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How Systems Work

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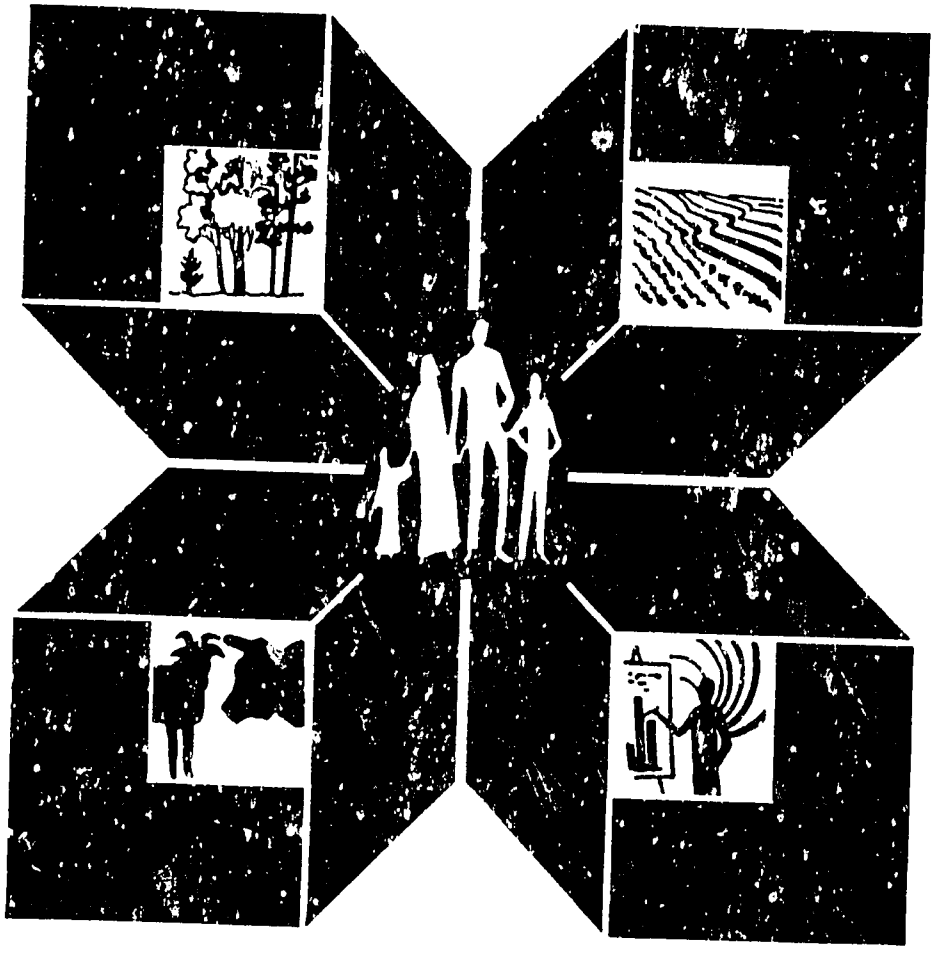

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After spending three years as a research fellow at Ahmadu Bello University, Zaria, Nigeria, David began employment with Kansas State University, becoming a professor. He was named head of the Department of Agricultural Economics and Rural Sociology at Ahmadu Bello in 1973 and remained in that post until 1967 when he returned to Kansas State to teach agricultural economics from 1976 to 1982. He has 22 years of experience in his discipline and 17 years of overseas experience.

His publication record began in 1964 while he was at Oregon State University. A prolific author and speaker, he has contributed to numerous journals, books, conferences, seminars and workshops throughout Africa, Asia, the Middle East, Latin America, Europe and North America.

Among his many contributions to the scientific body of knowledge are applying agricultural economics to African farming systems, sensitizing agricultural economists to work in U.S. Farming Systems Research and Extension Symposiums and graciously opening his personal research files to students and researchers worldwide. This collection is located in the resources-on-developing-countries unit of Farrell Library at Kansas State University.

