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ABSTRACT

AN ECONOMIC ANALYSIS OF SELECTED AGRICULTURAL EXTENSION PROGRAMS IN COLOMBIA, SOUTH AMERICA

By

K. James McKenzie

The objective of this study was to examine the effectiveness of selected agricultural extension programs in Colombia with a view to making suggestions for improving extension work in that country. The study focused on possibilities for improving the effectiveness of programs within existing budget allotments because of the scarcity of funds for public programs in Colombia and the relatively urgent need for devoting public funds to other uses such as roads, education, and agricultural research. All extension activities carried out by the Corporación Autonomo del Valle del Cauca (CVC) and the Department of Agriculture of Antioquia in 1967 were examined using a cost-benefit approach. Estimates of program benefits were based on interviews of program participants; program cost estimates were constructed from records of extension service expenditures.

The major products of agricultural extension work were considered to include technical changes in farm firms, rural households, and community activities. Changes in the managerial capacity of rural people was also regarded as a primary product. Secondary products were considered to

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include influences on institutions relating to (but not part of) rural society (e.g., agricultural credit), assistance provided to rural people in establishing careers outside of agriculture, educational assistance provided to bring rural youth up to the levels of managerial and technical competence already achieved by their parents, and influencing the orientation of agricultural research work. However, only technical changes in farm firms and rural households were reduced to monetary terms in this study.

The use of the adoption distribution curve provided a useful method of aggregating the benefits of extension programs directed at producing technical changes in farm firms and rural households. Benefit flow estimates were constructed by estimating distributions of adopters with and without extension influence and then subtracting the benefit flow attributable to technical changes in the latter situation from that which was obtained in the former. In general, this produced benefit flows which increased gradually to a peak and then decreased to zero over periods of ten to thirty years. If the estimated alternative distributions had been disregarded, the estimated benefit flows attributable to extension efforts would have been infinite in duration. The use of a distribution curve representing adoption without extension influence permitted estimating the marginal or added value of extension work given that research had already been carried out.

In all cases optimistic and pessimistic values of

benefit flows were made to test the sensitivity of the calculated benefit-cost ratios. All programs were evaluated using discount rates of 0%, 4% and 8% to test for possible program ranking reversals with changes in the interest rate.

Six extension programs were examined in Valle del Cauca. Benefit-cost ratios calculated with a discount rate of 4% ranged from 1.06 to 14.81. The relative size of these ratios was quite insensitive to variations in the interest rate but, because some benefit streams were estimated with a much higher level of accuracy than others, some programs were much more uncertain than others and, depending on one's decision criterion, this could cause a change in rankings. The absolute size of the benefit-cost ratios varied substantially with variations in the interest rate and benefit flow estimates. The total range of these in response to all sensitivity tests was 0.08 to 16.84. Income distribution effects also varied somewhat among programs. However, all factors considered, it was concluded that the CVC's fertilizer program with tomato producers and the home economics program were the most successful programs. In view of the fact that some benefits were excluded from the calculations it seemed highly likely that benefits from most CVC extension programs were substantially in excess of their extension expenditure although the Apiculture and the Pacific Coast programs were highly questionable.

Four field districts were examined in Antioquia. Benefit-cost ratios calculated with a discount rate of 4%

ranged from 1.39 to 3.43 for extension work in these districts. The relative size of these ratios was quite insensitive to variations in the interest rate, and moderately insensitive to variations in cost and benefit flow estimates. However, the absolute size of the ratios varied substantially with changes in all three principle components. The total range of these ratios in response to all sensitivity tests was 0.43 to 13.96. No significant difference in income distribution effects were noted among districts. No conclusion was reached regarding the relative success of extension programs among districts. In view of the fact that some benefits were not included in the calculations, it seemed highly likely that the benefits from extension work in Antioquia were significantly greater than extension expenditures although several opportunities for improving extension effectiveness were noted.

The results of this study indicate that extension agencies in Colombia could make more effective use of their resources by directing technical agricultural programs at commercial (but not necessarily large) farmers, directing home economics programs at families earning 100 to 500 pesos per week, and focusing on changes in community activities in regions where infrastructure is poorly-developed but agricultural production can be competitive in the national market. Technical agricultural programs directed at subsistence producers and/or part-time farmers have relatively low pay-offs in relation to costs because of the lack of new

technology of relevance to many such producers. Home economics programs are often not applicable to the families of commercial farmers or very low income families. Material assistance such as noted in Antioquia often costs more than it is worth to recipients. However, a number of qualifications must be placed on these conclusions and, in general, there does not appear to be any good substitute for developing extension management capable of detecting high pay-off programs as they arise.

If the results of this study are to be used for purposes other than measuring extension effectiveness, two major qualifications should be placed on the benefit-cost ratios measured herein. First, no allowance has been made in the cost estimates for research expenditures and, in the long-run, improvements in technology must cover these as well as extension costs. Secondly, extension expenditures undoubtedly underestimate the social costs of doing extension work.

AN ECONOMIC ANALYSIS
OF SELECTED AGRICULTURAL EXTENSION
PROGRAMS IN COLOMBIA, SOUTH AMERICA

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CHAPTER I

INTRODUCTION

The problem confronted in this study was one of suggesting ways and means of improving the effectiveness of agricultural extension work in Colombia. As a prelude to defining this problem more precisely, and devising a means of attacking it, the author attempted to familiarize himself (via existing literature) with the status of Colombian agricultural extension activities and the environment in which these are carried out. The following discussion permits the reader to join him.

