The University of Sydney
Department of Agricultural Economics

COMMUNICATION BETWEEN AGRICULTURAL SCIENTISTS AND EXTENSION WORKERS

A Study in the Sheep and Wool Branch
of the New South Wales
Department of Agriculture

by

LESLEY E. HARGREAVES

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Lesley E. Hargreaves

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CHAPTER I

INTRODUCTION

The flow of scientific information in agriculture is commonly viewed as a three-step process, passing as it does from the research scientist to the extension worker and thence to the practising farmer. But the process is by no means as simple as that. For instance, not all the information originating at the research level is of immediate relevance to farming situations. The information often consists of the results of basic research, which are mainly of value to other scientists. In addition, not all information goes through the extension personnel. It can go directly from the scientist to the end-user, either by direct contact or by means of publications.

This report deals merely with the flow of information between the research scientist and the extension worker. In particular, it is a study of the flow of information between such personnel within a specific branch of the New South Wales Department of Agriculture. The flow of information is vital to the effective functioning of the two groups. On the one hand, extension personnel need to be aware of the latest research findings in order to be able to convey to farmers the best available information about farming practice. On the other hand,

research workers need to have an appreciation of current farming problems to enable them to maintain perspective with respect to their particular research efforts.

In this situation the major sources of the information required by each group are the members of the other group. Extension personnel deal daily with farmers and their problems, and are in a good position to report on these problems. Research workers, on the other hand, are usually employed on research stations, working with or beside other personnel engaged in the same or allied disciplines. In such an environment they can be seen both as a source of information about their own work and as a channel of communication about the work of other research scientists, at least of those in their own field of specialization.

Until recently, research in agricultural extension has concentrated primarily on the efficacy of the transfer of information from extension workers to farmers. Investigators have failed to realise that unless extension personnel are themselves well-informed, the effectiveness of their efforts in communicating to farmers is reduced.

Although studies on the flow of information from the research worker to the farm adviser and back again are few in number, the problem has been formally

recognised in various contexts.[1] In the mid-sixties, research-extension liaison officers were appointed in the various departments of agriculture of the Australian states. A major aspect of the role of these people was, and still is, to act as middlemen in the flow of information between research and extension personnel. Those appointments suggest that agricultural administrators were aware of the existence of this problem. In addition, annual refresher courses for selected extension workers were initiated on an Australia-wide basis, a further indication that information was not passing between research and extension personnel at a desirable rate. The Explanatory Handbook on Sheep and Wool Refresher Courses describes the function of such courses in the following terms.

> The annual Sheep and Wool Refresher Course arose out of the need to keep extension officers up-to-date with research findings, and research workers familiar with industry's needs for information and technology.[2]

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[1] In 1969, Dr. A.T. Johns, the Director-General of the New Zealand Department of Agriculture, in an address to an O.E.C.D. meeting of agricultural research directors in Paris in 1969, identified a similar problem in that country. He expressed the view that

> The growing problem in New Zealand, and no doubt elsewhere, is not one of communication between extension workers and the farmer, but between research and extension....

[2] Australian Wool Corporation, Explanatory Handbook on Sheep and Wool Refresher Courses (Melbourne, 1973), p.1.

Towards the end of the sixties, some steps were taken to determine possible differences in the channels used by the two groups in gathering and communicating information. From these studies came an awareness that whereas extension workers preferred informal face-to-face or verbal communication, research workers preferred to communicate their findings through formal channels such as scientific journals.[3] The possibility exists that this result is a reflection of habit patterns rather than of personal preferences. However this hypothesis has not been empirically tested.

At about the same time, extension workers were beginning to express concern about their professional standing and about their role in relation to research scientists. Some tension or hostility was evident in the stereotypes of the two groups which emerged. Research workers were regarded as being interested primarily in pure science rather than in practical farming problems, while extension personnel were said to show no interest in research findings however relevant to the farming situation they might be. Similar problems have been

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[3] J.C. Hazell and J.N. Potter, "Information Practices of Agricultural Scientists", Australian Library Journal, Vol. 17, No.5 (1968), pp.147-157. See also J.P. Brien and J.N. Potter, "Agricultural Scientists and Technologists Not News and Review Readers", Journal of the Australian Institute of Agricultural Science, Vol.38, No.2 (April, 1972), pp. 120-124.

reported from other countries.[4]

The present study had, as its primary objective, the identification of problem areas in the communication behaviour of research and extension personnel and, it was hoped, the subsequent discovery of means of improving this behaviour. In the course of the investigation an attempt was also made to determine whether, in fact, the two groups were antagonistic, and, if such antagonism existed, whether it affected the flow of information between the groups. Information about other attributes of the relationship between research and extension workers was collected in an attempt to gain as complete a picture as possible of the existing communication patterns and the factors which promoted and hindered effective communication between the two groups.

The Nature of Agricultural Communication and the Communicators

Most studies in the general field of information dissemination and retrieval have dealt principally with communication among research scientists themselves, and their use of conferences, pre-prints, abstracts and

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[4] E.g., I. Arnon, Organization and Administration of Agricultural Research (Amsterdam: Elsevier Publishing Coy. Ltd., 1968); R.J. Hildreth, "Tensions between Research and Extension Workers - Three Hypotheses", Journal of Farm Economics, Vol.47, No.3 (August, 1965), pp.838-840; and J.B. Wyckoff, "Closer Co-operation between Research and Extension", ibid., pp.834-837.

journals to this end.[5] The study reported here departs from this tradition in that, in an applied area like agricultural science, scientists as well as communicating with themselves, have a duty to communicate relevant findings to practising farmers as well. As has already been pointed out, not all such scientific information is of immediate relevance to farmers. Pure science has no end-user in the short run except other scientists. Therefore, it is scientific information of an applied nature which is the focus of this study, information which can be communicated by the extension worker to the farmer and used in actual farming situations.

There are differences in the background of the majority of agricultural scientists and extension personnel employed by the N.S.W. Department of Agriculture which help to explain some of the problems of communication between them.[6] In the past the majority of the extension personnel in that state, being diplomates from agricultural colleges, have generally not been trained in research techniques.

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[5] There are many studies of this nature reported in the literature. A typical example is the series of investigations made by Garvey and his colleagues, who studied the flow of information among members of the American Psychological Association, as well as scientists in other disciplines.

[6] In contrast, the states of Victoria and Western Australia employ university graduates in both their research and extension services, which means that the gap between the two groups in terms of formal qualifications is much narrower.

As against this, a substantial number of the research workers, either by inclination or as a result of their training, are not concerned about the practical application of their findings. This situation is conducive to a limited understanding of the problems faced by members of the other group. These differences in training are probably more clearcut in the case of the Sheep and Wool Branch of the N.S.W. Department of Agriculture (the locale of the present investigation) than in other sections of the department.

There are also organizational differences. A research position has higher status and professional standing than an extension position both within and without the organization. Research workers, until recently, attracted higher salaries than extension workers of equivalent seniority. There have also been greater opportunities for research workers to advance to senior positions on the administrative side of the department thus affording such people enhanced prestige, increased salary and greater personal responsibility. In general then, extension personnel are overshadowed by research workers, both in the organization for which they work and in the population at large.

Agricultural extension (advisory work) as a profession is largely unknown outside the agricultural sector, while agricultural science is a known and

respected profession. Even within agriculture itself, there is a misunderstanding of the role of the extension worker. Contrary to the views of many, such people are not just technical experts. The proper discharge of their task nowadays entails expertise in many fields - communication techniques, educational theory, farm management and marketing - in addition to technical aspects of crop and livestock production. Extension personnel have a responsibility to their farmer clients which scientists and administrators do not. A generally accepted definition of the role of extension workers was presented in 1974 in a report by the Extension Services Branch of the Australian Department of Agriculture. It was couched in the following terms.

> Agricultural extension has been defined in various ways ranging from narrow simple definitions concerning the transfer of information from research to the farmer, to more complex definitions in terms of an educational process to help people adjust to change. The view generally accepted in extension circles and in State departments of agriculture is that extension services are a form of adult education and are designed to assist farm people to increase their production efficiency by improving farming methods and business management techniques. In effect, agricultural extension contributes to the lifting of the social, educational and environmental standards of rural life.[7]

Previous Research

Past research in fields related to this study can conveniently be divided into two broad categories - studies

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[7] Australian Department of Agriculture, Extension Services Branch, The Australian Government and Agricultural Extension (Canberra: Australian Department of Agriculture, 1974), p.1.

in the field of agricultural extension, and studies in organizational and social psychology.

Agricultural Extension Research

As stated earlier, little research directly analogous to the present study has previously been undertaken. The investigations mentioned below, however, have helped to demonstrate some of the problems involved in communication between research and extension personnel.

Overseas Studies

Rogers and Yost undertook a study of 44 county extension agents in Ohio.[8] Data were gathered through structured personal interviews. The county agents were asked to list the most important sources of information to them. The three most frequently listed were extension specialists (20 per cent),[9] experiment station bulletins (19 per cent) and farm magazines (17 per cent). It should be noted that none of these is in fact a source of information - all are channels of information. Other "sources" listed were key farmers (9 per cent), direct contact with experiment stations (9 per cent), news releases from the extension service (7 per cent),

[8] E.M. Rogers and M.D. Yost, Communication Behavior of County Extension Agents (Research Bulletin 850, Ohio Agricultural Experiment Station, 1960).

[9] These people are subject matter specialists in particular disciplines supplying information for extension purposes.

newspapers (4 per cent), commercial companies (4 per cent) and the United States Department of Agriculture (4 per cent). No agent mentioned a scientific journal as an important "source".

Three categories of journal were considered by Rogers and Yost - farm magazines, professional publications ("those magazines which are written for the professional agricultural worker") and scientific journals. The county agents reported reading (including scan reading) an average of 7.8 different farm magazines regularly. However only two on average were read thoroughly. An average of 7.5 professional publications were reported as read (only 3.8 of them being read thoroughly). Of the 44 county agents, only seven reported receiving one scientific journal. No one received more than one.

Personal contact with agricultural scientists was measured by asking county agents to estimate the number of visits made to their nearest experiment station in the previous year. The average number of trips was 2.5 per agent. The county agents were also asked to list the meetings of a technical agricultural nature (including conferences, field days, county fairs, ploughing matches and meetings of professional societies attended in the past year. It was found that they attended an average of 3.5 in their state. Only one in two had attended a meeting outside his home state.

A major aspect of the study was an evaluation of the information "sources" used by county agents in the process

of "adopting" a new farm practice. Adoption on the part of an agent referred to the act of recommending a farm practice to farmers. The respondents were given a list of ten new farm practices (the use of stilbestrol in feeding beef cattle and the installation of bulk milk tanks on farms were two) and they were asked where they first heard of the practice. Mass media communications were found to be most important at this stage. Personal sources proved necessary for the ultimate conviction of extension workers. At that time experiment station personnel and extension specialists were the most commonly listed sources.

There are a few problems associated with this study. For instance, too great a reliance was placed on the honesty and memory of the agents interviewed. The results can therefore be regarded only as indicative. The study was also undertaken more than fifteen years ago and in another country - both facts which limit its relevance to the Australian situation in 1976.[10]

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[10] Another study of the flow of information to farm advisers was reported in C. Webb and H. Read, Analysis of Information Flow from Sources to Illinois Farm Advisers to People (Communications Evaluation Report 7, University of Illinois, Co-operative Extension Service, 1965). This investigation concentrated on written information and is therefore of only marginal relevance to the present study. It was found that 80 per cent of 50 technical questions which farm advisers were asked to answer could be adequately dealt with by them without their having to leave their offices.

In a journal article in 1965 Hildreth posed three hypotheses concerning the causes of tension between research and extension workers.[11] They were:

1. "Tension is caused by difference in orientation to variables of time and depth of analysis." In other words, research workers are rarely in a position where there is pressure to provide an answer promptly, whereas extension workers often are.
2. "Tension is caused by the different methods and supporting disciplines used by the two groups." Research workers must have a detailed knowledge of scientific method and the technical field within which they work. Extension personnel require knowledge of principles of education and psychology, as well as a broad knowledge of the technical field in which they work.
3. "Tension is caused by different scholarly social circles of research and extension workers." Hildreth states further that the audience for research and extension work varies. For research workers it includes other research scientists, administrators, and policy makers. The audience for extension is largely made up of the specific users of research findings, namely the farmers.

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[11] Hildreth, op. cit., pp.838-839.

Hildreth did not test these hypotheses. They would in fact be very difficult to test, as he acknowledges. However, the more general hypothesis outlined above was incorporated in the present study, viz. that tension between the two groups exists and that it affects the success of communicative interaction between them.

Australian Studies

Previous work on the interrelationships between research and extension personnel in Australia is very limited. Hazell and Potter have reported, with respect to written information sources, that extension workers ranked extension-oriented publications first, books second and scientific journals third.[12] Brien and Potter, on questioning a random sample of extension workers later about their use of such journals, found that only one in twelve rated them highly as a source of information of direct use in extension, and that one in eight so rated them as a source of information about new trends in agriculture and as a source of increased knowledge in their own field of work.[13] Talking to colleagues was ranked by those interviewed only slightly higher than reading as an information channel. On the other hand, research workers who were surveyed gave a high rating for both of these channels. The only printed matter rated highly by extension workers

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[12] Hazell and Potter, op. cit., p.154.

[13] Brien and Potter, op. cit., p.123.

was circulars from their own organizations dealing with the direct application of research results. Brief reviews were deemed the most useful by extension workers and research workers alike, followed by news of research in progress.

In 1971 Gidley undertook a more thorough investigation of communications between all agricultural research and extension personnel located in the northern inland of New South Wales.[14] His sample consisted of 143 research workers and 52 extension workers. Data were collected by means of mail questionnaires. He found that most work which research workers considered of interest to extension workers was published in journals which the latter were unlikely to read. Of the 106 journals listed by research workers as avenues of publication, only 18 were listed by the entire extension group as journals they read or scanned. Of the same 106 journals, only 17 were extension-oriented.

It should be borne in mind that the purpose of publication by agricultural scientists is not primarily to provide information of immediate practical use to farmers. Much of the research carried out is of immediate interest only to other scientists, though in the long-term it may be relevant to the farming situation. Therefore it is

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[14] V.N. Gidley, "Written Communication from Research to Extension: A Regional Study". (Unpublished manuscript)

reasonable to expect that a sizeable proportion of agricultural research will be published in scientific journals not commonly read by extension personnel, but read rather by other scientists.

Extension workers were also asked by Gidley to rate a series of communication channels in terms of their past usefulness. The group collectively rated them in the following order: (1) conferences, seminars and field days; (2) direct contact with research workers; (3) research journals; (4) correspondence with the New South Wales Department of Agriculture; (5) other journals and (6) newspapers.

Gidley also studied the degree of liaison or contact existing between research and extension personnel in terms of the research worker's knowledge of farming problems and the extension worker's knowledge of ongoing research. The measures used were subjective estimates by the sample population, thus limiting the usefulness of the results. For example, 85 per cent of the research group considered they kept in touch with technical farming problems "moderately" to "very well", and 15 per cent rated their performance in this regard as "poorly". In contrast 85 per cent of the extension group interviewed felt they had no influence at all over research either as regards its initiation or evaluation.

Gidley listed five factors likely to affect liaison between research and extension personnel. These were administrative separation, spatial separation, differences in qualifications, age and experience, and what he called "conceptual factors". By the term, administrative separation, Gidley referred to the existence of large numbers of agricultural research workers in the Commonwealth Scientific and Industrial Research Organization (CSIRO) and the universities in addition to those in the Department of Agriculture. Significant differences were found in the attitudes of research workers in different organizations towards (1) responsibility for communication of research results to extension workers (CSIRO staff felt the responsibility rested entirely with extension personnel while staff of the Department of Agriculture saw the responsibility as equally shared) and (2) consultation with extension staff about research projects (CSIRO staff did not consult extension workers at all while staff of the Department of Agriculture consulted with extension personnel to an unspecified degree).

The term, spatial separation, had reference to the physical distance of an extension worker from the nearest research station. Gidley found that 11 of the 19 extension workers situated less than 16 kilometres from a research station rated their ability to keep in touch with research relevant to their work as "poor". In the case of

extension personnel who felt they had no influence on research, there was no relevant research unit in their district.[15]

In Gidley's study, extension workers were divided into two groups in terms of qualifications - diplomates (i.e. those holding diplomas from agricultural colleges) and graduates (i.e. those holding degrees from universities). Those extension personnel who indicated that research contributed little to the problems they faced were principally diplomates.

Experience was defined as the number of years since leaving college or university. This was found to be related to the frequency with which a research worker consulted with extension workers in the course of planning a research project. Research workers, who had graduated less than six years previously consulted most with extension workers whereas research workers who graduated between six and ten years previously consulted least with extension officers. Extension personnel with between six and ten years' experience also indicated the poorest ability to keep in touch with research.

By conceptual factors, Gidley meant differences in the conceptions of the two groups (research and extension) with regard to the methods they believed extension workers employed to keep in touch with research. He found that when research scientists were presented with

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[15] Gidley does not specify the physical extent of these districts.

a list of the methods by which an extension worker could gather information and were asked to order them according to their probable importance, they ranked them significantly differently to extension workers. The two groups also held different views concerning whose responsibility it was to convey research findings to extension personnel. Finally, there were differences of opinion as to how much responsibility a research worker should take in following up the use of his research results.

Organizational and Social Psychology

The relevance of organizational psychology lies in the fact that all the research and extension workers interviewed in the present investigation were employees of the N.S.W. Department of Agriculture, and accordingly the policies and administrative procedures of that department materially affect communication between the two groups.

Though a large proportion of the literature in this field of psychology is theoretical and exploratory it is nonetheless pertinent to some of the problems under examination. In 1966, Katz and Kahn published a definitive work in this area.[16] Their book provides a thorough coverage of the functional characteristics of organizations, the flow of information within them, psychological factors significant to them, and means of effecting organizational change.

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[16] D. Katz and R.L. Kahn, The Social Psychology of Organizations (New York: John Wiley and Sons, Inc., 1966).

The authors stress the importance of communication within an organization but warn against putting excessive emphasis upon communication without regard to cost and without a detailed prior knowledge of the functioning of the organization and the roles of the various sub-systems in the organization. As psychologists, they suggest that the complex interplay of group identification and the differential distribution of reward according to status, responsibility and power, has a major effect on the successful functioning of an organization.

Rice, in 1958, coined the term socio-technical system which he defined in the following terms.

> The concept of the socio-technical system arose from the consideration that any production system requires both a technological organization - equipment and process lay-out, and a work organization relating to each other those who carry out the necessary tasks. The technological demands place limits on the type of work organization possible, but a work organization has social and psychological properties of its own that are independent of technology....[17]

Katz and Kahn suggest that the ideal socio-technical system would be one where

> ...the technical aspects of the work could be organized in such a manner that the immediate work group would have a meaningful unit of activity, some degree of responsibility for its task, and a satisfactory set of inter-personal relationships. And the greater the

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[17] A.K. Rice, Productivity and Social Organization, the Ahmedabad experiment: technical innovation, work organization and management (London: Tavistock, 1958), p.4.

> differences in skills, prestige and status among members of the work group, the more difficult it will be to establish and maintain satisfactory interpersonal relationships.[18]

Still within this framework of the socio-technical system, or the organization, Katz and Kahn suggest there are two basic types of strain or conflict between sub-groups in the system, namely what they call horizontal and vertical strain. Horizontal strain refers to conflicts between functional sub-systems on similar levels in the organizational hierarchy. By contrast, vertical strain refers to conflicts between sub-groups which differ in terms of power, privilege and reward. As an example of this type of strain, they point out that:

> ...the research and development people, with the task of innovation and adaptation, may want to move the entire organization in a different direction than seems reasonable to people in the production subgroups.[19]

For an organization to run effectively, its members must have common goals. It is fatal to have just a series of sub-groups each with its own set of goals and ideas. Such common goals are difficult to achieve in the presence of the conflicts described above. Where progression to senior positions relies on academic qualifications which are not necessarily relevant to the job at hand, rather than on

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[18] Katz and Kahn, op. cit., p.435.

[19] Katz and Kahn, op. cit., p.447.

ability gained through experience, it is likely that conflict will develop between those holding the academic qualifications and those who do not.

Tannenbaum, Weschler and Massarik in an earlier study of bureaucracy in a government laboratory presented several parallels to the present case.[20] The laboratory in question was a department of a naval station, relatively independent of the rest of the station. Research, administrative and technical personnel were employed therein. The study was based on data from interviews, documents and observations of meetings and discussions in the laboratory. Specific attention was paid to the groupings of personnel, staff organization, and the effect of the personnel's attitudes on the successful functioning of the unit. The relevant findings can be summarized here under four headings - the principles of grouping, staff organization, staff attitudes and group identification.