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COMMUNICATION AND INFORMATION SYSTEMS IN FARMING SYSTEMS WORK: AN OVERVIEW

D. W. Norman[1]

INTRODUCTION

Initially I was delighted when invited to give a plenary paper at this symposium, especially because I have been unable to attend these meetings since the first one in 1981. Then, when I sat down much later to write something, I realized to my dismay that I really know very little about the subject that probably would be of value to an audience such as this. After a couple of days reading about the subject and thinking about my own lack of formal training in communication and information systems, I decided to be pragmatic and consider the subject in terms of the farming systems practitioner in the field.

As I look back to the late 1960s and early 1970s when many of the tenets underlying farming systems work were coming together, I think many of us were still very discipline "blinkered," sometimes arrogant in our thinking and certainly simplistic in our thinking about the process of change. The farming systems approach was, and is, conceptually sound, but its very simplicity and internal consistency fooled some of us into a false sense of security that it would be readily accepted. Obviously we were wrong, although it has, of course, had considerable popular appeal. Like so many concepts, its implementation has not always been easy. There are many reasons for this, some of which are location specific, but on reflection it seems to me a number of these could have been reduced or eliminated through better communication and information-transfer systems.

As Bemis et al. (1987) point out in their paper, communications technology has seldom been designed and tested successfully. Instead, expertise in communications in farming systems projects is often assumed as coming from previous training and on-the-job experience. Certainly I confess I did not start seriously thinking about this as an explicit issue until mid-1986 when our project was subjected to its second external evaluation. At this time the issue of developing stronger links with extension and planning was emphasized. Obviously improved communication and information systems can help in bringing this about.

That is enough in the way of a confession! What I have tried to do in this paper is to address very briefly the communication and information channels that farming systems projects need to address to be effective, ways of encouraging this, the types of communication and information that are required, progress that has been made and challenges that are remaining. Since this is an overview paper and other people are more qualified to speak on specific topics, I will not dwell much on detail but, when relevant, will reference other work -- including papers presented at this symposium. The perspective I will be using is that of

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a team leader on a farming systems project, working in a low-income country.

CONTRIBUTORS TO AGRICULTURAL DEVELOPMENT

It has long been recognized that there are four groups of actors contributing to the process of agricultural development: farmers, extensionists, researchers and policymakers (planning/development). However, with the advent of farming systems work, the one-way "top-down" pattern depicted in Fig. 1, so characteristic of many low-income countries, was to some extent replaced by that in Fig. 2, where on-farm research -- done by farming systems teams -- has attempted to create a "bottom-up" perspective. In this approach two-way linkages are emphasized rather than the single direction of earlier days. The two-way linkages are important between all the actors in the process of agricultural development. Unfortunately some of these linkages tend to be fragile. From the practitioner's viewpoint, the relative strengths of these linkages tend to be those shown in Fig. 3. Why does this occur? Can improved communication and information systems help overcome this?

In terms of the former question, some of the problems that often contribute to this situation revolve around the following (Poey, 1986; Fresco and Poats, 1986; Gilbert et al., 1980):

Educational elitism. Differences in the level of formal education tend to inhibit productive dialogue. This is manifested in a number of ways. For example, researchers have often regarded farmers of limited value in making useful contributions to the technology-development process. Also researchers have regarded extension workers -- who in low-income countries usually have poorer academic qualifications -- in somewhat the same light. Finally, policymakers, because of their dominant position in many government bureaucracies, have acted somewhat independently of the other participants in the agricultural development process.

Maintaining the status quo. Farming systems projects have often been viewed as a recipe for overcoming failure. As "newcomers on the block," they are often viewed with a good deal of suspicion by other actors in the agricultural development process who have been around much longer. Quite understandably, most of the other actors have vested interests in maintaining the status quo and consequently regard farming systems workers as a threat rather than as partners. This is particularly true in the case of the people in the department in which such projects are institutionally located. This also tends to be the case when projects involve strong donor agency input of funds and personnel. The desire to maintain the status quo is further strengthened when limited resources are available after external funding dries up. In such a case, if the domestic-resource pie is not increased to absorb such types of work, other actors in the agricultural development process could be adversely affected.

