pengembangan Pertanian* (often referred to as *Warta Litbang*) (Figure 4.4). This four-color, 12-page newsletter is the most widely distributed AARD publication. Previously 10,000, its print run is now 2500 to 5000, depending on the availability of funding. It is the only AARD publication regularly sent to *Dinas* offices at the district level. However, budget shortfalls sometimes mean that *Warta Litbang* is published late or not at all.



Vol. 10 No. 6

November 1988

Dikenal ada sirsak (*Annona muricata* L.) yang rasanya masam dan ada pula yang rasanya manis. Sirsak yang rasanya masam banyak tersebar secara luas pada ketinggian 0–800 meter di atas permukaan laut terutama di daerah Jawa Barat. Sedangkan sirsak yang rasanya manis masih jarang ditemukan. Hasil survei buah-buahan unggul yang dilakukan penulis pada bulan Desember 1988 di sekitar Pelabuhanratu, Jawa Barat; kedua jenis sirsak ini ditemukan.

Pada waktu survei ini sirsak yang rasanya masam kurang mendapat perhatian karena tidak banyak berbeda dengan sirsak masam dari daerah lainnya baik dari segi produktivitas maupun kualitas buahnya. Sedangkan sirsak yang rasanya manis diambil cabang entris dan bijinya untuk bahan perbanyakan di Kebun Percobaan Buah-buahan Balithort Cipaku, Bogor, yang juga merupakan tempat pemeliharaan plasma nutfah sementara sebelum ditanam di Kebun Plasma Nutfah Buah-buahan Subang.

Sirsak manis ini ditemukan tepatnya di Desa Karangpapak, Pelabuhanratu, Kabupaten Sukabumi, Jawa Barat. Oleh pemilik pohon sirsak manis ini sirsaknya dinamakan sebagai "sirsak ratu". Umur pohon pada waktu

Plasma Nutfah Sirsak



Sosok buah sirsak ratu menjelang tua, tampak duri-durinya mulai merenggang

Front page of November 1988 issue, reproduced 65% of actual size. The original has high-quality, four-color printing. The lead story in this issue is on preserving soursop germplasm.

Figure 4.2 *Warta Litbang*, AARD's bimonthly newsletter.

CALREC staff are relatively well qualified in communication fields. Several have obtained master's degrees through Bogor Agricultural University's graduate program in development communication. CALREC has held numerous training courses and workshops on research communication for staff of other AARD institutes and other parts of the Ministry of Agriculture.

Central research institutes

Until 1985, the only other operating communications units within AARD were at the central research institute level. The largest of these is at the Central Research Institute for Food Crops. From 1985 to 1990, this unit published 18 major book titles (mostly symposium proceedings), five issues of the occasional English-language periodical *Contributions of CRIFC*, and numerous research reports and brochures. Unlike most of its counterparts, the unit has its own mini-offset printing press, giving it considerable flexibility and the ability rapidly to produce single- or two-color publications. Again unlike most other units, several of the CRIFC unit staff have graduate degrees in communication; this has enabled them to conduct several training courses for communication personnel in other AARD institutes.

The communication unit at the Central Research Institute for Animal Science has been less well supported. It lacks a printing press and adequate computing facilities. Nevertheless, it has been active in publishing symposium proceedings; between 1985 and 1991 it published 11 such volumes (Sejati 1991). It plans to renew publication of the review journal *Wartazoa* shortly.

Research institutes

Realization that research communication was being neglected led in the mid-1980s to the creation of Information Units in all AARD research institutes. These took over some of the functions of the existing communication departments at the central research institute level. For instance, the newly created information unit at Bogor Research Institute for Food Crops took over from CRIFC's communication department the publication of the prestigious Indonesian-language triannual scientific journal *Penelitian Pertanian*. The other food crops research institutes also began publishing their own journals: *Pemberitaan Penelitian Sukarami* by the Sukarami institute, *Media Penelitian Sukamandi* from Sukamandi, *Penelitian Palawija* from Malang, *Agrikam* from Maros, and *Pemberitaan Penelitian Banjarbaru* from Banjarbaru (Puslitbangtan 1990). The livestock research institutes publish the journals *Ilmu dan Peternakan* and *Penyakit Hewan* (Schumacher et al. 1991:28-29, Puslitbangtan 1990, Puslitbangnak undated). Nearly all AARD institutes now publish their own scientific journals (Tjitropranoto and Syam 1989:343).

AARD audiences

Research institutes must serve three main clienteles: policy makers, scientists, and extensionists. They have so far concentrated mainly on reaching the policy makers and scientists.