With reference to the first, it was found that in the case of scientific staff, the members of the group would often resist moves made by other administrative or technical personnel to change, even in minor ways, the direction or content of their work. They often referred to professional standards as the basis for their actions.

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[20] R. Tannenbaum, I.R. Weschler and F. Massarik, Leadership and Organisation (New York: McGraw Hill Book Co. Inc., 1961).

Their "professional standards" were used as an excuse for disregarding administrative attempts to change qualitatively or quantitatively the work they did, work which others saw as harmful to the larger purposes of the organization.

In the matter of staff organization, a certain amount of tension or conflict was discovered between scientists and engineers. This had its origins in the tendency of the scientists to identify themselves with university scientists rather than with the departmental engineers. Engineers were found to feel uncomfortable in the presence of staff scientists due partly to the above phenomenon and partly to the fact that the friction between scientist and engineer was intensified by the departmental promotional policy which favoured the scientific staff. The situation is clearly analogous to that in state departments of agriculture, where research personnel identify with university and CSIRO research workers, and are also favoured as far as promotion to senior positions is concerned.

As far as staff attitudes towards other staff and the department were concerned, it was found that scientists, being more isolated and less subject to management decisions, were indifferent to many problems of the department. However, engineers and technicians, who had to co-ordinate their work with many other members of staff, voiced some bitter criticism of other staff and the

department. Much of this was justified, but some of it pointed to a tendency to avoid responsibility for certain problems, and to project it away from their immediate group. Most members of staff resisted adaptation to departmental directives and organizational change, but the group resisting most strongly was the scientists, who harked back to their view about their professionalism and their right to a large degree of freedom to carry out work projects they desired.

Finally, in regard to group identification, it was found that each group member confined his contacts mainly to other members of his group, or other groups on the same working level. As the authors suggest, the individuals are probably more comfortable working with someone on the same level than with someone of greatly different status. This does not solve the problem however. It merely states it. Group identification was seen to be intensified by variations in status, salary levels, degree of authority and promotional policy. However, in many cases as the authors point out, it was given a "technical" basis.

> As university-trained scientists and engineers, they seem to feel that their professional standing depends upon the technical reasons they can advance to support attitudes and decisions.[21]

In this way strong group identification was found to have

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[21] Ibid., p.303.

some counter-productive effects on the over-all functioning of the department.

CHAPTER 2

THE NATURE OF THE INVESTIGATION

As indicated in the previous chapter, the central aims of the study were (1) to obtain factual information about the extent of technical communication between research and extension personnel in the New South Wales Department of Agriculture and (2) to identify the factors affecting the magnitude and success of this communication.

In this Department, technical personnel are divided into divisions and ultimately branches according to their area of specialization (e.g. agronomy, horticulture, animal industry). Each division or branch tends to operate relatively independently of the others, though all follow similar administrative procedures. Within each branch there is a further sub-division of personnel into research and extension groups. The activities of these groups are directed by different personnel so that although they administratively belong to the same branch, their daily activities are not highly integrated. Research and extension personnel are also, in their regional manifestations, spatially separated in the majority of cases. Research personnel are located, in the main, on research stations throughout the state whereas extension personnel are located in district extension offices.

To study the flow of technical information between research and extension personnel in concrete terms inevitably requires the use of technical information to some degree. It was felt that it would be unwise to extend a study such as this to more than one technical sub-group, if only because the comparability of the results might be questioned. Accordingly, it was decided to use one group for the investigation, to wit, the Sheep and Wool Branch. This choice stemmed from practical considerations (such as the size of the sample) and technical considerations (such as the degree of applicability of research findings to all parts of the state). The Sheep and Wool Branch is one of the largest in the Department in terms of personnel, and is one of the longest established. Moreover it caters for an industry in which research findings at a research station in Trangie will often apply equally at Tamworth. By contrast, in the field of agronomy, where regional differences are of greater significance, a research finding relevant to one region may have little or no application in even a neighbouring region.

The sample population consisted of 25 extension personnel, 23 of whom were officially designated livestock officers (sheep and wool) and two of whom were designated special livestock officers.[22] In addition, 12 livestock

[22] Special livestock officers are specialists in certain aspects of sheep production (e.g. fat lambs). They are generally more senior extension workers with a considerable number of years' experience.

officers who were in training in the Branch participated in most of the survey. They were excluded from one part of the investigation because it was not relevant to them. Finally, there were 24 research workers all of whom were involved in research into some aspects of sheep production.

Construction and Administration of the Survey

Prior to the construction of tests and questionnaires for the purpose of measuring the variables involved, informal interviews were held with research and extension personnel in two country centres (Maitland and Cowra) and one Sydney-based research centre (the Biological and Chemical Research Institute, Rydalmere). These interviews were aimed at gaining background information from departmental personnel in the field. In particular, information was sought concerning their beliefs about the existing level of communication between research and extension groups and why they thought it fell short of their expectations, if indeed it did. Some of the comments made during these interviews were later used in the construction of the scales used to measure attitudes towards the value of agricultural research and research workers and attitudes towards extension.

Following this preliminary investigation, questionnaires and tests were developed for the purpose of securing objective measurements of all the variables

considered to be of relevance.

Extension Workers' Knowledge of Recent Research

A test designed to assess knowledge of recent research findings relevant to sheep and wool production was constructed with the assistance of a technical panel. This panel consisted of two research workers and two extension workers from the head office staff of the Sheep and Wool Branch of the New South Wales Department of Agriculture, a research scientist from the CSIRO, and a senior lecturer in the School of Wool and Pastoral Sciences of the University of New South Wales. None of these formed part of the sample population. The test consisted of 47 multiple-choice questions, 25 of which covered research conducted in the New South Wales Department of Agriculture, 4 research conducted in other state departments of agriculture in Australia, 8 research undertaken by the CSIRO, and 10 research work done by staff located in Australian universities. The content of the questions was drawn from the annual research reports of the Sheep and Wool Branch of the New South Wales Department of Agriculture for the years 1971/72, 1972/73 and 1973/74, from CSIRO publications and from journals published in the same years. Questions were drawn exclusively from publications to ensure that the information was actually available to all extension personnel in the sample.[23]

[23] A full copy of the test is available on application to the Department of Agricultural Economics, University of Sydney.

The test was taken by all extension personnel in the sample, including district livestock officers, special livestock officers and livestock officers in training. The instructions given at the time of administering the test were verbal. They consisted of an explanation of the procedure of answering a multiple-choice question. It was also suggested that wild guessing was fruitless and that unless the answer was known, or an "educated guess" could be made, it would be simpler for all concerned to circle the final alternative to each question, "don't know". It was also emphasized that the test results would be completely confidential and would in no way be "used against" individual participants. No time limit was set for completion of the test. On average, those taking it took approximately one hour to complete it. Sample questions from the test are presented in Table 1.

Attitude Scales

Three attitude scales were constructed aimed at measuring (a) attitudes towards the value of extension and extension workers, (b) attitudes towards the value of agricultural research and research workers and (c) attitudes towards the value of science. A thorough search of existing libraries of attitude scales failed to reveal any suitable scales. There were scales designed to measure attitudes of high school students towards science as a school subject, and there were

TABLE 1

SAMPLE ITEMS FROM THE CURRENT KNOWLEDGE TEST FOR EXTENSION WORKERS

4. At Hay when lactating ewes were fed a diet consisting solely of wheat:

   * (a) milk production was significantly lower than in pasture fed ewes;

   (b) lamb mortality and lamb growth rates were normal;

   (c) milk production was similar to pasture fed ewes;

   (d) milk production was greater than in pasture fed ewes;

   (e) lamb growth rates were normal but lamb mortality was increased;

   (f) don't know.

7. Knight at the University of Western Australia tested the technique of incorporating different metallic elements into marking saddles for rams and their later detection by X-ray spectrophotometry as a method for identifying the individual rams which mate with each ewe under field conditions. He concluded that when up to 9 rams were joined:

   * (a) the technique was accurate and practical;

   (b) the technique was inaccurate but was practical;

   (c) the technique was no better than using diatomaceous earths in saddles;

   (d) the technique had no advantages over ordinary saddles;

   (e) the technique differentiated between rams that had mounted ewes and achieved intromission and those that had merely mounted ewes;

   (f) don't know.

43. Work at the CSIRO Division of Animal Physiology, Prospect has shown that the libido of rams may be:

   (a) increased markedly;

   (b) increased slightly;

   * (c) not increased;

   (d) don't know.

   by hormone injections early in life.

*This indicates the correct answer to the question.

scales designed to measure attitudes towards certain defined groups. The former were considered inappropriate for adult respondents working in a practical situation, and the latter dealt in the main with defined groups such as ethnic or religious groups which bore little resemblance to the groups involved in this study. Hence, new scales had to be constructed.

Item pools were gathered in a variety of ways. Many were obtained by means of informal interviews with extension personnel and research staff located in branches of the Department of Agriculture other than the Sheep and Wool Branch. Some were adopted from the existing scales mentioned above, some from papers and articles written by research and extension personnel about research and extension, and some from sessions conducted in association with members of the Extension Research and Evaluation Unit of the Department. From these pools, three Likert scales were constructed consisting of 38 items for the science scale, 36 items for the extension scale, and 45 items for the research scale. The variation in the number of items has no significance. All items considered potentially "good" were included without any initial numerical restriction on the size of the scales. There were approximately equivalent numbers of positive and negative statements in each scale. The scales are reproduced as appendices to this report.

Again, in administering these attitude tests instructions were presented verbally. The respondent was asked to tick the column, the heading of which represented most nearly his feelings about each statement. Five answers were possible, namely "strongly disagree", "disagree", "don't know", "agree" and "strongly agree". It was also suggested that not too much time be taken thinking about individual statements - that it was essential to give instant responses rather than duly considered ones.

The Use of Diaries

Three diaries were devised for the purposes of measuring pressure from farmers for information and contacts between the two groups of respondents. Extension personnel were requested to keep a diary of farmer enquiries and a diary of contacts with research workers. Research workers were asked to maintain a diary of contacts with extension workers and farmers. The instructions accompanying the diary for farmer enquiries asked for details of the type of contact (for example, a query by telephone, by letter or during a personal visit), together with details of the subjects discussed (for example, drenching, mulesing or pasture utilization).

The instructions accompanying the diaries for the purposes of recording contact between research and extension personnel were to give details of the initiator

of the contact (his name and the organization he worked for), the receiver of the contact (again his name and the organization he worked for), the type of contact (whether by telephone, letter or a chance meeting for example), the subjects discussed during the contact and the estimated success of the contact in terms of information derived from it.

The diaries were maintained on a daily basis for a period of nine weeks beginning on 17 February 1975 and ending on 18 April 1975. Respondents were asked to forward diaries each week in order to enable the author to ensure that they were following the instructions and that the diaries were being filled in regularly.

This section of the survey was the only part in which livestock officers in training did not participate. The reason for their exclusion was that while in training, livestock officers do not deal directly with farmers. They are situated on research stations for a large part of the time, and their contact with research workers is often a daily occurrence.

The Questionnaires

Two general questionnaires were constructed to gather the remaining data required, one specifically for research personnel and one for extension personnel. Each included straightforward questions concerning the respondent's age, length of service, his formal

professional qualifications and the location of the nearest relevant extension centre or research station. Each questionnaire also included questions aimed at obtaining information regarding the respondent's personal prejudices, his work-load, the degree of personal responsibility he took for collecting or disseminating information, and his evaluation of current farming problems. In the questionnaire for extension personnel, an assessment of the relative merits of different information channels and sources was sought. In the research workers' questionnaire, respondents were asked to indicate the primary sources of research ideas and the channels by which they came to them. Both groups were asked to indicate the refresher courses, seminars, conferences and workshops they had attended during the years, 1972 to 1974.

The tests and the questionnaires were administered personally at group meetings arranged at various country centres during the week, 14 to 18 April 1975. Two members of the extension group and seven members of the research group were unable to attend these meetings. The tests and the questionnaire were personally administered to the remaining extension workers in the week following the group meetings. Personal administration was found to be impracticable in the case of the research workers who were stationed at a variety of country centres. Accordingly, after discussions by telephone, the tests and questionnaire

were forwarded and returned by mail.

At all group meetings, informal discussions were held after completion of the tests and questionnaires concerning the aims of the project and the testing procedures. Some concern was expressed at the difficulty of the knowledge test for extension personnel. From comments made about the attitude scales it was apparent that many respondents were aware of the attitudes which were being measured, and this knowledge may have tended to bias their responses. There was no criticism of the general questionnaires.

The Hypotheses

The survey sought to test several hypotheses. These hypotheses can be divided into two groups, those concerning the behaviour of research workers and those concerning the behaviour of extension workers.

The Behaviour of Research Workers

In the flow of technical information between research and extension workers, research workers are seen primarily as the originators of technical or scientific information. As originators, they carry out research programmes which yield new information. The aspects of research relevant to the present study are the determination of the subjects for research on the one hand and the results of relevance to farm situations which flow from it, on the other. Research workers in the Sheep and Wool Branch of the Department are generally not free to proceed

on their own research problems without gaining prior approval from the directors of research in the Department and/or the funding bodies. Their proposals may be examined from the standpoint of statistical procedure or subjected to cost-benefit analysis before approval is given. However, once approval of the general project area has been gained, the specific direction which the investigation takes is largely under the control of the research worker or team, within the constraints placed upon it by costs and statistical feasibility.

As has been explained, not all agricultural research work produces results of immediate relevance to the farmer. Basic or pure research is a vital element of any scientific discipline, though its advantages are not immediate and are therefore often obscure to the practical man. Equally, a scientist engaged on basic research may believe the practical side of his discipline to be irrelevant to the success of his work. An applied agricultural scientist, however, needs to be in closer contact with what is going on at the grass roots and to be aware of the current farming problems. These, in many cases, provide the material for his research activities. It is important then that he be receptive to feed-back from farmers, farmers' organizations and extension personnel.

This study sought to discover which factors might be relevant in determining a research worker's receptivity

to feed-back from extension workers and farmers. Details of the factors examined in this connection are set out in Chapter 4. Another aspect of the behaviour of research workers within the realms of the communication of scientific or technical information is their use of different channels of information gathering, and the major sources of new research ideas. It was hypothesized that their major sources of ideas for research are (1) their colleagues, (2) their own previous research, and (3) instructions from head office personnel.

Finally, research workers' attitudes towards science, the value of agricultural research and the value of extension were considered to be relevant in determining their communication behaviour. It was hypothesized that research workers' attitudes towards each of these elements did not differ significantly from extension workers' attitudes. The study was also designed to ascertain the factors affecting the intensity with which each of the attitudes listed above was held.

The Behaviour of Extension Workers

Extension workers, to be effective in their role as purveyors of scientific and technical information to farmers, require a general knowledge of the results of recent applied research in their discipline. As has been explained, an objective measure of the extent of the sheep and wool officers' knowledge of recent research

was carried out as part of the present investigation. Other factors considered to be of possible significance in determining the extent of extension workers' knowledge of recent research were also measured. Their specific nature is described in Chapter 4.

Extension workers' use of various channels of information gathering and sources of information was also examined. The following hypotheses were tested.

(a) Extension workers prefer verbal rather than written channels for information gathering.

(b) Extension workers' use of different channels of information gathering is a function of their age.

(c) Extension workers' evaluation of different sources of information is a function of their age.

Finally, the attitudes of extension personnel towards the value of science, agricultural research and extension were considered to possibly influence their communication behaviour. Accordingly, these attitudes were measured and a further investigation was made into the determinants of the intensity of the attitudes held by the personnel concerned.

CHAPTER 3

RESULTS

The information collected during the investigation fell into two broad categories - information about the sample of research workers, and information concerning the sample of extension personnel. In addition, there were the results of the derivation of attitude scales with respect to the two groups. Each of these will be discussed in turn.

Characteristics of the Research Personnel

In this section a broad description is given of relevant characteristics of research workers surveyed, their appreciation of farm problems relevant to their research activities and the nature of their relationships with the extension service.

Personal Characteristics

The average age of the research personnel was 29.3 years. Of the 24 research workers 15 were in the 20 to 30 years age group, eight were between 31 and 40 years old and one was over 40 years of age.

The research personnel interviewed had spent on average four years at the location where they were stationed at the time of the survey. Fourteen research workers had spent four years or less at their present

location, nine had spent between four and 10 years and the remainder had been stationed at the one location for over 10 years. The range in the number of years spent at the present location was six months to fourteen years and six months.

The research workers interviewed had been employed by the N.S.W. Department of Agriculture for 7.8 years on average. This number of years varied from one to 20 in the sample group.

As might be expected, all of the research workers participating in the survey had completed at least a bachelor's degree at university. Eleven of them held post-graduate qualifications as well, and eight of these held the degree of Doctor of Philosophy. One had completed an agricultural college course before proceeding to the university.

An indication was obtained of the number of conferences and seminars attended by research workers. The view was taken that such attendance added to the respondents' "informal" educational qualifications in the sense that the meetings might be regarded as having the purpose of increasing the technical knowledge of those attending. Research workers were given a check-list of some 14 kinds of conferences, seminars and workshops held during the years 1971 to 1974 at which both research and extension workers had been represented. They were asked to indicate

those meetings they had attended, whether as participant or lecturer. On average, the research group attended 7.1 meetings, the individual variation among the group being from one meeting to 18 meetings. Wherever possible, meetings were also classified in terms of the technical field covered. Of the ten fields of sheep and wool husbandry examined conferences on genetics, reproduction and nutrition were by far the most regularly attended. Conferences on objective measurement and disease control on the other hand, attracted scant attention. The average number of meetings attended covering specific fields are listed in Table 2.

Two questions were asked with the aim of determining the existence of personal prejudices in terms of favouring particular technical fields of research. The questions required the respondent to cite a specific area of sheep and wool production which he considered to be deserving of greater emphasis in research, and also to indicate the area in which he believed himself to have more expertise than others. Part of the required response included an estimate of the importance of this specific aspect of sheep and wool production. Emphatic positive responses to the same cited aspect were taken to indicate the existence of pronounced bias to one problem area. Of the 24 research workers, six were found to have such biases. As regards the field of prejudice, three

mentioned reproduction, while genetics, nutrition and meat production were each listed by one of the remaining three research workers.

TABLE 2

Research Workers - Attendance at Conferences in Various Technical Fields

Technical Field	Meetings Attended	Range
Genetics	1.9	0-6
Reproduction	1.2	0-8
Nutrition	1.4	0-12
Wool	0.3	0-3
Management	0.8	0-2
Marketing	-	-
Objective measurement	0.2	0-2
Blow-fly control	0.3	0-2
Disease	0.1	0-1
Other	0.4	0-8

Bases for Research

The receptivity of research workers to feedback from extension personnel concerning current problems in the farming situation was measured by asking members of each group to list the five most pressing problems in sheep and wool production. The listings given by extension workers (excluding livestock officers in training) were then used to construct a five-item list best representing the opinions of the extension group. These items were weighted according

to the number of times they were cited by the extension group, giving an indication of the importance placed on them by extension workers. The resulting list and corresponding weights for each item were:

(1) Reproduction	31
(2) Economic considerations	29
(3) Blow-fly control	22
(4) Nutrition	10
(5) Marketing	8
Total	100

A research worker scored the weighted value of an item if he listed that item. His total score showed the degree of similarity of his estimation of the most important sheep farming problems to the estimation of the combined extension group. It was taken to represent the extent of his receptivity to information from extension workers concerning the problems they dealt with in the farming situation. The average score gained by the research group was 53.8, and scores ranged from zero to 90. Three members of the group gained scores between zero and 30, nine between 31 and 60, 12 between 61 and 90 and none scored over 90.

Research workers were asked to assess a list of channels which could be used to gather information about new ideas for research. They assessed each channel by giving it a score out of 10 according to how often in the past that channel had provided new ideas. Averaged scores

for each channel are presented in Table 3. It is apparent that literature reviews and contacts with research colleagues were the principal channels used for securing information of relevance to research activities. However, head office personnel and extension workers in the same branch also received scores in excess of four. Two points emerge. First, the results appear to confirm other studies emphasizing the importance of personal contacts as a means of keeping abreast with research. Second, they suggest that departmental research workers rely for inspiration more on colleagues within their own organization than on those outside.