Institutional rigidity. In many low-income countries, agricultural research, extension and planning are separated into different

administrative units (for example, divisions, departments, ministries). Sometimes even livestock and crops are separated into different administrative units (Abalu and Raza, 1986). Since budgets and personnel relate to specific administrative units, there is vertical control, discouraging the horizontal links that are necessarily implied in the interactive nature of the various groups in the agricultural development process. As far as farming systems projects are concerned, the strongest links are obviously within the institution in which they are located. In many countries this tends to be within the research organization. Indeed, I have assumed this in Fig. 2 and 3. However, analogous arguments do prevail if farming systems projects are in another administrative unit. However, effective farming-systems-type work requires that links be established and maintained.

Evolving methodology. I believe that farming systems work gained too much popularity too quickly. Many methodological issues for undertaking farming systems work are still being resolved. For outsiders, particularly for station-based researchers and planners, this does not look good. Indeed, many of them appear to regard farming systems work as more of an art than a science. Even within a country, different farming systems projects sometimes have different approaches. This is not necessarily unhealthy, since farming systems work by its very nature is location specific, but it can contribute to reduced credibility as far as outsiders are concerned.

Lack of expertise. Lack of national staff available and trained in appropriate techniques obviously creates problems and needs no further discussion.

In the above discussion I have deliberately used the word "project." This word has specific connotations for many people in low-income countries. Often it implies donor-agency involvement and, to a greater or lesser extent, implies control of funds and personnel. By its very nature, a donor agency is concerned with quick results from its contributions. Therein lies the nature of the problem. Many of the problems listed above will take time to solve (Lev, 1986), but donor agencies for obvious legitimate reasons give little time. Thus team leaders on such projects face a dilemma. There is no way that changes can be legislated in such situations. What is required is the winning of people's hearts and minds. There is little doubt that this will take time. I believe that, given enough time, appropriate communication and information systems can help overcome some of the barriers or problems listed above and thereby strengthen the weak linkages in Fig. 3.

However, in the time equation, another factor that can be considered is the level of resources that are used to develop or strengthen the linkages. Some argue that use of large amounts of resources now could quickly break down some of these barriers. However, others argue that massive inputs of donor-agency funds would encourage criticism and have little constructive payoff in the long run. The same individuals are also likely to argue that, in the interest of leaving something viable in place after the departure of donor support, levels of input should approximate that which the host government can sustain in the long

Once again, there is a difficult trade-off as far as most team leaders of donor-funded projects are concerned.

I suppose decisions on such matters come down to personal biases. My own bias is that I believe longer time frames are required than most donor agencies would be comfortable with. I believe that, in order to get farming systems work enthusiastically accepted within most national settings, time is required. I also believe it is important to avoid being overly critical of an existing situation, particularly in the early days, until credibility, mutual trust and respect have been established and also that it is important to work within the existing organizational structure (Rawson and Grosz, 1986). In addition, it is important to strive for an operational system that can be sustained after donor funding dries up -- as indeed is currently happening in many countries. Resources from donor agencies can now be used to create the conditions necessary to sustain such programs in the future (e.g., trained staff). Also I believe many farming systems projects, including ours, can productively spend more money in setting up communication and information systems that facilitate the development of good links.

The desirability of trying to work within the institutional structure that exists may appear to be unnecessarily constrictive, since the ideal structure for incorporation of farming systems work is unlikely to exist. There are relatively few examples -- notable exceptions are Guatemala (Hildebrand and Kearl, 1986) and Zambia (Eylands et al., 1986) -- where a decision was made at top governmental levels to reorganize agricultural institutions to incorporate farming systems work. Thus most farming systems projects are working in imperfect organizational situations for which Collinson (1986) had delineated less radical options for incorporating farming systems work. Thus communication and information systems become even more significant in overcoming the negative characteristics of most existing institutional structures.

I want now to turn to a discussion of some of the links specified in Fig. 3. These links are as follows:

- farmer/farming systems workers
- farming systems workers/station-based researchers
- farming systems workers/extension personnel
- farming systems workers/planners and development specialists

Before discussing these in detail, I will discuss briefly two other areas that are important in terms of communication and information exchange. These are the desirability of having overall coordination of farming systems work and communication within farming systems teams.

OVERALL COORDINATION

The challenge is to provide greater coordination between farming systems work and other institutions involved in agricultural development. Such links need to be established and, as a result, have the potential for improving communications and thus improving the effectiveness of farming systems work. The problem of such coordination is that it can be

perceived by administrators in government institutions as a takeover bid by farming systems teams.