Policy makers

Policy makers have been a priority because the communication units must respond to orders from above. The units have to provide the upper levels of the hierarchy with high-quality (and therefore costly) material, often on short notice. They also aim for visibility for their institute to ensure continued funding and attention.

Scientists

The communication units have also served scientists by publishing institute journals and symposium proceedings. There are a number of reasons for this. The agricultural literature in the Indonesian language is very small, and there has been a conscious attempt to expand and improve it. Scientists are familiar with the "scientific" style of writing, and find it easier to write a research paper than to summarize their findings for an extensionist's use. The communication units find publication of such journals easier for the same reasons. Researchers are keen to publish in such journals, as under Indonesian civil-service rules, their promotion depends largely on the number of scientific articles they write. Articles published in prestigious journals amass the author a larger number of credit points that can be used toward promotion. Scientific publications also contribute to the prestige of an institute, and so are likely to attract funds from administrators.

Extension

Providing information for extension has none of the benefits enjoyed by serving the policy maker and scientist clienteles. The prime task of AARD and its researchers ends once a research finding has been disseminated (Abbas, Tjitropranoto, and Yakub 1989:56). There is thus little commitment to (or funding for) publishing materials aimed at extension. Suitable publications for this audience are likely to be newsletters, brochures, technical and "how-to" guides, and summaries of a particular research area. None of these are "high-profile" or prestigious publication types, and scientists cannot achieve promotion by writing them.

These factors combine to produce a preponderance of output in the form of scientific articles rather than formats more suited to extension and farmer audiences. AARD appears to serve policy makers and scientists relatively well. The extension clientele is only now beginning to receive serious attention. Nevertheless, the comments below about weaknesses in research-extension linkages should be seen in light of the multiple audiences

the research institutes must serve.

AARD communication activities

The most important channels for research communication are libraries, publications, scientific and consultative meetings, field days, on-farm research, training courses, and informal communication (Schumacher et al. 1991:22-44, Siwi and Mundy 1986, Tjitropranoto and Syam 1989:343-345).

Libraries

Each AARD institute has its own library, coordinated by CALREC. However, with certain notable exceptions, these libraries suffer from a lack of attention and funding from institute leaders, their facilities and services are under-utilized by researchers, and they fail to share scarce resources among themselves (Schumacher et al. 1991:24-24).

Publications

While there is considerable variation among institutes, most communication units seem to devote most of their energies to editing and producing publications. These include research journals, symposium proceedings, technical guides, annual reports, newsletters, and brochures. I discuss these in greater detail below.

Scientific and consultative meetings

Although they may be open for extensionists, these meetings are normally aimed at researchers and policy makers. They therefore often do not provide the type of information that extensionists can use in solving problems in the field. Moreover, many are ad-hoc in nature and lack coordinated follow up (Schumacher et al. 1991:37). Meetings are, however, an important means of exchanging information with policy makers, including the extension hierarchy.

Field days

Exhibitions and open days at research sites offer extensionists the opportunity to see the use of new technology in the field and to discuss directly with the researchers. They are most often held as part of farming systems research projects (Tjitropranoto and Syam 1989:344). However, they are held infrequently, only a limited number of topics can be covered at a time, and logistics and cost severely restrict the number of extensionists who can attend. The discussions are not published, and so there is no permanent record that can be referred to at a later date or by other extensionists.

On-farm research

AARD has several on-farm research projects, particularly in a farming systems research context. However, information exchange among project researchers and extension personnel may not be as great as is sometimes supposed (Widjono et al. 1989, see above). Projects sometimes fail to take full advantage of their communication possibilities, and the number of people that can visit a site is limited by logistics and cost.

Training courses

AARD institutes occasionally hold training courses for extension personnel, and scientists are sometimes invited to make presentations to courses held at the ministry's in-service training centers. However, both are rather infrequent: researchers participate on average in one such course less than once every five years (Hussein 1986:422).

Constraints to research communication

Research communication by AARD institutes face a number of constraints (Schumacher et al. 1991:32-33). These are discussed below.

Publication authorship and production

Publications are produced irregularly or infrequently. This means that research results may be untimely when they reach their audience (Schumacher et al. 1991:32).

The promotion system based on credit points militates against researchers' collaborating on joint publications, since the number of credits allocated per publication is divided up (unequally) among the authors. The same is true of collaborative articles between researchers and extension personnel (Schumacher et al. 1991:32).

The format of publications is not standardized, adding confusion as to what is editorially acceptable. Some journals change their format frequently (Schumacher et al. 1991:2).

Communication staff status and skills

Senior staff in the institutes' information units are often drawn from among the institute scientists, so have technical backgrounds in science but limited skills in or commitment to communication. In some institutes, frequent changes in unit leadership lead to lack of continuity and momentum. In others, the information unit is even seen as a convenient backwater for placing personnel unwanted elsewhere (anonymous informant 1991). Many staff of institute communication departments have limited training in communication. There is a shortage of staff with skills in such areas as editing, publication design, desktop publishing, publication management, photography, and graphics.