The questionnaire asked research personnel to list in their order of importance the three most important sources of new ideas for their research. Table 4 gives a list of the sources cited together with the number of times each one was mentioned and the order of importance given to it by the research personnel. They were also asked to tick on a check-list the source from which they got the latest idea useful to them in their research. The results are shown in column four of Table 4. The sources most commonly cited as of prime importance were research colleagues and the research worker's own previous research. Rather unexpectedly, members of the head office staff were not mentioned with any regularity.

Relations with Extension Personnel

As indicated previously, research workers were asked

to indicate how far the centre of their operations was from the nearest headquarters of their opposite number in

TABLE 3

Research Workers - Channels Used in Gathering Information

Channels	Average Score	Range
Scientific literature	7.2	3-10
N.S.W. Department of Agriculture publications	2.1	0-6
Research for post-graduate degree	4.9	0-10
Livestock officers (sheep and wool)	4.4	0-10
Farm visits	4.0	0-9
Field days	2.3	0-9
The annual research report of the Sheep and Wool Branch	2.0	0-5
Annual seminar (extension)	3.1	0-6
Annual seminar (research)	3.5	0-9
Regional conferences	3.3	0-9
Study tours	3.6	0-8
Research colleagues	7.2	4-10
Research/extension liaison officers	2.5	0-6
Head office staff	4.3	0-9
CSIRO research workers	4.0	0-10
University research workers	3.5	0-8
Scientific personnel from private industry	2.4	0-6

the extension service. Respondents were asked to record both the physical and the perceived proximity. Physical

proximity entailed a straightforward calculation of the number of kilometres from their research station to the nearest extension office where a district livestock officer (sheep and wool) was based. Perceived proximity was measured by asking respondents how easy they felt this office was to reach. The results are presented in Table 5. Approximately 40 per cent of research workers were within 15 kilometres of a sheep and wool extension worker. Except where the distance exceed 150 kilometres, the majority of research personnel considered the extension workers to be within easy access.

TABLE 4

Research Workers - Sources of Ideas for Research

Sources of Ideas for Research	Number giving particular rating			Source of latest Idea
	1	2	3	
A research colleague	9	4	5	13
A farmer	1	1	1	1
A member of head office staff	1	1	2	2
Scientific literature		10	7	14
Own observations	5	4		12
A research/extension liaison officer		1		1
A Livestock Officer (Sheep and Wool)		2	8	1
Own previous research	8		1	11
A university research worker	1		1	3
A CSIRO research worker		2		3
A scientist from private industry				1
An overseas research worker				
A Livestock Officer (Beef Cattle)				2

Research workers were asked how many hours per week they felt they could put aside for assisting extension workers with technical queries without such activities interfering with their work. This was taken to represent their "approachability" in terms of how ready the research workers were to aid extension workers by making themselves available for comment or as a channel for obtaining information. Thirteen of the 24 research workers were prepared to put aside three hours or less to such activities, nine indicated they would put aside between four and six hours and three were prepared to give between seven and nine hours to these activities. The average number of hours mentioned by the research group was 3.2.

TABLE 5

Research Workers - Their Proximity to the Nearest Extension Worker

Distance	Number of Officers	Perceived ease of Access			
		Very Easy	Easy	Difficult	Very Difficult
0 to 15 km.	10	5	4	1	-
16 to 50 km.	4	-	3	1	-
51 to 150 km.	4	-	3	1	-
more than 150 km.	6	-	2	3	1

Data on contacts with extension workers and farmers were drawn from the diaries maintained by the

research group which were described in Chapter 2. All the diaries distributed were returned. The results are summarized in Tables 6, 7 and 8.

Table 6 summarizes respondents' records of the average number of contacts which were initiated by either themselves, extension personnel or farmers. For the cases where the research workers were the initiators, the table shows the average number of contacts they initiated with livestock officers and farmers. There were several instances where contact was made without prior planning on the part of either party, for example, where a research worker and an extension worker "bumped into each other" in the street and proceeded to discuss some technical matter.

TABLE 6

Research Workers as Initiators and Receivers of Contacts with Extension Workers and Farmers

Person Involved	Number of Contacts Initiated		Number of Contacts Received	
	Average	Range	Average	Range
The research worker (self)	11.9	0-62	7.8	0-29
Livestock officer in the same region	1.5	0-13	2.0	0-14
Livestock officer in another region	2.8	0-13	2.8	0-12
Farmer	1.2	0-7	9.5	0-52
No initiator or receiver	4.7	0-21		
Total	22.1		22.1	

This type of contact is recorded under the heading of "No initiator or receiver". On average over half of the research worker's contacts with extension workers and farmers were initiated by himself, and of those contacts approximately 80 per cent were with farmers. It is interesting to note that research workers had more contact with livestock officers outside their region than they did with those located in the same region.

Information about the various channels used by respondents in establishing contacts was also obtained from the diaries they kept. The results are set out in Table 7. Telephone conversations and personal visits were the most commonly recorded channels.

TABLE 7

Research Workers - Channels of Contact with Extension Workers and Farmers

Type of Contact	Average Number	Range
Personal visit	6.3	0-35
Phone	7.6	0-41
Letter	2.4	0-23
Chance meeting	1.0	0-7
Semi-planned meeting	1.4	0-12
Informal meeting out of office hours	2.1	0-23
Group meeting	1.3	0-12
Total	22.1	

Research workers recorded an average of 22.1 contacts with extension workers and farmers over the nine-week period. Of these contacts, an average of 12.6 were considered successful, 3.9 moderately successful, and 0.5 unsuccessful. The success of the remaining 5.1 was irrelevant because they were contacts about personal non-technical matters, for example, meeting for a game of squash.

TABLE 8

Research Workers - Subject Matter of Contacts with Extension Workers and Farmers

Subject	Average Number of Contacts	Range
Genetics	1.0	0-9
Reproduction	1.9	0-12
Nutrition	0.8	0-7
Management	1.2	0-10
Marketing	0.2	0-4
Wool	1.2	0-25
Objective measurement	0.8	0-10
Blow-fly control	0.0	0-1
Disease	0.3	0-2
Other technical	3.5	0-15
Co-operative trials	7.3	0-58
Personal	4.1	0-47
Total	22.3	

Table 8 presents information on the range of aspects of sheep and wool production which were the subjects of the contacts made. The highest average number of contacts recorded concerned some aspect of reproduction. Apart from conversations about private matters, co-operative trials were the most frequent subject of conversation.

Respondents were given a choice of five degrees of personal responsibility for communicating the results of their research to extension personnel. Fourteen of the 24 in the sample felt they had a moderate responsibility in this regard, nine said they had a lot while one accepted total responsibility.

Characteristics of the Extension Personnel

This section presents the information gathered about the sample group of extension personnel. It covers three broad areas, their personal characteristics, their knowledge of research information and use of information channels, and their relations with research personnel.

Personal Characteristics

The average age of the extension workers was 33.4 years. Eighteen of the twenty-five were 35 years of age or younger. Four were between 36 and 45 years of age and two were over 45 years. For the 12 livestock officers in training, their average age was 25.4 years. Two were under 25 years of age, eight were between 25 and 27 years and two were between 28 and 30 years of age.

Extension workers had been stationed at their location at the time of the survey for an average of 5.3 years. Nine had spent two years or less at that location, six had spent between three and six years there, six had been there for between seven and 10 years, three between 11 and 17 years and one between 18 and 20 years. Livestock officers in training had spent on average 8.4 months at their present location. Four had been there for between zero and six months, four between seven and 12 months and four between 13 and 18 months.

The average number of years that extension workers had been employed by the N.S.W. Department of Agriculture was 12.7. Nine extension workers had been with the Department for between zero and 10 years, nine for between 11 and 15 years, three for between 16 and 20 years and four for between 21 and 30 years. Livestock officers in training had been employed by the Department on average for 4.6 years. Three had been with the Department for less than four years, five for between four and six years, and four for between seven and ten years.

Of the total number of extension personnel who had completed various formal courses at the time of the survey, over 80 per cent held agricultural college diplomas, while less than 20 per cent possessed degrees from universities. Four of the extension workers held post-graduate diplomas and one trainee had a post-graduate degree.

The qualifications of trainees were not significantly different from those of the extension workers. This is typical of the qualifications of extension personnel in New South Wales.

As in the case of research workers, the extension personnel interviewed were asked to tick off on a check-list those conferences, seminars and workshops they had attended during the years 1971 to 1974. The list was identical to that shown to the research personnel. The average number attended by extension workers was 11. One respondent had attended less than six meetings, 16 had attended between six and 11 meetings, seven between 12 and 17 meetings and one between 21 and 24 meetings. Understandably trainees had attended fewer conferences than their more senior colleagues.

The meetings, as far as possible, were also classified in terms of their subject matter. The results are set out in Table 9. The highest attendance was registered at conferences on management, followed by those dealing with nutrition. It will be recalled that genetics and nutrition were the most popular topics for conferences attended by research personnel. This variation reflects the fact that extension personnel deal more directly with practical farm performance than research personnel.

The extension personnel were asked three questions aimed at determining the existence of personal

prejudice. As in the case of the research workers, repeated emphatic positive responses to a particular aspect of sheep and wool production were considered to indicate the existence of a "hobby horse". It was found that seven of the 25 livestock officers and two of the trainees displayed prejudice of this kind towards a particular field. As regards the field of prejudice, two extension workers and

TABLE 9

Extension Workers - Attendance at Conferences in Various Technical Fields

Subject	Extension Officers		Trainees	
	Average	Range	Average	Range
Genetics	1.3	0-7	0.8	0-2
Reproduction	1.5	0-4	1.2	0-3
Nutrition	1.8	0-6	1.3	0-3
Wool	0.6	0-4	0.2	0-1
Management	2.7	1-6	1.0	0-2
Marketing	0.3	0-2	0.2	0-1
Blow-fly control	1.2	0-3	0.8	0-2
Disease	0.3	0-2	0.2	0-1
Objective measurement	1.3	0-3	0.2	0-1
Other	1.5	0-5	0.9	0-2

the two trainees mentioned reproduction, two emphasized management considerations, one objective measurement, one

diseases and one goats. Ten of the 37 respondents were found to display prejudice of this kind.

TABLE 10

Extension Workers - Channels of Contact with Farmers

Channel of Contact	Number of Contacts	
	Average	Range
Personal visit	37.1	8-109
Telephone	32.0	1-240
Group meeting	15.2	0-46
Chance meeting	10.3	0-33
Informal meeting out of office hours	3.7	0-26
Letter	1.0	0-8
Total	99.3	21-418

From the diaries maintained by the extension personnel, an indication of the pressure from farmers ("client-push") experienced by each extension worker was gained. The average number of queries received from farmers over the nine-week period was 119 or just over 13 per week. The range in number of queries dealt with varied enormously from 35 to 492, suggesting that extension personnel were subjected to very variable amounts of pressure from their clients. The lowest numbers of queries were recorded by the special livestock officers, whose positions entail less contact with farmers

and more liaison with research workers and other extension workers.

The most common channel of contact with farmers was the personal visit, followed closely by telephone conversations. Both situations involve person-to-person verbal communication. The detailed results are shown in Table 10. Sheep management problems were the ones most commonly discussed. As Table 11 reveals, problems in reproduction and genetics were the other topics to which reference was most regularly made.

TABLE 11

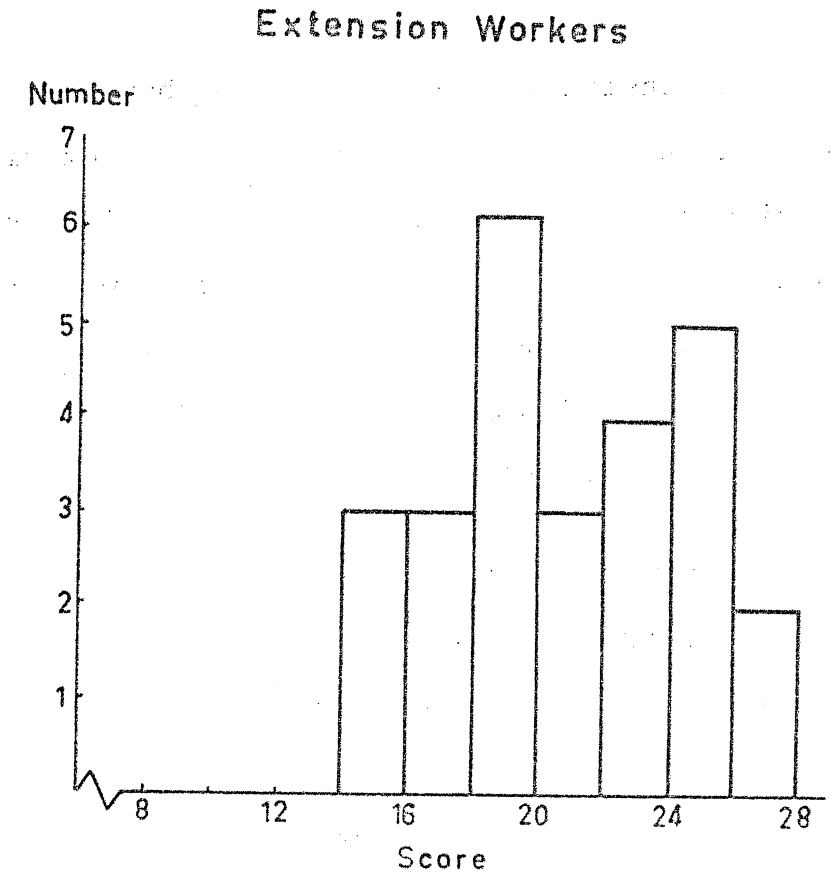
Extension Workers - Subject Matter of Contact with Farmers

Subject	Number of Contacts	
	Average	Range
Management	24.3	3-106
Reproduction	18.8	1-77
Genetics	17.3	0-50
Nutrition	10.6	0-39
Disease	8.8	0-48
Objective measurement	8.4	0-25
Marketing	7.1	0-25
Blow-fly control	6.1	0-33
Wool	4.4	0-21
Other	13.2	0-101
Total	119.0	35-492

Extension workers were asked how much of their time per week was taken up by direct extension activities or preparation for them. They reported spending on average 27.4 hours per week on such activities. Two participants spent less than ten hours per week and two said they spent over 40 hours per week.

Knowledge of Research Information and the Use of Information Channels

Extension workers and trainees were asked to complete 47 multiple choice questions covering research carried out and/or reported in the literature during the years 1971 to 1974. The method of constructing the test was described in the previous chapter. Participants on average answered 20.5 questions correctly. The average score for the trainees was 17.5. Six extension workers and seven trainees scored less than 18. Nine extension workers and two trainees scored between 18 and 21. Nine extension workers and three trainees scored between 22 and 25, and one extension worker scored between 26 and 28. Seeing that on average less than half of the questions were answered correctly, it should be pointed out that the test was not intended to be an examination of extension workers' overall knowledge or competence. Its purpose was to estimate the amount of research information reaching extension workers. Given the average score, it can be inferred that less than half of the recent research



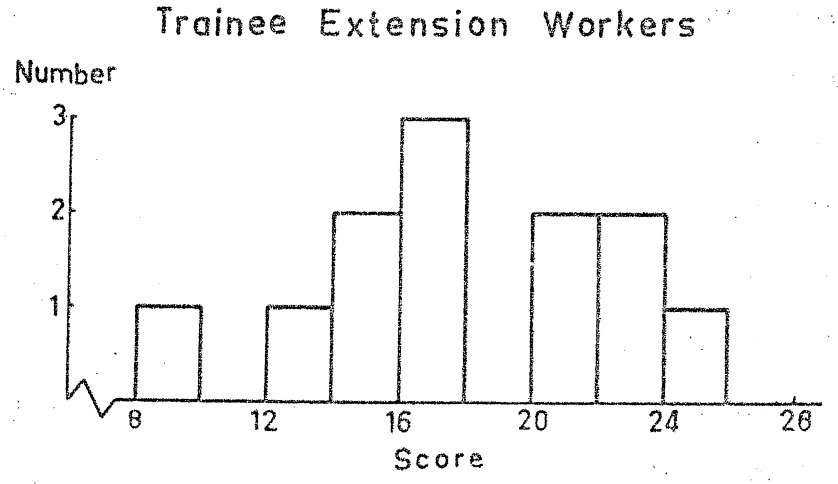


Figure 1. Scores Obtained in the Current Knowledge Test

findings in their discipline are reaching and being assimilated by the extension workers.

The test consisted of questions covering research by the personnel of various organizations as has been stated previously. The average scores for questions covering research results from these institutions are presented in Table 12. The average scores were highest for questions dealing with research undertaken by the state departments of agriculture and lowest for questions concerning university based research. The variation in the pattern of scoring between extension workers and trainees is interesting. Trainees displayed similar knowledge to their seniors concerning research carried out by members of state departments and universities, but their knowledge of research by CSIRO personnel was less.

The 47 questions could also be broken down into technical fields. Seventeen questions dealt with research on reproduction, 14 with nutrition, eight with genetics, seven with wool and one with internal parasites. The average scores for these groupings are listed in Table 13. Average scores were lowest in the fields of reproduction and nutrition, and (excluding the one question about internal parasites) highest for questions covering wool and genetics. It is interesting to note that reproduction and nutrition were acknowledged by extension workers to be two of the five most pressing problem areas in sheep and

wool production, whereas wool and genetics were not considered so pressing.

TABLE 12

Extension Workers - Knowledge of Recent Research by Personnel in Various Organizations

Location of Research Workers (a)	Extension Workers		Trainees	
	Average Score	Range	Average Score	Range
State departments of agriculture (29)	14.0	10-19	12.4	5-18
Universities (10)	3.6	1-7	3.3	2-6
CSIRO (8)	3.0	1-4	1.8	1-3

(a) The figures in the first column refer to the number of questions drawn from the particular source named.

TABLE 13

Extension Workers - Knowledge of Recent Research in Various Technical Fields

Technical Field (a)	Extension Workers		Trainees	
	Average Score	Range	Average Score	Range
Reproduction (17)	6.3	3-12	5.7	3-10
Nutrition (14)	5.9	3-10	4.3	1-8
Genetics (8)	3.8	1-6	4.0	2-6
Wool (7)	3.7	2-7	2.8	1-4
Internal parasites (1)	0.9	0-1	0.8	0-1

(a) The figures in the first column refer to the number of questions asked in the particular field.

Extension workers and trainees were given a list of channels by which technical information came to them and they were asked to indicate (by giving each item a score out of 10) how much success they had had in the past in getting relevant information through that channel. Averaged scores for each channel are presented in Table 14. Allowance was made for a "not applicable" response (that is, where an officer had never used or been in a position to use a particular channel). These cases were excluded from the average scores.

Highest scores were on average given to channels involving personal contact with the information sources or bearers (e.g. other livestock officers (sheep and wool), research workers employed by the New South Wales Department of Agriculture and farmers), and channels having an educational orientation (e.g. sheep and wool refresher courses, post-graduate diploma courses, and study tours). Lowest scores were given to personnel employed by organizations other than the New South Wales Department of Agriculture. Channels involving the receipt of information in written form were given scores in the middle range.

As might be expected, there were differences in the scores given by extension workers and trainees. Trainees tended to value the channels more highly across the whole range of channels listed. This probably

TABLE 14

Extension Workers - Channels Used in Gathering Information

Channels	Extension Workers		Trainees	
	Average	Range	Average	Range
Annual sheep and wool seminars	7.2	3-10	6.4	0-10
Sheep and wool refresher courses	6.9	0-10	10.0	0-10
Small group workshops	6.1	0-10	6.4	0-10
Regional conferences	5.0	0-10	3.5	0-7
Scientific journals	5.5	2-9	6.3	2-10
N.S.W. Dept. of Agric. journals	5.2	2-10	5.8	2-9
Annual research reports	5.4	2-9	4.5	0-8
Other departmental publications	4.4	0-8	5.4	0-7
Original training	4.8	1-10	7.5	5-10
Post-graduate degree courses	5.0	0-8	7.0	0-8
Post-graduate diploma courses	7.5	0-9	9.0	0-9
Study tours	6.8	0-10	8.0	0-10
Other extension officers	6.8	3-10	6.9	5-10
Dept. of Agriculture research workers	6.6	2-10	6.3	3-9
Tours of research stations	4.6	1-10	5.3	0-8
Research/extension liaison officers	3.2	0-8	2.5	0-4
Farmers	6.6	2-10	5.6	0-9
Head office staff	4.2	1-10	3.8	0-8
CSIRO research workers	5.2	1-10	5.8	0-8
University research workers	3.0	0-8	4.8	0-9
Scientists from private industry	3.1	0-7	6.0	0-7
Representatives from private industry	4.4	0-10	6.0	0-10

reflected their inexperience. The high value they placed on all forms of education may be explained by the fact that their years of formal education remain fresh in their minds whereas their opportunities to use other potential channels of gathering information have been limited.