Possible strategies to overcome this lack of overall coordination are many. At the very least, farming systems workers need to meet to exchange experiences -- something we are currently doing in Botswana. The next step in widening the impact is to provide information to existing national committees, usually through the department in which the farming systems teams are located (e.g , research). A more visible approach is to employ a national coordinator of farming systems work, as is the case in Zambia (Eylands et al., 1986). Such a coordinator can help in accessing policy-making groups, a point that is stressed by Zandstra (1987), as well as provide links between research and extension and between station-based research and the farming systems teams. There is no doubt that a coordinator or a steering group composed of research, extension and planning representatives can facilitate or improve the potential impact of farming systems work. In most countries, however, this is not immediately possible and requires work.

TEAM HARMONY

The challenge is for farming systems teams to operate in an interdisciplinary rather than a multidisciplinary manner. Team members must have compatible personalities, confidence in using the analytical tools of their own disciplines and a healthy respect for the role of other disciplines. They must be wiling to be team players (Norman et al., 1982). And above all, as Rincon (1987) has pointed out, they must be able to listen, understand and accept other viewpoints, and be prepared to modify their own views. There are many obstacles to this idealistic situation, as Knopp et al. (1986) have pointed out, not the least being the lack of professional rewards in terms of salary, etc., as far as interdisciplinary work is concerned. Special problems can arise on donor-funded farming systems projects that have both local and foreign representation. Moussie (1987) indicates that such problems can be surmounted to some extent through sondeo-type activities where local researchers obviously have a comparative advantage, thereby providing an opportunity for establishing their credibility.

In an ideal situation, it would obviously be desirable for the team leader to choose the team members. Important strategies that can help create the basis for harmony are holding frequent and open conversations in formal and informal settings (Esslinger and McCorkle, 1986), striving for relaxed situations in which dialogue can take place and producing multi-authored papers. Thus communication and information systems are definitely important in fostering harmony within farming systems teams -- something that we tend to forget when we are busy with field work.

FARMER/FARMING-SYSTEMS-TEAM LINK

In the late 1960s, technical and social scientists of many disciplines realized what sociologists and anthropologists already knew, namely that

farmers were communicators who could contribute substantially to the identification, development and evaluation of relevant improved technologies. That realization provided the major impetus for advocating the farming systems approach. The challenge still stands as to how such farmer participation can be made truly effective.

I submit that, even though we have preached farmer participation, we often are not good at ensuring that it takes place. In this sense I agree with the general tone of the recent workshop on farmer participatory research held at the University of Sussex. A lot has been learned in recent years on this (see, for example, Farrington and Martin, 1987; Ashby, 1987; Ruano and Calderon, 1982; Youmans, 1986; Sigman and McArthur, 1986; Fernandez and Salvatierra, 1986; Cook, 1987; Miller et al., 1987). Still, as Galt and Mathema (1987) rightly point out, shorter and more cost-effective ways of including farmers in the research process need to be found. In an effort to address this, one of the methods we are trying extensively at the moment is the use of different types of farmer groups (Norman et al., 1987).

Sondeos, farmer-implemented and sometimes farmer-designed trials, farmer field days and workshops, etc., have all become part of farming system programs. Indeed, there is little doubt that there has been a move, justifiable in many cases, away from the "hard" data syndrome characteristic of some early farming systems work to the "soft" data bias that tends to be more popular now. Emphasis on verbal communication has increased. However, how many of us have received tips on how to speak with farmers in a constructive, productive and egalitarian manner? I suspect not many of us who are technical scientists or agricultural economists. Obviously many of us need help with respect to this.