Scientist authors may view editors as gatekeepers to be assuaged or bypassed rather than as allies in the struggle for audience understanding (Widjono 1990). Tensions can be heightened if the scientist regards the editor as having low status because of poor qualifications. Under such circumstances, it can be difficult for editors to require changes in a manuscript, enforce deadlines, and maintain compliance with manuscript submission requirements.

Communication policy and funding

There is no systematic policy for working with the mass media (Schumacher et al. 1991:34). Two agricultural periodicals, the newspaper *Sinar Tani* and the magazine *Trubus*, receive nationwide distribution (Figure 3.7 and Figure 3.8). In addition, the government subsidizes many rural newspapers through the *Koran Masuk Desa* program. But AARD has no policy for working with these and other media. They do not produce press releases, since this is seen as the prerogative of the Ministry of Agriculture's public relations department, and communication unit staff lack skills in this area. A number of well-known agricultural researchers (mainly at universities) do write for newspapers fairly regularly, but their articles tend to discuss policy questions rather than provide technical details. Nor do the communication units engage in public relations activities, except for handling visitors and holding occasional exhibitions of research findings.

The publication budget is inadequate and often fails to cover the cost of distribution. Print runs and the speed of distribution depend on the budget available rather than the potential needs of the audience. Many copies remain undistributed because of insufficient funds (see discussion below).

AARD publications must be given away free of charge to qualified individuals (such as extension personnel) and institutions (such as university libraries). There is no provision under government accounting rules for them to be self-financing. While some institutes do sell some publications from their own premises or through local bookstores, the number involved is very small and there is no attempt at marketing them to a wider audience. This is despite the potentially large audience for some publications, such as major symposium proceedings or textbooks.

Publication distribution

AARD publication print runs are typically small. For instance, the Central Research Institute for Food Crops typically produces about 1000 copies of its publications, the number depending on the size of the publication and the amount of budget available. They are distributed to CRIFC researchers, plus a mailing list of 413 addresses, including ministry officials in Jakarta, university libraries, and provincial-level agricultural officials and institutions (heads of *Kanwils*, food crops *Dinas* offices, SMS provincial coordinators, AICs, Seed Centers and Seed Certification Centers, provincial planning offices, and agricultural training centers) (Puslitbangtan 1991). They are *not* sent to any institution at the district level, (e.g., to district *Dinas* or *Bimas* offices), to individual SMSs, or to agricultural high schools

The situation is similar for animal science publications. Print runs of CRIAS publications range from 300 to 1650. CRIAS has a mailing list of about 550 addresses, including ministry officials in Jakarta, provincial institutions, and livestock *Dinas* offices in some (though not all) districts (Puslitbangnak 1991). The mailing list of the veterinary institute contains 181 addresses outside the institute itself; a total of 500 copies of the scientific journal *Buletin Balai Penelitian Veteriner* are printed (Balitvet 1991, Simandjuntak 1988:58). The animal husbandry institute's mailing list contains 161 names (Balitnak 1991).

The only AARD publication with a print run large enough to be sent to all SMSs is the bimonthly newsletter *Warta Litbang*, published by CALREC (Figure 4.4). CALREC maintains a large database of addresses, but many of these are out of date.

Mailing lists are maintained either on paper (with handwritten corrections) or in a word processing file. There has been an attempt by CALREC to train research institute personnel in database management (Haryani and Mulyati 1990), but such efforts have been limited.

Limited publication dissemination budgets mean that some publications are not mailed out immediately (Schumacher et al. 1991:33). This reduces their timeliness and negates the purpose of producing the publication in the first place.

AARD has recognized that the problem of publication distribution is severe (Schumacher et al. 1991:32, Tjitropranoto 1991:6). As described above, it has three causes:

- Limited funding means print runs are too small to send copies of publications to everyone that needs one.
- Adequate mailing lists are not maintained.
- Limited budgets mean some publications remain in storage instead of being distributed to users.

The first of these problems is also faced by AICs in their publication program (see the earlier discussion of this).

Summary

Research-extension linkages in Indonesia are complex. The research and extension systems are separated into different administrative divisions within the Ministry of Agriculture, and the official process of developing technology recommendations is highly centralized. Direct contacts between researchers and extension personnel are limited.

All AARD institutes have units responsible for fostering the flow of research-based information to extension and other audiences. These units use a variety of dissemination methods, but face numerous internal and external constraints. The result is that most AARD institutes have not actively served their extension audiences.