TABLE 15

Extension Workers - Use of Various Sources of Information

Information Sources	Extension Workers		Trainees	
	Average	Range	Average	Range
University research	2.4	0-5	2.0	0-4
CSIRO research	3.2	2-5	3.2	2-4
Private industry research	1.9	0-5	1.1	0-4
N.S.W. Dept. of Agriculture research	3.9	2-5	4.2	3-5
Farmers	3.3	1-5	2.3	0-5
Own original research	2.9	1-5	1.6	0-5
Own observations	3.4	2-5	3.2	1-5
Research in other states	2.6	1-5	1.6	0-4
Overseas research	1.6	0-5	1.1	0-4
Original research by other extension officers	2.6	0-5	2.3	0-5

Respondents in the extension group were asked to examine a list of primary sources of new technical information relevant to their work and give each a score out of five reflecting the frequency with which that

source had provided them with useful information in the past. Table 15 lists the average scores for both extension workers and trainees. For both groups research workers in the N.S.W. Department of Agriculture rated highest. Respondents' own observations were also scored high by both groups, while extension workers saw farmers as a more important source of information than did the trainees. The in-service training period for extension workers has, to date, been geared towards giving such personnel experience on research stations. If, however, farmers are an important source of information, training might profitably include more frequent contacts with farmers.

Relations with Research Personnel

Table 16 presents the extension workers' estimates of their physical and perceived proximity to the nearest research station where sheep and wool research was carried out. The question was not considered relevant to trainees as most of this group were located on research stations. Only four respondents saw the nearest research station as difficult of access, but three of these were located over 150 kilometres from the nearest research station. This compares with seven research workers who saw access to the nearest livestock officer (sheep and wool) as difficult, two of whom were less than 50 kilometres from that livestock officer. Speaking generally more extension workers than research workers described access

as very easy. This may reflect the fact that the former are more accustomed to travelling long distances at frequent intervals.

TABLE 16

Extension Workers - Their Proximity to the Nearest Research Worker

Distance	Number of Workers	Perceived Ease of Access			
		Very Easy	Easy	Difficult	Very Difficult
0- 15 km	6	5	1	0	0
16- 50 km	1	1	0	0	0
51-150 km	13	6	6	1	0
more than 150 km	5	0	2	2	1

Extension workers maintained a diary of their contacts with research personnel over a nine-week period. Table 17 lists the average number of contacts initiated and received by extension workers involving research workers from various organizations. Over half of the contacts were initiated by extension personnel. Of the remainder, the initiators of contact were predominantly departmental research personnel. It is interesting that these latter personnel were based most often in regions other than that in which the extension worker contacted was located. Contact outside the department was low. Contacts were made on average twice a week over the nine-week period.

The range in the number of contacts made was high, some extension workers having no contact at all, while others had up to eight or nine per week on average.

TABLE 17

Extension Workers As Initiators and Receivers of Contacts with Research Workers

Person Involved	Number of Contacts Initiated		Number of Contacts Received	
	Average	Range	Average	Range
The extension worker (self)	9.9	0-50	8.3	0-28
Department research worker in the same region	1.7	0-10	3.5	0-23
Department research worker in another region	3.7	0-18	4.2	0-35
Department research worker in another state	0.2	0-2		0-1
CSIRO research worker	0.3	0-2	0.7	0-3
University research worker	0.1	0-2	0.4	0-3
Scientist in private industry	0.4	0-5	0.1	0-1
Other research worker	0.5	0-3	1.0	0-8
No initiator or receiver	1.4	0-12		
Total	18.2	0-76	18.2	

The channels used in making contacts are set out in Table 18. Telephone conversations accounted for almost 40 per cent of the contacts. The next most common form of contact was the personal visit. These accounted for almost 20 per cent of the total. Written communication made up approximately 15 per cent of contact. As in the

case of contact with farmers, the most common form of contact involved direct conversation.

TABLE 18

Extension Workers - Channels of Contact with Research Workers

Type of Contact	Number of Contacts	
	Average	Range
Telephone	7.0	0-23
Personal visit	3.5	0-12
Informal meetings out of office hours	2.6	0-31
Letter	2.6	0-33
Group meeting	1.8	0-11
Chance meeting	0.7	0-12
Total	18.2	0-76

The respondents' judgments of the success of contacts revealed that just over 65 per cent of them were regarded as successful and only four per cent as unsuccessful. Nineteen per cent were considered moderately successful. Five per cent of the contacts recorded concerned personal matters and their success was therefore irrelevant. A further seven per cent of contacts could not be judged successful or otherwise by the respondents as the final outcome of the contact had not been ascertained.

TABLE 19

Extension Workers - Subject Matter of Contacts with Research Workers

Subject	Number of Contacts	
	Average	Range
Reproduction	4.0	0-32
Management	3.9	0-14
Co-operative trials	1.8	0-14
Objective measurement	1.7	0-13
Nutrition	1.0	0-7
Genetics	0.9	0-4
Blow-fly control	0.8	0-4
Personal	0.7	0-7
Wool	0.4	0-3
Disease	0.3	0-3
Marketing	0.1	0-1
Other technical	3.2	0-13
Total	18.8	0-76

Table 19 gives details of the subject matter of the contacts made. Reproduction and management figured most prominently. Discussions on co-operative trials and objective measurement were the next most common. Reproduction and management were also the most common areas of farmer enquiry. This fact tends to suggest that the extension workers, in contacting research workers, were prompted by farmer enquiries. In other words, client-push was operating.

The extension workers interviewed were asked how much responsibility a research worker should take for the dissemination of the results of his research to the extension audience. No one responded in the negative. One trainee said "a little", 13 respondents (eight extension workers and five trainees) said "a moderate amount", 22 said "a lot" (16 extension workers and six trainees) and one extension worker said research workers should take all the responsibility. Research workers on the same question favoured the answer "a moderate amount" (14 of the 25 respondents chose this option). By contrast, the extension group tended to favour the response "a lot" (22 of the 37 respondents choosing this option). This result supports the belief that extension workers have traditionally expected to be hand-fed the results of research, although there are indications that this trend is changing. Only half of the trainees said "a lot", as compared with almost 70 per cent of the extension workers surveyed.

Attitude Scales

As indicated in the previous chapter, three attitude scales were developed for the purpose of testing respondents' attitudes towards the value of science, the value of agricultural research and research workers, and the value of extension and extension officers. The original scales administered to the sample

group consisted of large pools of attitude statements which had not been subjected to statistical analysis of any kind.

Attitude towards the Value of Science

In accordance with the customary procedure for the derivation of attitude scales, 27 statements were drawn from the original 38 item pool (see Appendix A) by a process of excluding least correlated items until the alpha coefficient reached its peak ($\alpha = 0.824$).[24] The total possible score on the scale was 135, representing the most positive attitude towards the value of science. Mean scores were 90.7 for the research group, 90.9 for the extension group, and 91.7 for the extension workers in training. As might be expected there was no significant difference in mean scores among the groups ($P = .01$). These scores are not meaningful in isolation. It cannot be said that a score of 90 or over denotes a positive attitude and a score of 89 or less represents a negative attitude. The scales were new and no norms had been established for them. Thus the scores are meaningful as a comparative measure of where individuals stand in relation to each other or where groups stand in relation to each other.

The range and distribution of scores for the members of each group are shown in Figure 2. Six

[24] The alpha coefficient is a measure of internal consistency reflecting degree of reliability among the items of a scale, in terms of overlapping variance. Its range extends from 0.0 to 1.0. See L.J. Cronbach, Essentials of Psychological Testing (New York: Harper, 1951).

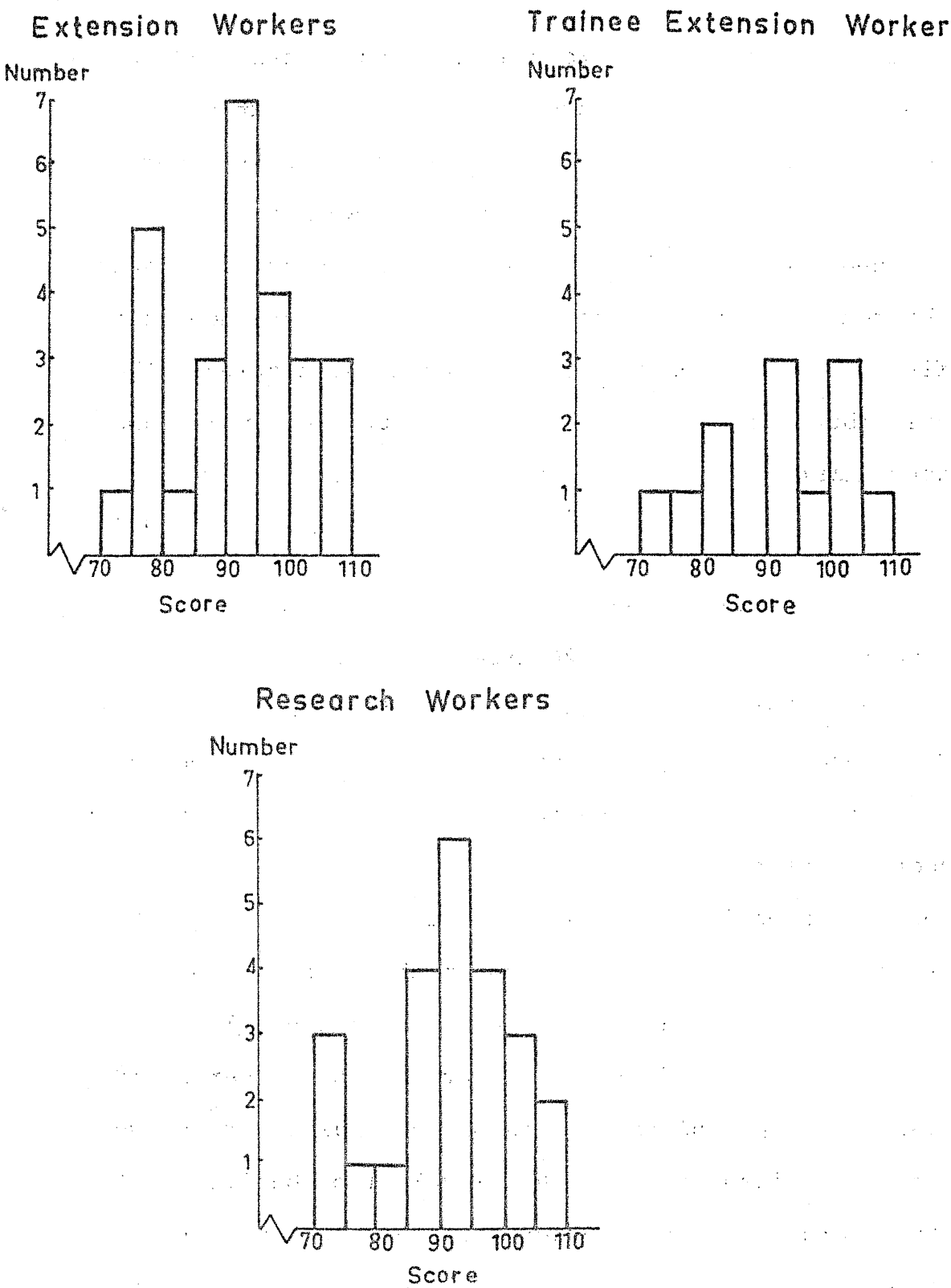


Figure 2. Attitudes Towards the Value of Science

extension workers and two trainees scored below 80 on the scale, as did four research workers. Four extension workers, two trainees and five research workers scored between 80 and 89, while 11 extension workers, four trainees and 10 research workers scored between 90 and 99. The remaining six extension workers, four trainees and five research workers scored between 100 and 109. The distributions of scores for each group are similar and approximate a normal distribution curve.

Attitudes towards the Value of Agricultural Research and Research Workers

As far as the scale assessing attitudes to research was concerned, 26 items were drawn from the original 45-item pool, the alpha coefficient being 0.913. The reduced form of the scale is reproduced in Appendix B. Total possible score in this case was 130. The mean scores obtained were 96.8 for the research group, 78.4 for the extension group and 90.5 for the group of trainees. The difference between the research and extension groups was significant at the 0.01 level of probability. The differences between the research and trainee groups and the extension and trainee groups were both significant at the 0.05 level of probability. In other words, research workers placed a much higher value on agricultural research and research workers than did the extension personnel surveyed, and the extension trainees held more positive attitudes towards research than

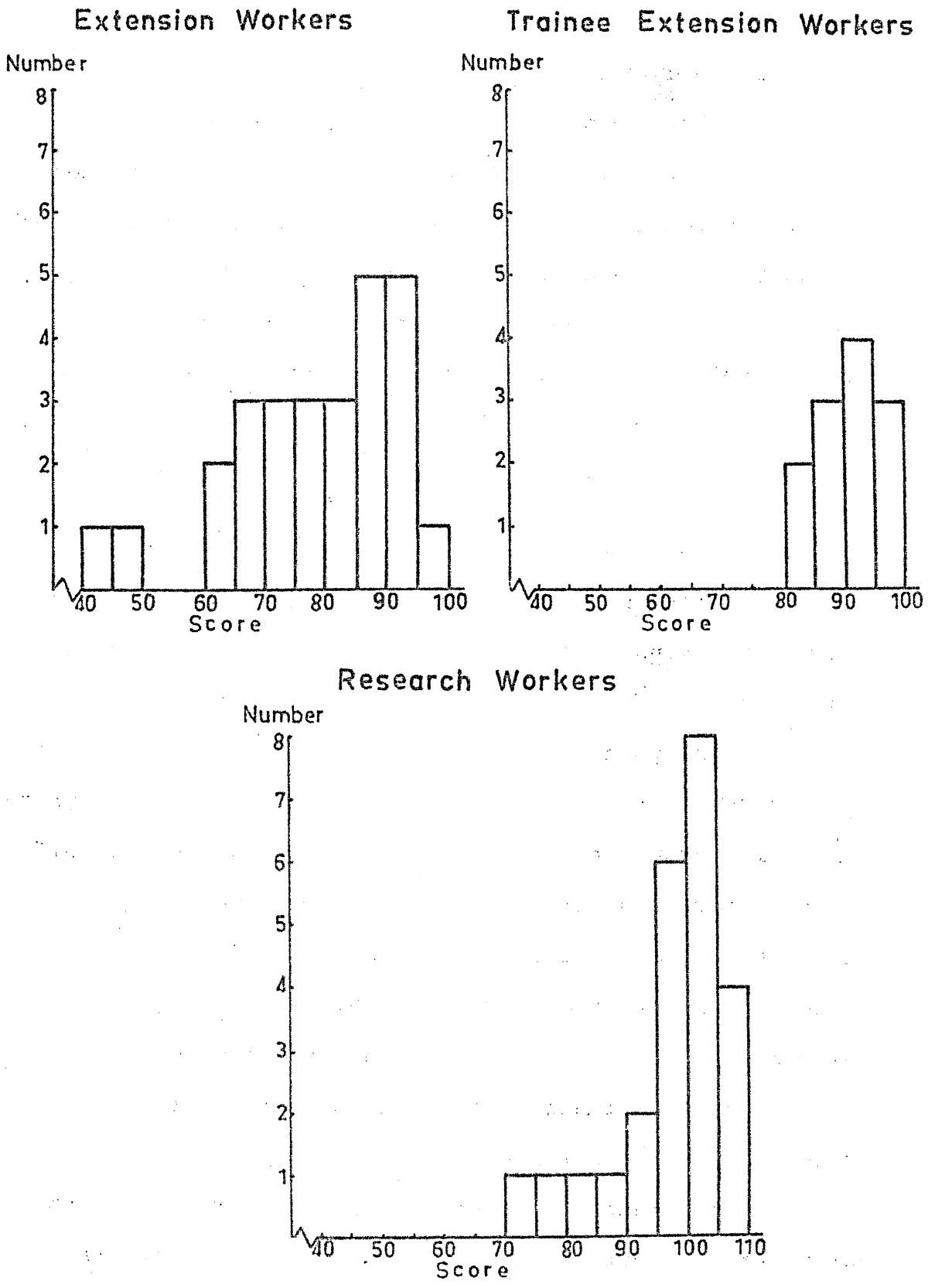


Figure 3. Attitudes Towards the Value of Agricultural Research and Research Workers

extension workers.

The range and distribution of scores for the groups are presented in Figure 3. The scores obtained by the extension group ranged from 43 to 98 as compared with a range in the research group from 74 to 109. No trainee extension worker scored lower than 80 or higher than 99. The distribution of scores for each group tended to have a positive skew.

Attitude towards the Value of Extension and Extension Workers

There were 36 statements in the original pool assembled for the scale measuring attitudes towards the value of extension, of which 24 remained after analysis. The alpha coefficient was 0.865. The shortened scale is laid out in Appendix C. The total possible score was 120. Mean scores were 80.2 for the research group, 86.3 for the extension group and 86.0 for the trainee group. Significant differences were found between the average scores for the research and extension groups ($P = 0.025$) and the research and trainee groups ($P = 0.05$). In other words, extension personnel saw more value in extension work and had a higher estimation of extension workers than the research workers surveyed.

The range and distribution of scores for each group are set out in Figure 4. No extension workers, one trainee and three research workers scored below 70 on

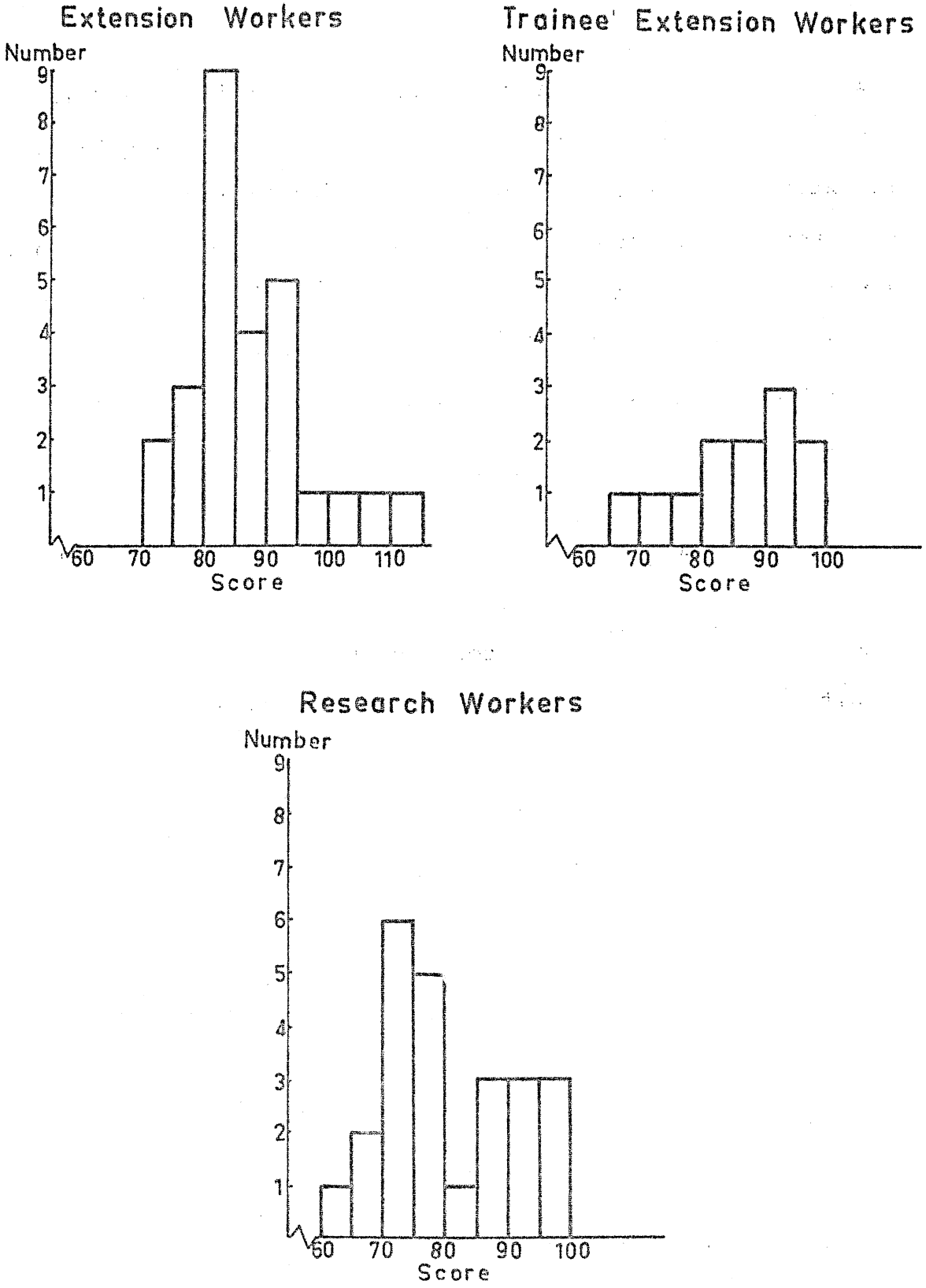


Figure 4. Attitudes Towards the Value of Extension and Extension Workers

this scale. Five extension workers, two trainees and 11 research workers scored between 70 and 79. A majority of 13 extension workers, together with four trainees and four research workers scored between 80 and 89, and nine extension workers, five trainees and six research workers scored 90 or above. The distributions of scores for the research and extension groups have a slightly negative skew as compared with a more positive trend for the group of trainees.