Three of the major issues we need to resolve are:

"Hard" or "soft" data. As Galt and Mathema (1987) indicate, the objectives and use of data determine the frequency, intensity and method of data collection. "Soft" data, often qualitative and essentially "subjective" in nature, is less amenable to statistical analysis than is more expensively collected, quantitative and therefore "objective" hard data. For farmers, soft data are likely to be more influential, embedding information in their own terms of reference. For example, Durant and Christy (1987) found that subjective attributes of the technology were a major factor in its adoption by farmers. However, for encouraging links between farming systems teams and station-based researchers, planning/development staff and possibly extension staff, hard data are likely to be a lot more convincing. Therein lies the dilemma. Concentrating on farmers alone does not facilitate development of other links important in the farming systems process. Thus, in practice, a judicious mix of the two usually is desirable. Fortunately, with the advent of microcomputers, either soft or hard data can be and should be entered and, whenever possible, analyzed and made easily accessible to other interested people. This revolution in microcomputer technology greatly facilitates the dissemination of data from farming systems projects. (It also makes standardized analysis simple and quick (Zandstra, 1983)).

Units of analysis. How to define the unit of analysis (e.g., should it be family or household or supra-household -- where resources are shared, etc.) continues to be a contentious issue (Caldwell, 1984; Behnke and Kerven, 1983). The same dilemma applies as with soft and hard data. What might be suitable as far as farmers are concerned might be different from what planners use.

Gender issue. The debate over inequitable participation of male and female farmers in the research process, and in accessing the fruits of such work, justifiably continues. Many have written on this issue, and still it needs to be resolved (Spring, 1986; Hahn, 1986). Communication channels have to be established with, and information collected from, disadvantaged female farmers to ensure that abuses do not occur. Increased sensitivity on the part of many farming systems teams concerning this issue is required.

FARMING-SYSTEMS-TEAM/STATION-BASED-RESEARCH LINK

While all of us recognize the complementarity of on-farm research (farming systems teams) and on-station research (station-based research), the challenge is to make the two-way linkage effective. In general, station-based researchers have found the link from them to the farming systems teams (which select technologies off the shelf) less threatening than the link in the opposite direction (in which farming systems teams help determine on-station research priorities) (Schulman, 1983).

Such attitudes are further aggravated by the fact that farming systems teams often consist of individuals who have lower academic qualifications and, as indicated above, often collect data "soft" in nature. This is sometimes explicitly encouraged through nonformal experimental designs in which farmers play a significant role (Lightfoot, 1986). However, even when an attempt is made to use standard experimental designs, assumptions and ceteris paribus, conditions are often violated, resulting in unacceptably high levels of variation in terms of results.

Such situations often lead to statements about the experimental work being sloppy, implications concerning lack of technical expertise on teams (Lev, 1986), etc. Undoubtedly these criticisms sometimes have some validity, but the severity of the problem can be reduced through greater contact (communication and information exchange) between the two groups of researchers. Obviously this is easier when both are housed in the same administrative unit. Ways in which greater contact can be facilitated are through encouraging station-based researchers to visit the farmers' fields, to participate in farm field days and, when feasible, to engage in collaborative research (Norman and Baker, 1986). Annual meetings at which results from the previous year's work and plans for the next year's work are presented for discussion and approval can also be important elements in bringing about better contact.

In recent years, the introduction of microcomputers and programmable calculators has been important in facilitating in-site data management

and analyses (Ranaweera and Gonzaga, 1987). Such innovations have enormous potential for improving timely exchange of information between on-farm and station-based researchers. We have found that using different series and numbering systems on documents written and distributed can be very useful when keeping track of such information, which may be either provisional or final. Computerized mailing lists can facilitate making this information available to a wider audience.

Although a great deal of attention has in recent years been given to devising appropriate methodologies for undertaking on-farm research, Byerlee (1986) has noted that very few guidelines have been developed for efficiently summarizing and synthesizing information generated by such work, which can be approved by research for transmission to extension and farmers. Usually, large amounts of data are condensed into a single package or "recipe" of improved technology. Byerlee (1986) argues that a greater return can be made from invested research resources. According to him, the challenge is now to synthesize the most important findings to simplify them in a way that can be readily understood by extension staff and farmers, to develop recommendations (prescriptive information) and to give extra guidelines (auxiliary information) to help extension staff and farmers adapt the recommendations to their own circumstances. Auxiliary information has not traditionally been used in recommendations drawn up in many low-income countries. Such information places special demands on researchers in tailoring recommendations to the realities of the farmer's environment and on the extension staff in moving to more of an educational role, as opposed to the more traditional approach of simply communicating messages.