The data presented in this chapter were used in a series of regression analyses to determine the relationships among the various factors which were measured. The results of these analyses are set out in the next chapter.

CHAPTER 4

ANALYTICAL MODELS

An important aim of the present study was to identify problem areas in communication between research and extension personnel. To this end two models were developed, one of communication between research and extension workers, and the other of that between extension and research workers.

The Model Describing the Communication Behaviour of Research Workers

As far as is known, no previous attempt has been made in the field of communication research to estimate equations or systems of equations to determine the factors which influence the receptivity of research workers to information from "users". The word "user" is employed here in the sense that extension workers use the results of research in performing their advisory role. In this case they are intermediate rather than final users.

In the model developed the variable, knowledge of current farming problems, was taken as an indicator of research worker ' receptivity. It was basically a measure of the level of agreement between research and extension workers about what the major farming problems were.

First, a series of regressions was run taking research workers' receptivity as the dependent variable and all those variables previously described as independent variables. In so doing, it was assumed that there were no correlations amongst the variables themselves. This, however, was found not to be the case. A two-equation system was then developed to take account of interrelationships among the independent variables.

It was hypothesized that research workers' receptivity (RR) was a function of their age (AGE), the length of time spent at their present location (YPL), the level of their formal education (FE), their attendance at conferences where extension workers were also present (CA), their personal prejudices (PP), the range of their technical interests outside sheep production (OTF), their proximity to the nearest extension centre where a district livestock officer (sheep and wool) was based (PLO), the amount of contact they had had with extension workers (TCE) and their attitudes towards the value of extension and extension personnel (AE). The last-mentioned variable was specified as the major link in the system. It was hypothesized to be a function of the proportion of contacts with extension workers and farmers which were judged successful (SUC), the proportion of contacts consisting of informal meetings out of office hours (IM), the proportion of contacts consisting of written communications (WC), the

number of contacts about co-operative trials (COP),[25] the number of contacts initiated by extension workers (IEW), the research workers' attitudes towards the value of science (AS) and the value of agricultural research (AR), their age, the level of their formal qualifications, and their attendance at conferences where extension workers were also present. In short, the two equations were

$$(1)\quad RR = a_0 + a_1AGE + a_2YPL + a_3AE + a_4OTF + a_5FE + a_6CA + a_7PP + a_8PLO + a_9TCE$$

$$(2)\quad AE = a_0 + a_1SUC + a_2COP + a_3IM + a_4WC + a_5IEW + a_6AS + a_7AR + a_8AGE + a_9FE + a_{10}CA$$

Estimation of the Equations

Ordinary least squares analysis was used to estimate the relationships. The results from the estimation of the two equations are shown in Table 20. Any variables found to be statistically insignificant were eliminated. The significance levels for the variables are estimated from the computed "t" ratios (the ratio of the estimated coefficient for each variable to its estimated standard error). Given the complexity of the behaviour being measured and the brevity of some of the methods of measuring the behaviour, the resultant coefficients of

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[25] Co-operative trials generally involve extension workers assisting research personnel in carrying out research. The trials require the participation of farmers in terms of making available land, stock and/or information about their farming practices.

TABLE 20

Results from the Estimation of the Two Equations Comprising the Model for the Communication Behaviour of Research Workers[a]

Independent Variables	Dependent Variables	
	Equation 1	Equation 2
Constant	-65.86 (-1.82)	71.29 (16.17)
AGE	2.89 (2.85)	
YPL	-3.70 (-2.61)	
AE	0.71 (1.80)	
OTF	-2.20 (-2.35)	
SUC		13.70 (2.85)
CIO		0.27 (2.95)
IM		-14.18 (-2.50)
WC		17.11 (1.74)
IEO		-0.86 (-3.43)
R^2	0.48	0.73
F	4.30	9.68

[a]Numbers in parentheses are values for the Student's t statistic. The number of observations used in the estimation of these equations was 24.

determination are considered quite good, even though all of the variance in the dependent variables has not been explained.

The Results

Figure 5 is a diagrammatic version of the system established. One may conclude from the equations that the receptivity of research workers to feed-back from extension personnel regarding grass-roots problems is greater (a) the greater the age of the research workers, and (b) the more positive their attitudes towards the value of extension and extension workers. Their receptivity decreases (a) the greater the length of time they have spent at one location, and (b) the wider their technical interests in other industries.

From the second equation it may be concluded that research workers' attitudes towards the value of extension and extension workers are more positive (a) the higher the proportion of their contacts with extension workers which they judge to have been successful, (b) the more numerous the contacts they have with extension personnel regarding co-operative trials, and (c) the greater the proportion of their contacts with extension workers that is in written form. On the other hand, the negativism of research workers' attitudes towards the value of extension and extension workers increased (a) the higher the proportion of their contacts with extension personnel consisting of

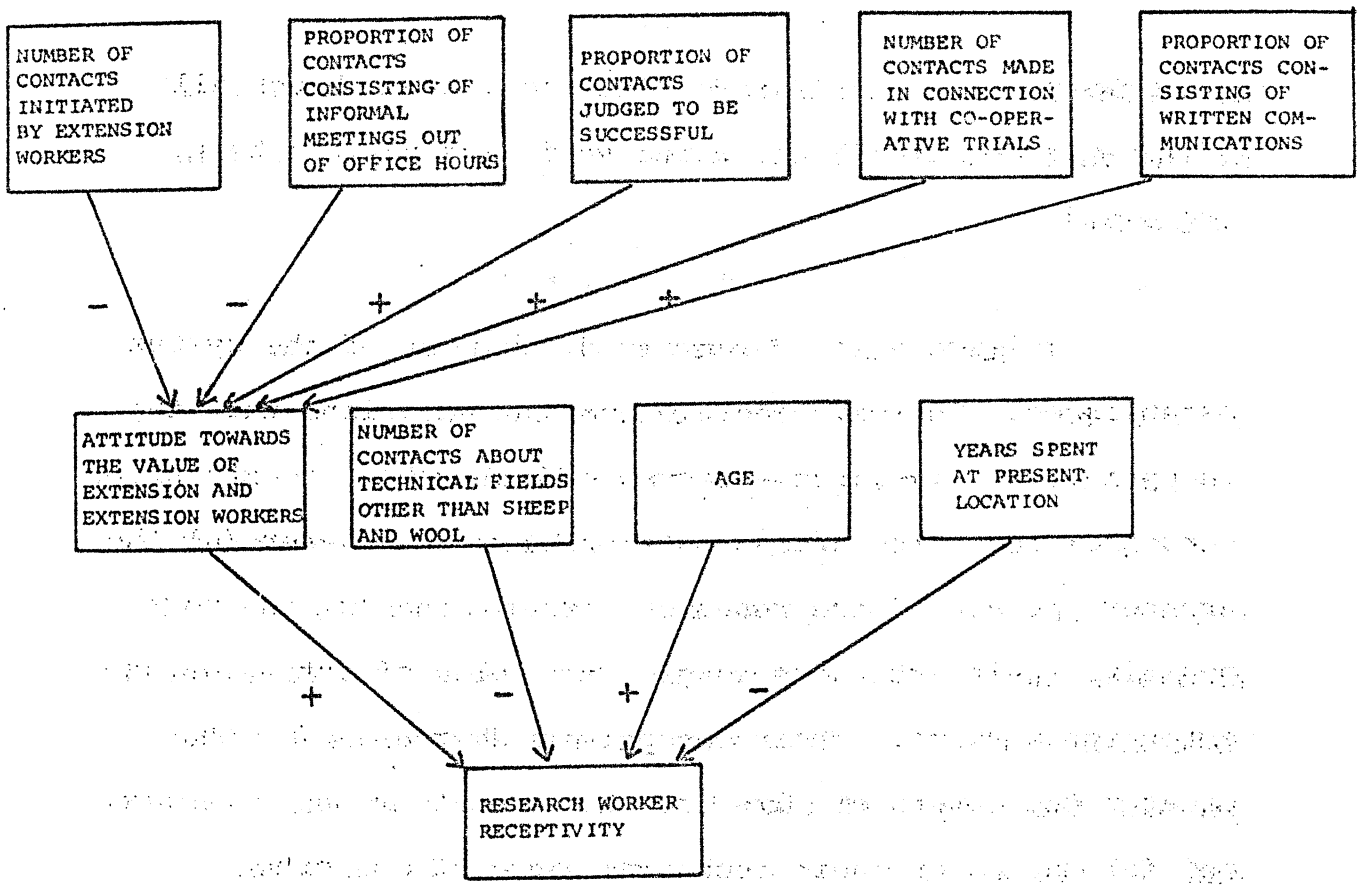

Figure 5. Model of the Communication Behaviour of Research Workers

informal meetings out of office hours, and (b) the more often they were contacted by extension personnel.

The Model Describing the Communication Behaviour of Extension Personnel

A model was also developed to study the significance of factors affecting the flow of scientific information from the originators of that information, the research workers, to a group of users of that information, the extension workers. First, a series of regressions was run taking extension workers' knowledge of recent research (CK) as the dependent variable, and other variables about which information had been collected as the independent variables. These included their age (AGE), the number of years they had spent at their present location (YPL), their possession of a university degree (FQU), their attendance at conferences where research workers were also present (CA), the number of hours they spent involved in direct extension activities (HDE), the amount of contact they had with research workers (TC), their attitudes towards the value of science (AS), the value of agricultural research and research workers (AR) and the value of extension (AE), the number of contacts they had had with farmers (FC), the proportion of contacts with research workers judged successful (SUC), and the level of responsibility they considered research workers had to disseminate their research results to them (RL). Extension workers' contact

with research workers was analysed in terms of the different channels of contact used (e.g. the proportion of contact with research workers made in written form (WCR), at group meetings (GMR) and by telephone (TR). Channels of contact with farmers were examined in terms of contacts established at group meetings (FCG), by telephone (FCT) and in the form of personal visits (FPV). Finally contact with research workers in the various organizations was studied (e.g. contact with research workers in the CSIRO (CSR), in private industry (PIR) and in the Department (DR)).

As in the study of the research workers' behaviour, it became apparent that there were interrelationships among these independent variables and that the factors affecting current knowledge were related in a more complicated way. A series of regressions was run to determine these interrelationships.

Estimation of the Equations

As with the previous model, ordinary least squares regression analysis was chosen as the estimator for the equations system. In two cases the variables were discontinuous and dummy variables were used. For the variable, the level of formal qualifications, where respondents could be university graduates or agricultural college diplomates, a score of 1 was given for those respondents with degrees and a score of 0 for those with

diplomas. In the case of responsibility for the dissemination of research results, those extension workers who saw research workers as having a major amount of the responsibility for the dissemination of their research findings to extension workers were given a score of 1 while those who saw research workers as having little or no responsibility in dissemination were given a score of 0.

Figure 6 is a schematic diagram of the system established. The system consists of the following equations:

(1) $CK = a_0 + a_1AS + a_2TC + a_3HDE$

(2) $AS = a_0 + a_1FCG + a_2WCR + a_3PIR$

(3) $HDE = a_0 + a_1TC + a_2CA$

(4) $TC = a_0 + a_1HDE + a_2AE$

(5) $AE = a_0 + a_1AGE + a_2FC + a_3CA + a_4AR + a_5AR^2$

(6) $AR = a_0 + a_1AGE + a_2FQU + a_3SUC$

(7) $SUC = a_0 + a_1TR + a_2RL + a_3AE$

The values of the coefficients, the computed "t" ratios and the R^2's for each equation are presented in Tables 21 and 22. Any variables which turned out to be statistically insignificant were dropped from the equations.

As in the case of the model for research workers' behaviour, some variables represent complex psychological factors, such as, the attitudes which were measured and

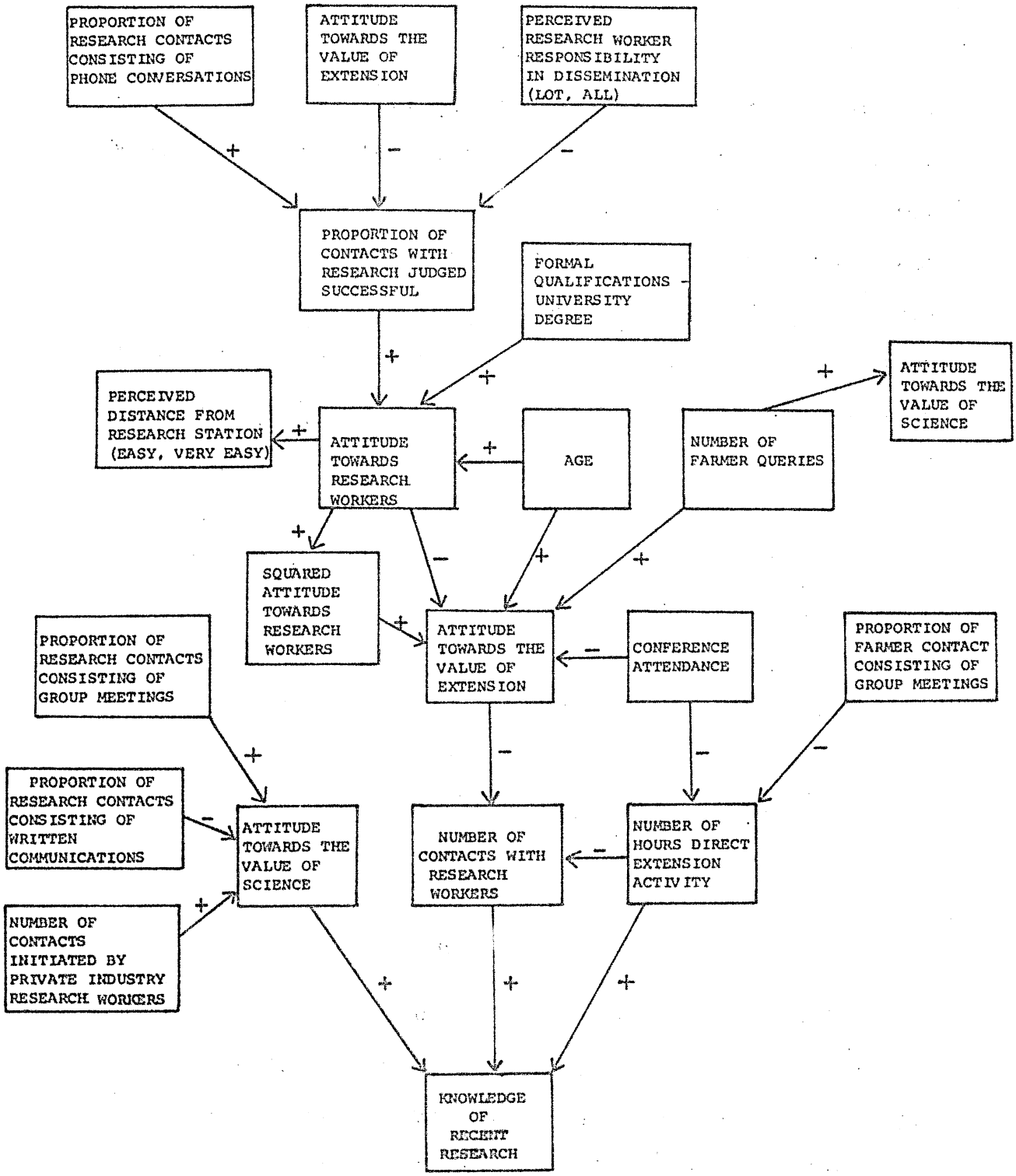

Figure 6. Model of the Communication Behaviour of Extension Workers

TABLE 21

Results from the Estimation of Equations 1 to 4 in the Model for the Communication Behaviour of Extension Workers[a]

Independent Variables	Dependent Variables			
	Equation 1	Equation 2	Equation 3	Equation 4
Constant	0.97 (0.13)	87.53 (43.88)	43.63 (9.97)	65.01 (3.52)
AS	0.14 (2.05)			
TC	0.10 (2.08)		-0.20 (-1.97)	
HDE	0.17 (2.25)			-0.44 (-2.01)
GMR		26.19 (2.43)		
WCR		-28.07 (-2.49)		
PIR		7.13 (3.00)		
CA			-0.89 (-2.12)	
FCG			-22.95 (-2.63)	
AE				-0.44 (-1.99)
R^2	0.28	0.48	0.59	0.35
F	2.69	6.54	10.00	5.85

[a]Numbers in parentheses are values for the Student's t statistic. The number of observations used in the estimation of the equations was 25.

TABLE 22

Results from the Estimation of Equations 5 to 7 in the Model for the Communication Behaviour of Extension Workers[a]

Independent Variables	Dependent Variables		
	Equation 5	Equation 6	Equation 7
Constant	178.42 (8.61)	35.62 (3.62)	1.69 (3.15)
AGE	1.02 (6.45)	0.77 (2.72)	
FC	0.03 (2.65)		
CA	-0.71 (-2.62)		
AR	-3.13 (-5.33)		
$(AR)^2$	0.02 (4.78)		
FQU		13.61 (2.31)	
SUC		23.21 (4.23)	
TR			0.41 (1.73)
RL			-0.29 (-2.45)
AE			-0.01 (-1.99)
R^2	0.81	0.63	0.44
F	15.80	11.86	5.45

[a]Numbers in parentheses are values for the Student's t statistic. The number of observations used in the estimation of the equations was 25.

the respondents' estimates of the degree of success of contacts with research workers. The resulting coefficients of determination are considered good in the light of this fact. Especially is this true of the equations developed to explain extension workers' attitudes towards science, agricultural research workers and extension.

The Results

From the results of the foregoing calculations, certain propositions about the behaviour of extension workers in relation to their communication with research workers can be made. These propositions might be summarized as follows.

It would appear that extension workers' knowledge about recent research findings was greater (a) the more positive their attitudes towards the value of science; (b) the greater the number of hours they spent in direct extension activities, and (c) the greater the number of contacts they had with research workers.

Second, extension workers' attitudes towards the value of science were more positive (a) the greater the proportion of their contacts with research workers which occurred during group meetings,[26] (b) the smaller the proportion of their contacts with such workers which consisted of written communications, and (c) the greater

[26] Group meetings included field days, local discussion groups and the like.

the proportion of their contacts with scientists in private industry which were initiated by these people.

Third, the absolute number of contacts with research personnel was greater (a) the fewer the number of hours which extension workers claimed they spent in direct extension activities, and (b) the less positive the extension worker's attitude was towards the value of extension.

Fourth, the number of hours extension workers spent in direct extension activities was found to be greater (a) the fewer the number of conferences and seminars they had attended, and (b) the fewer the number of contacts with farmers which they made at group meetings.

Fifth, the attitudes of extension workers towards the value of extension were found to be more positive (a) the older the extension worker, (b) the fewer the number of conferences and seminars they attended, (c) the greater the absolute number of queries they received from farmers, and (d) the more negative their attitude towards the value of agricultural research and research workers.

Sixth, extension workers' attitudes towards the value of agricultural research and research workers were more positive (a) the older the extension worker, (b) if they possessed a university degree, and (c) the greater the proportion of their contacts with research personnel which they judged successful.

Seventh, the proportion of contacts with research personnel which were judged successful by extension workers was greater (a) the less positive the extension workers' attitude towards the value of extension, (b) the greater the proportion of contacts with research workers which consisted of telephone conversations, and (c) the less responsibility the extension workers placed on research personnel to disseminate their research results to them.

Other Findings

During the course of the investigation some information was collected which did not bear directly on the success of the communication behaviour of research and extension personnel. Significant relationships were found to exist among some of these variables.

First, the extension workers' perception of the ease of travel to the nearest research station was examined. The following regression was estimated:

$$(1)\quad PDRS = \underset{}{0.50} + \underset{(1.45)}{0.01}\ AR - \underset{(1.81)}{0.004}\ DRS \qquad \underset{(-3.72)}{} \qquad R^2 = 0.45,\ F = 8.87$$

where PDRS represents perceived ease of travel to the nearest research station where sheep and wool research was in progress, AR stands for their attitudes towards the value of agricultural research, and DRS is the physical distance from the research station. In other words, though the actual distance did significantly affect extension workers' perception of the ease of access to

the nearest research station, their attitudes towards the value of agricultural research and research workers also affected this perception. The more positive the attitude, the less of an obstacle distance was perceived to be.

In reference to extension workers' attitudes towards the value of science (AS), it was found that the more enquiries they received from farmers (FQ), the more positive their attitude towards the value of science was likely to be

$$(2) \quad AS = \underset{(29.89)}{83.45} + \underset{(2.97)}{0.06}\ FQ \qquad R^2 = 0.28, \quad F = 8.80$$

In short, the stronger the push from their farmer clients for information, the more aware extension workers are likely to be of the value of scientific progress.

In relation to extension workers' contacts with research personnel, extension workers holding extreme positive attitudes towards the value of extension (AE) were found to initiate this contact (CRIE) less often. The equation estimated was

$$(3) \quad CRIE = \underset{(2.43)}{46.80} - \underset{(-1.98)}{0.44}\ AE \qquad R^2 = 0.15, \quad F = 3.92$$

Extension workers holding such views were also found to receive fewer contacts from research workers in general (CIR) and research personnel employed by the N.S.W. Department of Agriculture (CIDR) in particular.

$$(4) \quad CIR = \underset{(3.09)}{34.03} - \underset{(-2.53)}{0.32}\ AE \qquad R^2 = 0.22, \quad F = 6.38$$

$$(5)\quad CIDR = \underset{(2.55)}{27.82} - \underset{(-2.10)}{0.26\ AE} \qquad R^2 = 0.16,\ F = 4.41$$

In other words, the more extreme the attitude held by the extension worker toward the value of extension, the less likely it is that that extension worker will be contacted by research workers within and without the Department. This, of course, implies that extreme positive attitudes towards the value of extension are not desirable if the aim is to increase contact between research and extension personnel.

Finally it was found in the case of extension workers holding extremely positive attitudes towards the value of extension, that proportionately fewer of their contacts with research workers consisted of personal visits (PPV):

$$(6)\quad PPV = \underset{(2.99)}{1.12} - \underset{(-2.45)}{0.01\ AE} \qquad R^2 = 0.21,\ F = 5.98$$

That is, the more positive the attitude towards the value of extension, the less likely the extension worker is to visit research stations.

Some further analysis of the results of the knowledge test taken by the extension personnel was carried out with the object of ascertaining whether different factors affected extension workers' knowledge of research reported from the universities, the N.S.W. Department of Agriculture and the CSIRO. The questions in the test covering research reported by the Department

were further broken down to those dealing with information reported between 1971 and 1973 and those covering research reported in 1974. This was done to find out whether different factors affected extension workers' knowledge of relatively established as against very recent information. Extension workers' scores on each of these categories were used as the dependent variables in a series of regressions where the remainder of the variables relevant to extension workers were the independent variables. No statistically significant results were obtained, except for the category, N.S.W. Department of Agriculture research, where the same factors were found to affect knowledge scores as affected the total knowledge score. These factors, it will be recalled, were extension workers' attitudes towards the value of science, the level of contact they had with research workers and the number of hours they claimed to spend in direct extension activities.

An investigation was also made to ascertain whether the channels of communication used by research and extension personnel depended on their ages. The scores given by respondents representing the values of the various channels of information gathering to them, were used to estimate average scores for five aggregate groups of channels. These were conferences (CONF) (which included conferences, seminars and workshops), contact with "practitioners" (CPRAC) (which included contact with farmers,

extension workers, private industry representatives and research/extension liaison officers), contact with research workers (CRES), educational courses (EDUC) (including their original training, post-graduate degrees and diplomas, study tours and refresher courses), and publications (PUBL) (which consisted of scientific journals, Department publications and the publications of other institutions). Regressions were run taking each of these aggregate groups as dependent variables and age as the independent variable.

No significant results were obtained for the research group which suggests the age of a research worker does not affect his preferences for different channels of information gathering. However, significant results were found in the case of extension workers. The relationships between age and each aggregate group were shown to be non-linear, except in the case of publications where no significant result was obtained. The various estimations produced the following results:

(7) $CONF = \underset{(2.76)}{17.62} - \underset{(-1.93)}{0.73}\ AGE + \underset{(2.05)}{0.01}\ AGE^2$ $R^2 = 0.14$, $F = 2.67$

(8) $CPRAC = \underset{(3.38)}{22.31} - \underset{(-2.54)}{0.99}\ AGE + \underset{(2.56)}{0.0}\ AGE^2$ $R^2 = 0.16$, $F = 3.27$

(9) $CRES = \underset{(3.46)}{22.02} - \underset{(-2.86)}{1.07}\ AGE + \underset{(3.05)}{0.02}\ AGE^2$ $R^2 = 0.26$, $F = 5.92$

(10) $EDUC = \underset{(3.77)}{23.45} - \underset{(2.69)}{0.99}\ AGE + \underset{(2.63)}{0.01}\ AGE^2$ $R^2 = 0.18$, $F = 3.74$

These results suggest that older extension workers either have a greater appreciation of the value of all channels of information gathering, or are more generous in their scoring. The relationships established in the equations clearly show that younger extension workers gave lower estimates of the value of the various channels than their older counterparts.

CHAPTER 5

IMPLICATIONS AND RECOMMENDATIONS

This chapter discusses the implications of the findings reported in Chapter 4. In particular, it provides practical suggestions as to how research workers' appreciation of grass-roots problems, on the one hand, and extension workers' knowledge of recent research, on the other, might be improved by effecting changes in the communication patterns of the two groups. It is acknowledged that some of the recommendations if implemented might involve changes in organization and entail additional expense. The effort and expense involved may well be justified if the improvement of communication between research and extension personnel is considered of major importance.

The Communication Behaviour of Research Workers

The conclusions stemming from the study of the communication behaviour of research workers outlined in the previous chapter may be reduced to nine principal propositions. They will be discussed in turn.

1. Research workers' receptivity to farm information improves with age

As age is closely related to the number of years of experience of a worker, this result suggests

that younger research staff should be exposed to a wider range of experience at the farm level to supplement their participation in various research undertakings. If young research workers are involved in a single research project which may take several years to complete, this could well put them at a disadvantage with respect to the development of relationships with extension personnel. It is often argued in support of the involvement of a young research worker in a single long-term research project that he is likely to derive greater benefits by carrying that one project through from beginning to end than he would derive by getting bits of experience on several projects. It is clearly a matter of priorities, but it needs to be appreciated that the important job of building rapport with the extension service may suffer if the concentration on research is too narrowly interpreted.

2. The greater the length of time spent at one location, the lower the level of research workers' receptivity.

The implication of this finding is similar to that of the preceding one in that the potential range of experience is likely to be less, the greater the time spent at one location. Moreover, insularity may develop over the years unless a research worker spends time working in different localities, thus enlarging his perspective and increasing his sensitivity to regional variations in farm organization and rural problems.

3. Knowledge of farming problems in a specific industry is low where research workers have technical interests in other industries.

The measure of diversity of research interests employed was the absolute number of recorded contacts with extension workers and farmers, the subject matter of which involved something outside sheep and wool production. These might involve a topic such as beef cattle.

It is difficult to draw conclusions from this result in that no investigation was made of research workers' knowledge of farming problems across all industries. Hence there is no foundation for making value judgments as to the degree of specialization appropriate for a research worker. One possible interpretation is that a research worker who takes an interest in several fields may tend to "spread himself too thinly" as in the old adage "Jack of all trades, master of none".

4. A positive attitude towards the value of extension and extension workers increases the likelihood of a research worker being receptive to feed-back from extension personnel.

The implications of this finding are obvious. If improved communication between research and extension personnel is considered desirable, then the achievement of this goal will be facilitated by improving research workers' attitudes towards the value of extension and extension personnel. The individual factors, which it appears from the analysis in the last chapter affect such attitudes, are discussed separately below.

5. Where a high proportion of a research worker's contacts with extension workers about technical matters has been in his opinion successful, his attitude towards the value of extension and extension personnel is more positive.

This suggests that it would not necessarily be of benefit simply to increase the level of contact between research and extension personnel. Regard must also be paid to the informative value of the contact - the criterion by which respondents determined the success of contacts.

6. Where research workers have a high level of contact with extension workers in reference to co-operative trials, their attitudes towards the value of extension and extension workers are more positive.

Contact about co-operative trials would normally entail a certain level of team-work on the part of research and extension personnel. In such situations the special abilities and experience of the extension worker could prove an asset in terms of encouraging the co-operation of farmers. Contact about co-operative trials would therefore broaden the research worker's perspective with respect to some aspects of extension activities and the expertise of extension workers.

7. The greater the proportion of contacts research workers have with extension workers in the form of written communications, the more positive are research workers' attitudes towards the value of extension.

In the research world, strong reliance is placed on the written word as a channel of information gathering and dissemination, as against less formal verbal communication. One's interpretation of this finding is affected by one's

value judgment concerning the real benefits of verbal as against written communication. It would be unreasonable to conclude that all contact between the two groups should be in written form. Rather one might conclude that it would be beneficial for extension workers to express their views and queries in writing, perhaps enabling the research worker to gain a clearer perspective of the problem, or allowing him to deal with the problem at a convenient time for him.

Bertrand has suggested an additional reason for "putting everything in writing". He says

> It may be difficult to give verbal messages the proper legitimacy. It is more convincing to display a signed memo than to allege that a directive was given orally.[27]

In other words, oral messages or queries can be distorted or forgotten by the recipient. A written communication is clearly visible and acts as a reminder to the recipient.

8. Research workers whose contacts with extension personnel consist largely of informal meetings out of office hours have a more negative attitude towards the value of extension.

This does not mean that informal contact should be restricted. Rather it suggests that purely informal contacts give an unbalanced view of extension work and of the extension worker's role. The answer to this problem is to increase the proportion of formal contacts which

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[27] A.L. Bertrand, Social Organization (Philadelphia: F.A. Davis Co., 1972), p.144.

research personnel have with extension workers.

9. A research worker is more likely to have a negative attitude towards extension activities and extension personnel, the more often he is contacted by extension workers.

It should be noted that what is involved here is the absolute number of contacts initiated by extension workers rather than the proportion of the total number of such contacts. One interpretation of this result is that contacts which are initiated by extension personnel disturb the research worker's work pattern. Accordingly the more often they occur, the greater will be their disruptive effect on the recipient's work and the more likely will such a recipient develop a negative attitude towards extension workers. One solution to the problem might be to establish more formal channels through which extension workers could contact research personnel at mutually convenient times and locations.

Katz and Kahn have suggested that "social systems can be defined as restricted communication networks; unrestricted communication implies noise and inefficiency."[28] They conclude that

> Research, writing, the pondering of executive decisions, and other phases of creative work require uninterrupted blocks of time. The organization needs to put as much effort into protecting these activities from interruption as it does in facilitating communication where it is functionally required.[29]

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[28] D. Katz and R.L. Kahn, op. cit., p.257.

[29] Ibid., p.234.

Another possible explanation for the above mentioned finding is suggested by Allen's assertion that "the average technologist cannot communicate effectively with outsiders".[30] It is a common phenomenon that in groups of people (whether the group be defined according to occupation, age or social status), there exists a kind of accepted language which the members of the group use to communicate and which other members of the group understand. Problems can arise, however, when a member of one group attempts to communicate in that same language to a member of another group. Thus, the more often research personnel were contacted by extension personnel the more experience they might have of ineffective communication with them.

If this is the case, the possible reasons for the ineffectiveness of the communication should be studied. These might include differences in language use and interpretation, uncertainty on the part of the technologist in dealing with the traditionally "superior" scientist, differences in degree or type of organization of thoughts and the oral expression of those thoughts.

On returning from his overseas tour in 1968 Angrove of the South Australian Department of Agriculture observed that, "Without exception, all (research) centres

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[30] T.J. Allen, "Roles in Technical Communication Networks," in Communication among Scientists and Engineers, ed. by C.E. Nelson and D.K. Pollock (Lexington: Heath Lexington Books, 1970), p.191.

visited stated that they welcomed individual extension officers to discuss specific problems".[31] The phrase "specific problems" should be noted. The implication is that an extension worker is welcome only if he has a well-considered and expressed query or comment to make.

One possible cause of the research worker's attitudes is that extension workers often prefer to make a quick telephone call rather than go to the trouble of searching for information which they know is published. In effect they may be taking the easy way out. By acting in this way, extension officers create ill-feeling with research workers, who feel that the information is readily available to the extension worker in published form and that he should be able to find it himself rather than be spoon-fed.

Factors Affecting Extension Workers' Knowledge of Recent Research

Paralleling the treatment in the preceding section, the major conclusions which flowed from the statistical analysis concerning the communication behaviour of extension workers are discussed in the paragraphs which follow.

1. The knowledge of extension personnel increases the more positive are their attitudes towards the value of science.

It is therefore desirable that extension personnel

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[31] S.C. Angrove, Report of Overseas Study Tour (South Australian Department of Agriculture, Adelaide, 1968), p.4.

be encouraged to appreciate the value of science. Of the factors affecting the attitudes of extension workers towards science, three were specifically identified. These were the proportion of contacts extension personnel had with research workers which occurred at group meetings, the proportion of contacts with research workers which were in written form, and the number of contacts which were initiated by research workers in private industry.

(a) The greater the proportion of contacts with research personnel which occurred during group meetings, the more positive the attitude of the extension worker towards the value of science.

From this it may be concluded that contact between research and extension personnel through group meetings should be encouraged. As noted earlier, group meetings in this context refer both to seminars and conferences, and to less formal localized meetings such as field days.

One possible reason for this result might be that extension workers would, as a consequence of the exposure, be in a position to see the practical benefits of scientific knowledge in terms of handling of farmer queries with greater speed and ease. It is also a situation where communication would be less formal but still within the confines of the extension worker's formal role. At a field day, for example, the extension worker would basically be operating on his home ground

and would thus have more assurance and success in communicating with the scientist.

In addition, there is more structure and identifiable purpose in group meetings than there generally is in a telephone call, for example. It is not so much the factor of numbers present that is relevant, but rather the higher degree of organization involved.

(b) The greater the proportion of contact with research workers which consisted of written communications, the more negative the extension worker's attitude towards the value of science.

This finding supports the common belief that extension workers do not view with favour the communication of technical matters in the written form and that their acceptance of scientific research is adversely affected if the research is presented to them in recognized written scientific style. It suggests a need to deformalize scientific communication to extension personnel, and perhaps also allow for more instant feed-back, a factor lacking in written scientific communication.

This result regarding extension workers' attitudes towards science contrasts with the finding that research workers' attitudes towards the value of extension improve the greater the proportion of their contact with extension workers which is in written form. Taking both results together, it would seem desirable for extension workers to use written communication to document their queries or problems for the benefit of research personnel, and for

research workers to use less formal, oral channels of communication in answering these queries or problems. This would not necessarily mean a decline in the production of scientific articles. These remain important references to which extension workers can turn for specific information following any verbal exchange concerning the general content of an article.

(c) The greater the number of contacts initiated by research workers employed by private industry organizations, the more positive their attitudes towards the value of science.

Few extension workers had contacts with scientific personnel in private industry during the period in which diaries were maintained, but nevertheless the latter appeared to be a significant factor in attitude formation. The foregoing suggests that contacts with technical personnel in private industry should be encouraged, and perhaps that literature from private firms supplying fertilizers and other agricultural production requisites should be made more readily available to extension personnel.

2. Extension workers' knowledge of recent research is greater the greater the number of hours spent in direct extension activities.[32]

The implication of this result is that the

[32]Direct extension activities include advising farmers on an individual basis, at group meetings, at field days and through the media. They also include preparation for these activities. They do not include study and information-gathering or administrative work.

greater the contact extension workers have with farmers and their problems, the greater is their need for knowledge of research in order to satisfy the wants of their clients. Among the factors considered to affect the number of hours spent in direct extension activities were participation in conferences, and the degree to which an extension worker used group meetings as an extension technique.

(a) The greater the number of conferences, seminars and meetings attended, the fewer the hours spent in direct extension.

There are two, not necessarily mutually exclusive, interpretations of this finding. The first is that those who regularly attend conferences occupy more specialized or senior positions which involve less direct extension work. The second is that those who attend conferences regularly have correspondingly less time to devote to direct extension activities. Given that the average number of conferences attended by extension personnel over a period of three years was 11 and that no extension worker indicated that he attended more than 24, the latter interpretation seems the less likely one.

Accordingly this result should not be taken as implying that conference attendance has a detrimental effect on extension workers' involvement in direct extension activities. It is more appropriate to conclude that within the extension group there is a number of specialists whose roles involve less contact with farmers

and a higher level of participation in other activities, including conferences.

(b) The greater the proportion of contact with farmers which occurs during group meetings, the less the number of hours an extension worker spends in direct extension activities.

This finding reflects the fact that group meetings can be an economical and efficient way of dealing with farmer enquiries, by avoiding repetition and cutting travelling time.

3. The greater the number of extension workers' contacts with research workers, the higher their level of knowledge of recent research.

The implication of this is that contact between the two groups should be increased. The degree of extension workers' contact with research personnel was found to be negatively related to the extension workers' attitudes towards the value of extension. All of the extension personnel surveyed had a positive attitude towards the value of extension. Those extension workers with extremely positive attitudes in this regard were found to have less contact with research workers.

Factors Affecting Extension Workers' Attitudes Towards the Value of Extension

The attitude of extension personnel towards the value of their profession can be taken as a measure of their defensiveness, resulting from the fact that extension has been a relatively ill-defined and little known field

for many years. The duties of extension workers have varied between regulatory and advisory roles and the scope of extension work has not, until recently, been clearly defined. Extension work has a history of low professional status in the state departments of agriculture and personnel so engaged have had little opportunity to advance to senior levels of responsibility. Extremely positive attitudes towards the value of extension therefore frequently denote a defensively high level of identification with extension.

This high level of identification takes its toll in terms of the readiness on the part of extension workers to approach and be approached by research scientists. Those extension workers with extremely positive attitudes towards the value of extension obviously cannot be removed from the service. A more reasonable approach might be to endeavour to decrease the extremeness of their attitudes in this respect. Four factors which affect the level of extension workers' attitudes towards the value of extension were revealed in this study. These factors were the age of the extension worker, the frequency with which he attended conferences, the number of contacts he had with farmers and his attitude towards the value of agricultural research and research workers.

1. <u>The older the extension worker the more positive his attitude towards the value of extension</u>.

The implication to be drawn from this is that the greater the number of years an extension worker has spent in

extension the more defensive he is likely to be because he has spent more years than his younger colleagues in a state of confusion about his status and self-image.

2. The greater the number of conferences and seminars attended by an extension worker, the less extreme is his attitude towards the value of extension.

Attendance at conferences with peers would tend to reassure the extension worker of his professional status and the worthwhileness of his professional role. He would consequently be expected to be less defensive about this role. In addition, it is the recognized practice of departments of agriculture to select personnel with special competence in specific fields to attend technical conferences dealing with such fields. This competence might involve specialization in specific subject-matter and/or good knowledge of local problems related to that field. Persons in this category should be able to contribute significantly to such meetings and should therefore be reinforced in the perception of their role in extension as an important one. There should, then, be less need for them to be defensive about their role as extension workers.

3. The greater an extension worker's contact with farmers, the more positive is his attitude towards the worth of extension.

The more enquiries an extension worker receives from farmers, the more important he will perceive his role as being. It was also found that the greater the

number of farmer enquiries received the more likely the extension worker's attitude towards the value of science will be positive. Scientific research is recognized as a necessary factor in the process of elucidating farming problems and of improving farming technique. The extension worker is made aware, by the existence of a strong push from his clients, of the importance of scientific research and of the role he plays in extending the knowledge of this research to his clients.

4. The relationship between extension workers' attitudes towards the value of extension, and their estimation of the value of agricultural research and research workers is a non-linear one.