FARMING-SYSTEMS-TEAM/EXTENSION LINK

In retrospect, it is unfortunate that, in the early days of farming systems work, the critical link with extension was not better appreciated. Abbott and Mundy (1986) in fact found that farming systems personnel attending last year's symposium felt that the lack of communication between research and extension was the most serious communication problem. The challenges are to overcome the image of extension work staff as junior partners to researchers (Sowers and Ousseini, 1987) and to devise ways in which they can be involved at all stages of farming systems work (Kellogg et al., 1984; Poey, 1986; Chamala and Keith, 1986) and not just at the dissemination stage, as some of us used to advocate. The extent to which this is practical would depend, of course, on factors such as the attitudes of supervisory extension personnel, other work commitments, incentives (Worden and Ludgate, 1987), etc. Nevertheless, such commitments at the local level, although desirable, do not have to be great to defuse lingering fears in extension staff minds of farming systems personnel invading their turf and taking over their jobs. Improved communication between extension and farming systems staff can open up possibilities for constructive suggestions from extension while at the same time providing such staff with opportunities for their own evaluation of technologies that later may be recommended. Minimum levels of contact involve encouraging their leadership in village-level meetings and farm field days at which work

plans and results of farming-system-team work are discussed and displayed.

In addition, the value of such contracts can be strengthened, usually from the headquarters level, through newsletters giving information on farming systems work, continual updating of recommendations particularly through the inclusion of more auxiliary information, provision of jargon-free abstracts of research reports and continuing in-service training of extension staff. For example, in Botswana there is a farming systems page in a monthly newsletter produced by extension that is distributed widely among government officers. Researchers are actively involved in writing recommendations, subject-matter specialists are now writing extension leaflets of various kinds, and farming systems personnel are involved in a major in-service training program for extension staff.

In many countries increasing the academic qualifications of subject-matter specialists at headquarters and regional levels is particularly critical in establishing collegial relationships with researchers and in helping them to increasingly take over responsibilities for some of the activities listed above. As an interim aid in the process of developing this expertise, a compromise strategy is often implemented. This involves the appointment of research extension liaison officers, usually at the headquarters or sometimes at the regional level (Eylands et al., 1986).

Desktop publishing systems with the aid of microcomputers have provided a relatively cheap, revolutionary technology for facilitating the distribution of information, including training materials. Recently such a system has been purchased in Botswana for use by the extension service. What still is required, in many cases, on the part of both the subject-matter specialists and the researchers in farming systems teams are skills in writing materials that can be easily understood by extension staff. In Botswana we are using a short-term consultant for this purpose. Collaborative writing on the part of researchers and extension staff would be an ideal to strive for in many situations.

FARMING-SYSTEMS-TEAMS/PLANNING-AND-DEVELOPMENT LINK

It is generally recognized that designing and disseminating relevant, improved technologies and policy/support systems are equally important in increasing the productivity of farmers. Nevertheless, until recently, most farming systems work has treated policy/support systems as parameters not amenable to adjustment. Perhaps one reason for this has been the leadership role played by the international agricultural research centers in developing and disseminating the farming systems approach. Because of their mandates, they were earlier reluctant to address policy/support systems that often were location specific and usually had political connotations. Although farming systems teams operating within national programs have long recognized the desirability of treating policy/support systems as variables, they have not had the expertise, clout or channels to do it. (However, for exceptions to this, see work done in some Francophone countries, such as Mali and

Senegal (Verbeek et al., 1986; Fresco and Poats, 1986)). Indeed, the challenge remains as to how the bottom-up orientation of farming systems work can constructively influence the designing and implementation of relevant policy/support systems. As Zandstra (1987) has emphasized, nonthreatening ways have to be sought to access policymakers. Oasa and Swanson (1986) have, in fact, pessimistically concluded that farming systems work will fail because "it ignores microeconomic and social structures that limit bottom-up development efforts." Although I agree that farming systems work was correctly conceived as a logical way of looking at the agricultural development process rather than as a development strategy per se, I prefer to be more optimistic in arguing that the farming systems approach potentially can help policymakers design and develop strategies that can channel technologies to the more disadvantaged farmers.