This is revealed in Figure 7. The fact that this relationship is not linear further supports the hypothesis that extremely positive attitudes towards the value of extension are the result of defensiveness on the part of extension workers. There is a point on the extension attitude scale above which the scores are negatively related to the attitude towards agricultural research workers. Below the point they are positively related. In other words, extension workers with extremely positive attitudes in favour of extension tend to have extremely negative attitudes regarding research workers.

Factors Affecting Extension Workers' Attitudes Towards the Value of Agricultural Research and Research Workers

It is important not to confuse the attitude of the extension worker towards agricultural research workers and

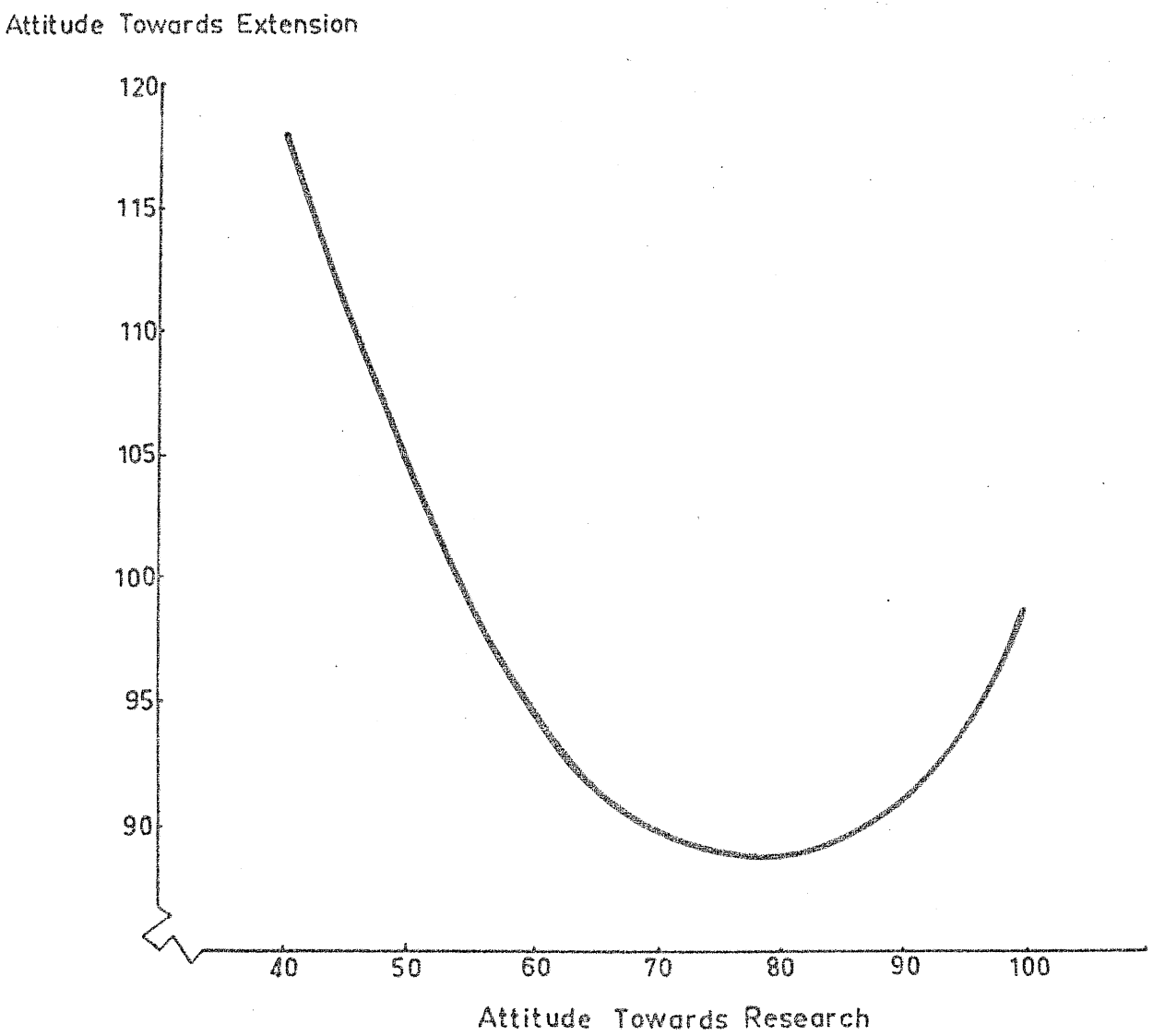

Figure 7. The Relationship Between Extension Workers' Attitudes Towards the Value of Agricultural Research and Their Attitudes Towards the Value of Extension

his attitude towards the value of science. The former is a personalized attitude concerning a recognized group of people, that is, agricultural scientists, with particular reference to those agricultural scientists employed by the N.S.W. Department of Agriculture. The attitude towards the value of science applies to the whole field of scientific research, and not to the people who are involved in it. It is an attitude concerning the value of scientific progress.

Given that the attitudes of extension personnel towards their professional role are related to their attitudes towards research workers in the manner described earlier, any action that can be taken to improve their attitudes towards these people could have far-reaching benefits. As indicated earlier, the attitudes of extension workers towards research personnel were studied *inter alia* in relation to their age, their formal qualifications and the proportion of their contacts with research workers judged by them to be successful. The findings are discussed sequentially.

1. The older the extension worker the more positive his attitude towards research workers is likely to be.

This result appears to conflict with the earlier findings that age is positively related to attitude towards the value of extension, which in turn has a non-linear relationship with the attitude towards research

workers. It would appear that the non-linearity of the latter relationship may be associated with age.

This result suggests that within the extension group surveyed there were actually two sub-groups defined superficially by age. It would seem that members of these sub-groups in practice followed different induction processes which probably reflects different past experience. The older extension workers, having had more years' experience in the Department of Agriculture, would have had more opportunity for extended contact with research scientists and their work, and have thereby developed a more positive attitude concerning them.

If this is so, recent appointees should be given more opportunity to have contact with a wide range of research workers. This may be simply a matter of the effluxion of time, but action could be taken to intensify experience in the short-run. It is likely, moreover, that older extension workers, by virtue of their longer experience, receive more respect and co-operation from research workers. Research scientists should be encouraged to be less biased against younger and less experienced extension personnel. This could begin at the induction stage when extension workers in training spend up to five years, in some cases, on research stations.

According to the results of this survey,

younger extension workers are likely to hold more negative attitudes towards research workers. This suggests that their experience of research workers in the past has not been particularly successful as regards the development of positive attitudes about them. A common remark heard during informal discussions with extension personnel, in connection with in-service training on research stations, was that young recruits were exploited by the research workers. This could well give rise to antagonistic attitudes towards research personnel. If this is the case, action could be taken to ensure that, in their training period, potential appointees to extension positions are involved more directly in the research being carried out on the stations.

The most recent statements on in-service training in the New South Wales Department of Agriculture urged that extension workers in training spend less time on research stations and more time on commercial farms. A Committee on In-Service Training for Extension set up by the Department in 1972 found that "research station training has been a major area for criticism by field staff".[33] It recommended:

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[33] New South Wales Department of Agriculture, Report on In-Service Training for Extension (Sydney, 1973), p.27.

> That systems of training prior to district appointment be changed so that the training includes an assessment procedure, counselling, responsibility, experience with a commercial enterprise and a field project in a region, with variations in the systems to suit the officer's previous experience and intended field of work.... The present deficiencies in training at research stations could be remedied by prior experience in an extension environment, counselling and an increase in the responsibility placed on officers-in-training on stations.[34]

These recommendations imply, in an absolute sense, less contact with research workers and are accordingly inconsistent with the findings of this study. The point at issue is really one of quality rather than just quantity of contact. An attempt should clearly be made to raise the quality of contact between research workers and extension workers in training.

2. Those extension workers with university degrees have more positive attitudes towards research workers than those who do not have degrees.

Graduates would, by virtue of the number of years spent at a university, have had more contact with research and research workers and might even have been involved in some research studies themselves. It is possible therefore that they would have a greater comprehension of the difficulties involved in such activities. It does not necessarily follow from this that all extension personnel should have university qualifications, though clearly this would help. At

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[34] Ibid., p.8.

least their in-service training should include more direct involvement in research - not just as an inexperienced assistant but as a professional in training.

3. The greater the proportion of successful contacts which extension workers have with research personnel, the more positive are their attitudes towards them likely to be.

The factors found in this survey to affect an extension worker's assessment of the success of contacts with research workers were (a) the amount of responsibility he considered a research worker had to disseminate his research results to extension personnel, (b) the proportion of his contacts made by telephone and (c) the extension worker's attitude towards the value of extension.

(a) Those extension workers who felt that dissemination was largely or entirely the responsibility of research workers had a lower proportion of successful contacts with research personnel.

When those extension workers who expected in essence to be "spoon-fed" found they were not, they expressed dissatisfaction with their contacts with research workers. Extension workers should be encouraged to take at least a moderate amount of the responsibility for finding out about research results, for example, by maintaining contact with relevant research stations and by reading appropriate journals. The situation is complicated, however, by the existence of traditional role expectations. Extension workers have not in the past been

trained in techniques of searching for the information they require.

(b) The greater the proportion of extension workers' contacts with research workers made in the form of telephone conversations, the greater the proportion of contacts likely to be judged successful by them.

This finding supports the commonly-held belief that extension workers prefer direct verbal communication. Feed-back in terms of information and explanation is instant. Communication by telephone is also very convenient, as compared with the arrangements which are normally made for a personal visit.

Meadows, endeavouring to generalize from previous research results has concluded that

> One of the firmest conclusions of information usage surveys seems to be... that the intrinsic value of an information channel has little, or no, bearing on the frequency with which it is used. The important factor is always its accessibility.[35]

This result contrasts with the earlier finding that the attitudes of research workers towards the value of extension are negatively affected by high levels of extension-initiated contact. Clearly thoughtless or ill-considered use of the telephone on the part of extension workers may have counter-productive effects. But possibilities of compromise are numerous. For

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[35] A.J. Meadows, Communication in Science (London: Butterworths, 1974), p.124.

example, the times when it would be convenient for both parties to establish contact could be specified in advance, increased opportunities could be provided for formal contact thus decreasing the need for frequent use of the telephone, and extension and research personnel could be located closer to one another.

(c) The more positive the attitude of the extension worker towards extension, the lower the proportion of his successful contacts with research workers.

This finding further supports the hypothesis that extremely positive attitudes towards extension represent defensiveness which results in a cautious approach when dealing with research workers. Means of remedying this defensiveness have already been discussed.

The Effects of the Attitudes of Extension and Research Personnel Towards Agricultural Research and Extension

In considering the implications of the foregoing findings regarding the attitudes of extension and research personnel, it is helpful to relate them to previous theory and research. Katz and Kahn in studying the effects of the perceptions and attitudes of employees, found that the occupational position held by the employee had significant effects both on his perception and interpretation of information and on his search for more information.[36] They stressed that any occupational position has to be seen in

[36] D. Katz and R.L. Kahn, op. cit.

the framework of the whole organizational system. The position itself has attached to it a set of role expectations and a pre-determined relationship with other positions in the organization which are over and above any individual psychological factors brought into the position by the incumbent of the position. As regards the incumbent, Katz and Kahn suggested that the attitudes held by the individual serve the purpose of "establishing his self-identity, /and/ confirming his notion of the sort of person he sees himself to be".[37] This identity includes both personal characteristics and broader social characteristics. Thus "occupational groups constantly strive to achieve a more attractive picture of themselves".[38]

The significance within the organizational framework of the attitudes held by employees is seen to lie in the potential conflict between employee attitudes or group norms, and organizational objectives. Thus, an objective of the N.S.W. Department of Agriculture is to cultivate collaboration between its research and extension personnel, but the attitudes of the two groups towards each other work against this objective.

Closely related to attitudes is the question of morale. Guion has suggested that high levels of morale

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[37] Ibid., p.346.

[38] Ibid., p.367.

are reflected in a high level of involvement of the members of a workforce in their work and a cohesiveness in terms of the members of a group working together with little conflict and favourable attitudes towards each other.[39] It may be safely concluded that the work force forming the sample in this study does have morale problems. The problems appear to lie not so much in dissatisfaction with the occupational roles of the personnel,[40] but rather with the relationship between different occupations. Stagner has touched on this aspect of morale in describing it in terms of "an individual-group relationship".[41] He asserts that

> ....there is no such phenomenon as morale in general; the state of an individual's morale must be gauged relative to some specific group, such as his company, his informal work group, or his union.[42]

The relationships between morale and attitudes and between these and efficiency are complex. The attitudes of a work force concerning their own role and that of their fellow workers affect their level of work

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[39] R.M. Guion, "Some Definitions of Morale", in Studies in Personnel and Industrial Psychology, ed. by E.A. Fleishman (Homewood: The Dorsey Press Inc., 1961), p. 304.

[40] The attitudes of each group concerning the value of the work they themselves did were found to be uniformly positive.

[41] R. Stagner, "Motivational Aspects of Industrial Morale", in Studies in Personnel and Industrial Psychology, op. cit., p.305.

[42] Ibid.

involvement and the success with which they fulfil the requirements entailed in their occupational position. The attitudes of research and extension workers would appear to be at the heart of many of the difficulties in communication between the two groups.

CHAPTER 6

CONCLUSION

In this chapter the major findings of the study are first briefly summarized. Some suggestions are then made as to how the recommendations outlined in the preceding chapter might be implemented in the Department in which the survey was conducted. Finally, in the light of the experience gained in the course of the investigation some observations are made as to further lines of research which might profitably be pursued.

The Findings

The primary focus of the investigation was the flow of information between research and extension personnel in the Sheep and Wool Branch of the N.S.W. Department of Agriculture. In particular, it aimed to identify the factors which facilitated and hindered communication between the two groups. The attitudes which the two groups held towards each other and the attitudes which extension workers held concerning the value of extension were found to be particularly important in this connection. The more negative the attitude of the respondent towards the other group, the smaller the flow of information. Extremely strong positive attitudes on the part of extension workers towards the value of their own activities were also found to have a

negative effect on the level and success of their communication with research workers. Such strong positive attitudes on the part of some extension workers were taken to denote defensiveness as regards the importance of their role as communicators.

Other significant factors directly affecting extension workers' knowledge of recent research were found to be their attitudes towards the value of science, the amount of contact they had had with research workers and the number of hours they spent involved in direct extension activities.

The factors found to affect research workers' appreciation of current sheep farming problems were their attitudes towards the value of extension, their ages, the number of years they had spent at their present location and the number of contacts they had with extension workers and farmers about technical matters other than those related to sheep and wool.

On the basis of these findings, some specific recommendations have been made for the improvement of the situation. These entail a qualitative increase in contact between research and extension personnel in directions which the survey showed were likely to have positive effects on the attitudes of two groups towards each other and on the flow of information between them. Contact involving co-operative trials, for instance, was

shown to have a positive effect on research workers' attitudes towards the value of extension. On the other hand, where a research worker's contacts with extension personnel were largely of an informal social nature, their attitudes towards the value of extension were likely to be negative. This should not be interpreted as implying that social contact should be discouraged. Rather its potentially negative effect might be dispelled by increasing the research workers' contacts with extension personnel in regard to technical matters.

The recommendations arising out of the investigation of the communication behaviour of extension workers similarly advocate procedures designed to increase their contact with research workers. These generally involve more formal contact between the two groups. This could mean expanded use of such communication media as group meetings. It could lead to a stipulation that requests for information and explanations of current problems on farms by extension workers be presented to research personnel in writing.

Another important aspect of the recommendations concerns the need to increase and broaden the in-service experiences of research and extension personnel with the aim of ensuring that members of each group develop a fuller understanding of the role of their opposite numbers in the other group and the difficulties they encounter in performing their roles. The ultimate goal is the enhancement

of co-operation and collaboration between research and extension personnel.

A Possible Approach to Implementation

Given the nature of the enquiry, some useful purpose could be served by making some recommendations as to how the findings of the project could be implemented in the specific milieu in which it was undertaken, namely the N.S.W. Department of Agriculture. Such is the purpose of this section. The suggestions made do not involve any significant organizational change within the Department. Their purpose is rather to endeavour to lay foundations for desirable changes to evolve. It is proposed, in particular, that a short series of workshops should be held. The people attending such workshops would be the participants in the project and the subject matter would be the project report.

A major reason for suggesting the workshop approach is a belief that any attempt to alter the various functions or behaviours found to be significant in the study through administrative directions would be ineffective for a variety of reasons. Without a proper understanding by the personnel concerned of the reasons for the changes, it is unlikely they will be taken seriously or be willingly accepted.

In the second place, the problems uncovered by the study are, in the main, social or inter-group problems,

not problems of individuals. It is the inter-play of the scientists and the extension workers which is involved, and more particularly their responses to each other. Accordingly, for effective change to take place, the vehicle of change should involve the interaction of the two groups.

The workshop approach has been used previously in analogous situations. In one such case it was used as a follow-up to a survey of a large company. This involved a study of its structure and organization and an examination of the morale, attitudes and absenteeism of its employees.[43] The advantages of such an approach are well outlined by Katz and Kahn.

> The presentation of survey findings to the various /groups/... sometimes brought new problems to light. More often it gave an objective and factual basis to problems that had either been brushed aside or dealt with by some opinionated gesture. Not only had vague reports about the perceptions and feelings of employees been reduced to facts and figures, but comparisons could be made among similar groups and the findings could be related to possible causal factors. In this objective atmosphere questions could be raised about the data, many of which could be answered by further analysis of the same data. And this was the emphasis of the Mann feedback procedure - group discussion of facts and figures in a task-oriented atmosphere where people were seeking to analyse the problem, identify possible causes as objectively as possible, and agree upon possible solutions.... /The participants/ know what questions should be asked to dig deeper into the available data for answers. Moreover, the group

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[43] F.C. Mann, B.P. Indik, and V.H. Vroom, The Productivity of Work Groups (Ann Arbor, Michigan: Survey Research Center, 1963).

> members are the immediate agents for implementing any policy changes with respect to problems at their own level. If they understand the causes, have been involved in a discussion of solutions, and perhaps have proposed the new policy, they will be more effective agents for achieving change.[44]

Mann and his colleagues had a high level of success in using the technique.[45] Significant positive changes were achieved in the employees' feelings about their work and their supervisors, their progress in the company, and their group's ability to get the job done.

The approach adopted by Mann could well be taken as a guide in setting up a series of workshop sessions within the Department of Agriculture. The workshops could be organized in several alternative ways. One extreme would be to keep the two groups, research scientists and extension workers, completely separate. However this would miss the whole point of the workshops. At the other extreme, the groups could work rogether in all sessions. In this case, many of the advantages of the procedure would be lost. For example, the old bogey of extension workers being over-shadowed by research

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[44]D. Katz and R.L. Kahn, op. cit., p.419.

[45]F.C. Mann, "Studying and Creating Change: A Means to Understanding Social Organization", in Research in Industrial Human Relations (Industrial Relations Research Association, Vol.17, 1957), pp.146-167.

workers in group situations could arise. Besides, not all of the issues which require discussion are relevant to both groups.

Accordingly, it would seem that a mixed approach would have the greatest potential. Again, there are various options. Workshops could be established by the random division of personnel into groups of roughly equal size. This would however necessitate some people travelling long distances to the locations of the meetings. It might be more practical to arrange groups on a broadly regional basis, consisting, where possible, of equal numbers of research and extension personnel.

If the suggestion of the workshops were adopted, the plan might be implemented in the following way.

1. If the extension workers in training and the members of the staff of the Sheep and Wool Branch located in head office were included, the participants would number 65. There is no universally recognised optimum size for a work group. However, to gain sufficient diversity of experience and points of view, approximately ten would seem a reasonable number of participants. Each group, where possible, should comprise equal numbers of research and extension personnel, together with two extension workers in training.

2. These work groups should meet initially to discuss the report in general, and decide on the desired breakdown of the report for further discussion sessions. The subject matter of the report should also be subdivided into areas more appropriate to separate discussion by research or extension personnel in isolation.
3. Dates should be set for future meetings, such meetings to be held as soon as possible and over as short a period of time as possible.
4. A record should be kept of the outcome of each meeting detailing the group's interpretations, suggestions and proposals for action and noting any unresolved differences of opinion that arise within the group concerning these issues.
5. The records of the meetings of each group should be combined and presented in the form of a report to all personnel involved.
6. A final meeting of the entire group should be held over a period of two to four days. Its purpose would be to outline a final set of recommendations to be presented to the relevant personnel for their consideration and subsequent action where necessary.