In addition to the issue of soft versus hard data, another matter of contention is that farming systems teams work in limited areas with limited numbers of farmers. On these two counts, attempts to build such data into representative national-level information are justifiably treated with scorn by policymakers. However, in recent years in Africa, dissatisfaction has been expressed with the work of national statistical agencies; a minority view is that greater emphasis should be placed on using simple techniques, nonrandom samples and qualitative reporting systems (Eele, 1987). If such a view were accepted generally, then data collected by farming systems teams could play a more prominent role.

It is interesting to note that several papers given at this symposium consider the necessity of relating data from farming systems projects to national surveys, resource inventories, etc. (for example, see Bertelsen et al., 1987; Brown et al., 1987; Schultink, 1987). At the very minimum, the advent of microcomputers permits data collected on farming systems projects to be properly documented and made easily accessible to other users. Used carefully, such data can be of great value. Unfortunately, it would appear that most farming systems teams do not have the time or analytical capacity to provide information in a manner that policymakers find acceptable and useful. Consequently, to provide policymakers with appropriate information, it may be necessary to have a particular person, usually an agricultural economist, undertake this task on behalf of the various farming systems teams and, in so doing, rely heavily on inputs from them. This in fact is currently being proposed in Botswana.

CONCLUSIONS

Adequate communication and information systems are a necessary but not sufficient condition for the development, dissemination and implementation of relevant improved technology and support systems (Bemis, 1985). Such systems provide an integrative function in establishing, developing and maintaining the essential linkages outlined in Fig. 2.

Although Bemis (1984) has criticized his own discipline in concentrating on the organizational and mechanical components of communication

technology, the fact is that farming systems teams, in general, have not recognized the role of such a discipline in improving their ability to communicate. Let us hope that in the mid-1980s we have learned our own limitations! Most donor projects have funds for short-term consultants, short-term and in-service training, etc., that can be used for improving such skills.

I also hope that there is a growing appreciation of the value of information systems. Different levels of information are required for different groups of actors in the agricultural development process. Microcomputers, with their database management, spread-sheet, statistical and word-processing software packages, improve the efficiency of data management and processing as well as increase their value in easing access to other users, providing an easy means for tailoring information to different audiences. Skills need to be developed in handling such microcomputer-based systems and in writing for different audiences.

An increasing number of studies and surveys have been undertaken in recent years looking at the role played by communication and information systems in farming systems work (Trail, 1986; Collie and Scherer, 1987; Lev, 1986). There is obviously room for improvement. At the same time, the whole approach is conceptually appealing to communication and information specialists who perceive it "as a 'unique interface' between information generators and users" (Lionberger, 1986). We need the help of such specialists if there is to be any realistic hope of farming systems work being accepted within national programs in the long run. This is why implicit in so much of the discussion in the paper has been the notion that improved communication and information systems can further the "institutionalization" of farming systems work within national programs.

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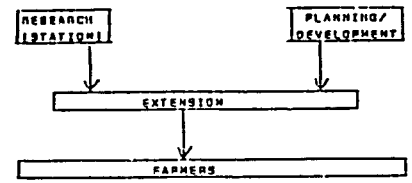

Fig. 1. The "traditional" flow of information and communication in the agricultural development process.

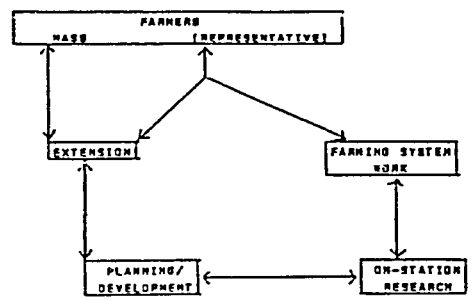

Fig. 2. The "ideal" flow.

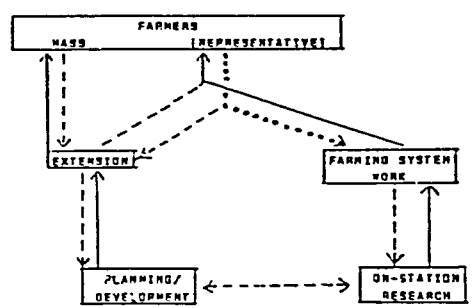

Fig. 3. The "usual" flow.

Note: Based on Lionberger (1986) and Bemis (1985) models.