It is believed that the foregoing procedure is a practical means of dealing with a set of problems not

readily overcome by purely administrative action. The success of any attempts to implement the recommendations made will obviously depend on the willing participation of the personnel concerned.

Directions for Future Research

In the course of the survey and its analysis, it became apparent that there were some aspects of the problem which would be worthy of further investigation but these could not be followed up in the time available. Some indication of this "unfinished business" is given in the paragraphs which follow.

First, it would be of interest to try to determine whether any relationship exists between the productivity of research workers (measured in terms of the number of published papers or some other criterion) and their receptivity towards extension advice and their attitudes towards the value of extension. It may be that if research workers achieve a better appreciation of contemporary farming problems as a result of the efforts of extension personnel, they might be induced to give their attention to a wider range of problems or problems of more immediate relevance. More published papers might be the result.

In the second place, it would be worth trying to find out whether the specific problem on which a research worker is engaged affects his receptivity to suggestions from extension personnel. It could be that the more

fundamental or erudite the investigation, the less the research worker is willing to accept or indeed listen to advice from extension personnel.

There is reason to believe that there might be a possible relationship between the size of research teams and the receptivity of research workers to extension advice and their attitudes towards the value of extension. This proposition could be tested statistically if the appropriate data were collected.

It might also be possible to define more precisely than has been possible in this study the degree and type of contact between research and extension workers which are likely to be optimal in terms of improving (a) the receptivity of research workers to suggestions by extension workers, (b) extension workers' knowledge of recent and current research and (c) the attitudes of the two groups towards each other. This would clearly involve a more intensive investigation. It would be made more difficult by the fact disclosed by the present survey that extension workers have a penchant for verbal communication whereas research workers prefer communications to be in written form. Any analysis of this issue would need to take account of the various channels of communication, and the advantages and disadvantages of each channel with respect to the messages to be communicated. It may be that the written form is best

used, for instance, to communicate specific problems being faced by extension workers. On the other hand, the spoken word may be more appropriate to communicate a general overview of research findings to extension workers. The efficacy of the various channels of communication in relation to the specialized use of each channel could be estimated by setting up a semi-experimental situation in which constraints are placed on the participants to send certain types of message in certain specified forms.

The technical complexity of the subject matter which is the motivation for the establishment of contact between research and extension personnel may affect the success of using the various channels of communication (the telephone, personal visits and written messages) as means of passing on the required information. As a result of differences in training, difficulty could arise in relation to jargon and technique which would be obstacles to effective communication between research and extension personnel. This is a matter worthy of closer investigation as it might have important implications for recruitment policy.

From a psychological point of view, it would be desirable to ascertain whether there are any relationships between aspects of the personalities of those involved (e.g. rigidity, extroversion, motivation and self-assurance) and their receptivity to extension advice, their knowledge of recent research, and their attitudes towards each other

and their own field of activity. These personality traits may well affect, for instance, the defensiveness of extension workers with respect to extension as a profession. Whether an individual is extroverted or introverted may play some part in his preferences for the various channels of communication. A highly motivated research worker may be more intent on having a large number of scientific articles published than on communicating his findings to interested extension personnel.

Possible Methodological Refinements

In the course of the investigation actually undertaken, various techniques were employed to measure a number of complex factors, including the attitudes of research and extension personnel towards each other, towards their own profession and towards science. A measure of the amount of information reaching and being assimilated by extension workers was also necessary.

The three attitude scales developed were described in Chapters 2 and 3. However, due to time constraints placed on the investigation it was not possible to assess the reliability of these scales by re-testing. Because the participants in the survey became aware of the object of the attitude scales when completing them, it would have been unwise to test the reliability of the scales by presenting them to the same

groups after a short time elapse. However, the use of the scales is not necessarily confined to members of the Sheep and Wool Branch of the N.S.W. Department of Agriculture. A reliability test could therefore be performed with members of another branch as respondents.

It will be recalled that the measure developed to estimate the amount of information being assimilated by extension workers consisted of a test of knowledge of recent research. No formal pilot test was undertaken for this test. The information contained in it dealt specifically with technical aspects of sheep and wool production. As all of the extension workers in this field were participating in the survey, there was no readily available group with whom a pilot run of the test could be performed. A further complication with respect to pilot runs of such knowledge tests has to do with the fact that the information contained in the tests would often be specific to one state, or in some cases, to a specific region in a state. This means that it is not feasible even to undertake a pilot test in another state.

The knowledge test used in this particular investigation was constructed with the aid of the principal livestock officer of the Sheep and Wool Branch. This, it was felt, would be a sufficient constraint on the difficulty or the simplicity of the test. Respondents completing the test did, however, claim that the test was very difficult.

In the analysis of the results of the investigation, the scores obtained on the original knowledge test were used. It might have been possible to amend the test by deleting items which are shown to be too easy or too difficult by the responses of the participants. In this way, a test could be obtained which might be more acceptable to the participants and yet be sufficiently discriminating.

Concluding Observations

This study has emphasized the importance of psychological factors in influencing the success of the communication of scientific information. Past research in agricultural extension has largely ignored psychological factors. Their orientation has been primarily sociological. The research has typically presented an aggregate view of systems of communication and of the effectiveness of various channels of communication (e.g. conferences, journal articles and off-prints). By contrast this study has looked more closely at the individuals who are involved in an agricultural communication system and at the effects which their differing attitudes and past experiences have had on the success of communication. The results of the investigation clearly show that the communication of scientific information is affected by the personal behavioural characteristics of the participants.

Attempts to improve communication simply by altering the operation of channels of information-gathering or dissemination, run the risk of being palliatives rather than effective remedies. It is clearly necessary to take fully into account the individuals involved, their inter-relationships and the attitudes they hold towards each other and the various channels of information-gathering and dissemination.

APPENDIX A

THE ITEMS IN THE SCALE MEASURING THE ATTITUDE TOWARDS THE VALUE OF SCIENCE

1. I think everyone should know more about science.
2. Science should be a compulsory subject at least to the final year at school.
3. Any scientific advance is of great benefit to mankind.
4. Everyone should have a greater appreciation of science.
5. Life would be a great deal happier without all the emphasis on scientific advancement.
6. Scientific research is a waste of time and money which would be better spent helping the poor etc.
7. Scientific advancement has done our society as much harm as it has good.
8. We need to think more about people and less about science and technology.
9. Scientific research is vitally necessary for the welfare of our country.
10. Science seems to be a necessary evil.
11. Science might be worthwhile if it was of a more practical nature.
12. The world was better off before all the scientific "break-throughs" happened, and started making our lives difficult.
13. Science ignores people.
14. We need to think more about people and less about science and technology.
15. Human happiness is more important than scientific achievement.

16. People lose their regard for one another in a society based on science.

17. Science has enabled us to enjoy a higher standard of living.

18. Mankind has gained a lot from space research programmes.

19. Science has created problems of urban squalor.

20. Nuclear powered ships should be banned because of the possibility of radiation leak.

21. If science keeps going there will be no nature to go back to.

22. Scientists often ignore the ethical problems of research.

23. Agricultural science is geared for quantity not quality.

24. Science reminds me of the title of Shakespeare's play - "Much Ado About Nothing".

25. Scientists will solve the world's food problems.

26. Science may have caused some pollution, but it will also cure it.

27. Scientific research is vital in improving the quality of life.

APPENDIX B

THE ITEMS IN THE SCALE MEASURING THE ATTITUDE TOWARDS THE VALUE OF AGRICULTURAL RESEARCH AND RESEARCH WORKERS

1. Research workers from their training and research experience know the problems for research.
2. Research workers only ask extension officers to co-operate when they want cheap labour.
3. Research workers produce few results that are useful in extension.
4. When it comes to the real world, research workers just aren't interested.
5. I have generally found research workers willing to co-operate in extension activities.
6. Research workers have yet to learn that what they do must be useful.
7. The highly trained research workers never get "mud on their boots".
8. The Department's sheep and wool research is nearly all about real problems in the industry.
9. Research workers have done more to boost agricultural production than extension officers.
10. Research articles are too detailed - when I want the time of day I don't want to know how a watch is made.
11. Research workers have their heads in the clouds.
12. Research workers don't even consider possible costs of farming innovations they suggest.
13. A bit less should be spent on research and spent instead on disseminating research results.
14. Research workers take an interest in extension problems to the limit of their resources.

15. There could be a major plague in the district and research workers wouldn't know about it.

16. Research workers orientate research purely according to what they happen to be interested in.

17. Research workers won't give definite answers unless they've done 15 years research on it.

18. Most research workers get along well with extension people or farmers.

19. Research workers take an interest in what extension people tell them are the problems.

20. Research workers only listen to an extension officer's problems if they can get a paper out of it.

21. One good research result pays for a lot of projects that don't come off.

22. Research workers are too busy chasing promotions to worry about farming problems.

23. Research workers co-operate well with extension when they get the chance to.

24. The ultimate goal of research workers is a Ph.D.

25. Many research workers just don't appreciate what's going on in the bush.

26. Research workers take a lot of interest in the problems faced by extension workers.

APPENDIX C

THE ITEMS IN THE SCALE MEASURING THE ATTITUDE TOWARDS THE VALUE OF EXTENSION AND EXTENSION WORKERS

1. Extension officers are often unwilling to accept change.
2. Extension officers aren't really interested in the research done by the Department or anywhere else for that matter.
3. Most extension people's knowledge is about ten years out of date.
4. Extension officers catch on to new ideas quickly.
5. Extension officers are often unwilling to co-operate with research workers.
6. Extension workers are so wound up in their own programmes they wouldn't use research results even if they can be applied directly.
7. Extension programmes are generally very well planned.
8. Extension men really know far less about farming than they think.
9. Extension officers' understanding of research is quite good on a face-to-face level.
10. Extension people are pretty naive in terms of technical and scientific knowledge.
11. Extension officers are always complaining about technical language in research papers before even having a go at understanding it.
12. Extension people have little appreciation of the problems involved in research.
13. It takes so long to explain something to an extension officer that it's just not worth the trouble.

14. Extension programmes are often ill informed and badly executed.

15. Extension people don't even try to understand the research done by the Department.

16. I have found combined conferences of research and extension personnel to be a waste of time in the past.

17. Extension officers have no difficulty in understanding applied research.

18. It is becoming increasingly doubtful that extension services serve a useful function.

19. The vital role that extension plays in agriculture has not had enough recognition in the past.

20. Extension workers know about any research results that are useful.

21. Extension officers don't even try to see value in research results.

22. Extension officers find out about the research results that are important to their districts.

23. The success of extension officers in N.S.W. is due to their ability to give sound practical advice.

24. Extension workers find out about new developments in agriculture quickly.

BIBLIOGRAPHY

Ackoff, R.L. and F.E. Emery. On Purposeful Systems. London: Tavistock, 1972.

Allen, T.J. "Roles in Technical Communication Networks." Communication Among Scientists and Engineers. Edited by C.E. Nelson and D.K. Pollock. Lexington: Heath Lexington Books, 1970.

Angrove, S.C. Report of Overseas Study Tour. South Australian Department of Agriculture, Adelaide: 1968.

Ansiaux, J.R., L.S. Carpentier and P. Louis. "Agricultural Research and Advisory Work." Phosphorus in Agriculture, Vol.56, No.1 (January, 1970), pp.1-6.

Arnon, I. Organisation and Administration of Agricultural Research. Amsterdam: Elsevier Publishing Co. Ltd., 1968.

Australian Department of Agriculture, Extension Services Branch. The Australian Government and Agricultural Extension. Canberra: 1974.

Australian Wool Corporation. Explanatory Handbook on Sheep and Wool Refresher Courses. Melbourne: 1973.

Bertrand, A.L. Social Organization. Philadelphia: F.A. Davis Co., 1972.

Brien, J.P., J.F. Wrigley and R. Jardine. "A Study of Some Personal and Social Factors in Relation to Farmer Performance." Review of Marketing and Agricultural Economics, Vol.33, No.3 (September, 1965), pp.126-146.

Brien, J.P. and J.N. Potter. "Agricultural Scientists and Technologists Not News and Review Readers." Journal of the Australian Institute of Agricultural Science, Vol.38, No.2 (June, 1972), pp.120-124.

Crane, D. "The Nature of Scientific Communication and Influence." International Social Science Journal, Vol.22, No.1 (1st Quarter, 1970), pp.28-41.

Crane, D. "Information Needs and Uses." Annual Review of Information Science and Technology, Vol.6. Edited by C.A. Cuadra. Washington, D.C.: American Society for Information Science, 1971.

Cronbach, L.J. Essentials of Psychological Testing. New York: Harper, 1951.

Dennis, W. "Productivity Among American Psychologists." American Psychologist, Vol.9, No.5 (May, 1954), pp.191-194.

Fleishman, E.A., ed. Studies in Personnel and Industrial Psychology. Homewood: The Dorsey Press, Inc., 1961.

Garvey, W.D. and B.C. Griffith. "Studies of Social Innovations in Scientific Communication in Psychology." American Psychologist, Vol.21, No.11 (November, 1966), pp.1019-1036.

Garvey, W.D., Nan Lin and C.E. Nelson, "Some Comparisons of Communication Activities in the Physical and Social Sciences." Communication Among Scientists and Engineers. Edited by C.E. Nelson and D.K. Pollock. Lexington: Heath Lexington Books, 1970.

Gidley, V.N. "Written Communication from Research to Extension: A Regional Study." (Personal communication).

Gidley, V.N. "Towards Better Liaison: A Survey of Communication between Agricultural Research and Extension." (Personal communication).

Goldhaber, G.M. Organizational Communication. Iowa: Wm. C. Brown Co., 1974.

Griffith, B.C. and N. Mullins. "Coherent Social Groups in Scientific Change." Science, Vol.177, No.4053 (September, 1972), pp.959-963.

Guion, R.M. "Some Definitions of Morale." Studies in Personnel and Industrial Psychology. Edited by E.A. Fleishman. Homewood: The Dorsey Press Inc., 1961.

Havelock, R.G. Planning for Innovation. University of Michigan, Ann Arbor: CRUSK, 1973.

Hazell, J.C. and J.N. Potter. "Information Practices of Agricultural Scientists." Australian Library Journal, Vol.17, No.5 (June, 1968), pp.147-157.

Henin, S. "De La Recherche à La Vulgarisation." Annales de Gembloux, Vol.76, 1970, pp.123-134.

Herner, S. and M. Herner. "Information Needs and Uses." Annual Review of Information Science and Technology, Vol.2. Edited by C.A. Cuadra. Washington, D.C.: American Society for Information Science, 1967.

Hildreth, R.J. "Tensions Between Research and Extension Workers - Three Hypotheses." Journal of Farm Economics, Vol.47, No.3 (August, 1965), pp.838-840.

Kantock, B.H. "Developing a Working Arrangement with Research-Extension Specialist View-point." Proceedings of the International Conference of Extension Administrators. South Dakota University: Co-operative Extension Service, 1965.

Katz, D. and R.L. Kahn. The Social Psychology of Organizations. New York: John Wiley and Sons, Inc., 1966.

Leavitt, H.J. and R.A.H. Mueller. "Some Effects of Feedback on Communication." Studies in Personnel and Industrial Psychology. Edited by E.A. Fleishman. Homewood: The Dorsey Press, Inc., 1961.

Licklider, J.C.R. "A Crux in Scientific and Technical Communication." American Psychologist, Vol. 21, No.11 (November, 1966), pp.1044-1051.

Lipetz, Ben-Ami. The Measurement of Efficiency of Scientific Research. U.S.A.: Intermedia Inc., 1965.

Lipetz, Ben-Ami. "Information Needs and Uses." Annual Review of Information Science and Technology, Vol.5. Edited by C.A. Cuadra. Washington, D.C.: American Society for Information Science, 1970.

Mann, F.C. "Studying and Creating Change: A Means to Understanding Social Organization." Research in Industrial Human Relations, Industrial Relations Research Association, Vol.17, 1957, pp.146-167.

Mann, F.C., B.P. Indik and V.H. Vroom. The Productivity of Work Groups. Ann Arbor, Michigan: Survey Research Center, 1963.

Marquis, D.G. and T.A. Allen. "Communication Patterns in Applied Technology." American Psychologist, Vol.21, No.11 (November, 1966), pp.1052-1060.

Mayo, E. The Human Problems of an Industrial Civilization. New York: Macmillan, 1933.

Meadows, A.J. and J.G. O'Connor. An Investigation of Information Sources and Information Retrieval in Astronomy and Space Science. Astronomy Department, Leicester University, 1969.

Meadows, A.J. Communication in Science. London: Butterworths, 1974.

Menzel, H. "Scientific Communication: Five Themes from Social Science Research." American Psychologist, Vol. 21, No.11 (November, 1966), pp.999-1004.

Menzel, H. "Information Needs and Uses in Science and Technology." Annual Review of Information Science and Technology, Vol.1. Edited by C.A. Cuadra. Washington, D.C.: American Society for Information Science, 1966.

Menzel, H. "Informal Communication in Science: Its Advantages and its Formal Analogues." The Foundations of Access to Knowledge. Edited by E.B. Montgomery. New York: Syracuse University Press, 1968.

Nan Lin, W.D. Garvey and C.E. Nelson. "A Study of the Communication Structure of Science." Communication among Scientists and Engineers. Edited by C.E. Nelson and D.K. Pollock. Lexington: Heath Lexington Books, 1970.

Nelson, C.E. and D.K. Pollock (Eds.), Communication among Scientists and Engineers. Lexington: Heath Lexington Books, 1970.

New South Wales Department of Agriculture. Report on In-Service Training for Extension. Sydney: 1973.

Oppenheim, A.N. Questionnaire Design and Attitude Measurement. London: Heinemann, 1966.

Orr, R.H. "The Scientist as an Information Processor: A Conceptual Model Illustrated with Data on Variables Related to Library Utilization." Communication among Scientists and Engineers. Edited by C.E. Nelson and D.K. Pollock. Lexington: Heath Lexington Books, 1970.

Perrucci, R. and R.A. Rothman. "Obsolescence of Knowledge and the Professional Career." The Engineers and the Social System. Edited by R. Perrucci and J.E. Gerstl. New York: John Wiley and Sons, Inc., 1969.

Rice, A.K. Productivity and Social Organization, the Ahmedabad Experiment: Technical Innovation, Work Organization and Management. London: Tavistock, 1958.

Rogers, E.M. and M.D. Yost. "Communication Behavior of County Extension Agents." Research Bulletin 850. Ohio Agricultural Experiment Station, Wooster, Ohio, 1960.

Rogers, E.M. Diffusion of Innovations. New York: Free Press of Glencoe, 1962.

Rubenstein, A. "Explorations on the Information Seeking Style of Researchers." Communication among Scientists and Engineers. Edited by C.E. Nelson and D.K. Pollock. Lexington: Heath Lexington Books, 1970.

Russell, H.M. "Dichotomy: A Self-Induced Punishment." Australian Agricultural Extension Conference Papers. Glenormiston, Victoria: 1973.

Shaw, M.E. and J.M. Wright. Scales for the Measurement of Attitudes. New York: McGraw Hill Book Co., 1967.

Shepard, R.N., A.K. Romney and S.B. Nerlove (Eds.) Multi-dimensional Scaling. New York: Seminar Press, 1972.

Stagner, R. "Motivational Aspects of Industrial Morale." Studies in Personnel and Industrial Psychology. Edited by E.A. Fleishman. Homewood: The Dorsey Press, Inc., 1961.

Stern, G. Scoring Instructions and College Norms. Psychological Research Center, Syracuse University: 1963.

Tannenbaum, R., I.R. Weschler and F. Massarik. Leadership and Organization. New York: McGraw Hill Book Co., Inc., 1961.

Trist, E.L. Organizational Choice: Capabilities of Groups at the Coal Face under Changing Technologies. London: Tavistock, 1963.

Van Cott, H.P. "National Information System for Psychology: A Proposed Solution for a Pressing Problem." American Psychologist, Vol.25, No.5 (May, 1971), pp.i-xx.

Walstrom, R.J. "Developing a Working Arrangement with Extension - Researcher View-point." Proceedings of the International Conference of Extension Administrators. South Dakota University: Co-operative Extension Service, 1965.

Webb, C. and H. Read. "Analysis of Information Flow from Sources to Illinois Farm Advisers to People." Communications Evaluation Report 7. Co-operative Extension Service, University of Illinois, 1965.

Wyckoff, J.B. "Closer Co-operation between Research and Extension." J. Farm Economics, Vol.47, No.3 (August, 1965), pp.834-837.