The Status of Agricultural Extension in Colombia

In an effort to "increase the agricultural productivity of the country and the welfare of the rural people",¹ a number of official and semi-official Colombian agencies have been permitted to take on responsibilities in the area of agricultural extension and direct technical assistance to farmers. Most of these agencies have acquired these responsibilities only in the last two decades. However, a few others were active in some form of technical assistance work prior to World War II. The institutional

¹See footnote 1, Chapter II.

structure of Colombia is by no means a static one. A number of changes have taken place in recent years in an effort to find a really workable system. Agricultural extension is one activity which often becomes involved in such changes. In 1967 the extension service of the Federal Department of Agriculture was transferred to ICA² and, in 1968 a fairly large expansion program was begun. This agency is supposed to serve as the co-ordinator of agricultural research, education, and extension in Colombia. Its employees report they do not know for sure how many other Colombian agencies are doing extension work in the country. Major extension programs, which are well-known, are operated by the National Coffee Federation, the Department of Agriculture in Antioquia, the Cauca Valley Corporation, ICA itself, and several producer associations.

Agricultural extension activities in Colombia are complemented by work in several related fields of endeavor. Two of which bear mention here are formal agricultural education and community development. The former area includes about 15 universities with agricultural and related faculties, three agricultural normal or technical schools, about 40 agricultural high schools, and SENA (Servicio Nacional de Aprendizajé), which devotes part of its resources to agricultural courses. The universities are currently producing about 550 agricultural professionals annually, of

²Instituto Colombiano Agropecuario (Colombian Agricultural Institute).

which 70 per cent are ingenieros agronomos. About 80 per cent of these graduates are employed by official or semi-official agencies while the rest find jobs in the private sector. The annual output of technical agricultural graduates is much larger than that of professionals. A large proportion of these people are also employed in the public sector although a significant number of the graduates of SENA and the agricultural high schools find jobs in industry and on farms as well. One of the most notable features of agricultural education in Colombia is that educational programs directed at training agricultural professional and technical personnel enrol very few students with farm backgrounds. Very few rural young people obtain sufficient basic education to permit them to enter such courses. As a result of this combination of circumstances many Colombian extension workers come from urban areas, have no university training, and belong to a much different social class than many of their clients.

A wide range of community development programs operate in Colombia.³ Some of the agencies operating these programs include CARE, Acción Comunal, Acción Cultural Popular, the Peace Corps, the National Coffee Federation, and the Rockefeller Foundation. Acción Comunal comes under the supervision of the Ministerio de Gobierno. By 1964 about

³For more details see "Colombian Community Development," A Survey Report submitted by CARE Inc. in fulfillment of an agreement with the National Coffee Federation, December 1960.

9,000 local boards had been established, about 450 full-time community agents were employed, and investments by local boards were between 10 and 13 million dollars - about the same as total government investments in the States.⁴ Acción Cultural Popular operates an extensive radio training program for campesinos and publishes the largest circulation farm paper in Colombia. The National Coffee Federation has been very active in community development in most coffee-growing areas of Colombia. In addition to its large agricultural extension service it also builds roads and schools, and carries out various other such projects.

In addition to official and semi-official activities in the areas of agricultural extension and direct technical assistance to farmers, a large amount of private resources are directed along these lines in Colombia. These usually emanate from agricultural consulting firms, companies selling inputs to farmers, and companies buying products from farms. They are primarily directed at commercial or larger-volume producers. Agricultural consulting firms sell their service to farmers who are willing to pay for it and to farmers who are required to have it to obtain government credit. Fertilizer, chemical pest and disease control, and feed suppliers predominate among the input sellers who offer technical advice. Some of these companies are well-established and very active in providing advice to large commercial

⁴Matthew D. Edell, "The Colombian Community Action Programs, an Economic Evaluation," Unpublished Ph.D. Dissertation, Yale University, 1967, Chapter 2.

producers.

Throughout their recent existence Colombian agricultural extension services have been regarded by some observers as inefficient and ineffective institutions. In 1958 a Mission organized by the International Bank for Reconstruction and Development reported the following:

The Mission found the extension work of the Ministry of Agriculture and of the Departamentos disappointing in general. Rarely was there any real co-ordination of program or execution although they were working side by side; the staff of both seemed to lack an adequate appreciation of the proper approach to extension; superior guidance by higher personnel in the making and execution of programs was insufficient; too little time was spent in the field among cultivators and too much in the office, either because of the burden of administration or of disinclination for fieldwork, or of both combined; the staff of both ingeniero agronomos and of practicos, particularly of the latter, was far too small in numbers to be effective.⁵

The mission recommended that the Federal Department of Agriculture appoint a number of technical officers to provide high level guidance and advice for extension activities; that action be taken to reduce the high rate of turnover of basic extension personnel; that an agricultural extension advisory board be created within the Department of Agriculture to co-ordinate the work of the various extension agencies; that the quality of existing staff be upgraded; and that the number of personnel be markedly increased. During the next few years a number of these recommendations were implemented

⁵ International Bank of Reconstruction and Development, Agricultural Development in Colombia (Washington: I.B.R.D., 1956), p. 153.

in various forms. Budgets were enlarged, staffs were increased, and the activities of Servicio Tecnico Agricola Colombiano Americano (STACA) were expanded.⁶

In 1961 the Commission on Higher Agricultural Education in Colombia made the following comment about the extension service of the Federal Department of Agriculture as it was then operating:

The organization cannot at present be said to be functioning properly. The personnel are not well trained and lack capacity. A great deal of time is spent in writing reports. Facilities for extension are few; most of the budget is spent on salaries. Formal programs of work are theoretically developed; there are few records of farmers contacted nor estimates of the economics of the service in terms of improvement in production. Co-ordination with DIA has been lacking.⁷

The Commission concluded that "more productive extension services are urgently and immediately needed in Colombia."⁸

A number of recommendations were made with a view to increasing the abilities of current extension workers and upgrading the educational programs by which people usually entered extension work. A study of five Colombian extension

⁶STACA was a co-operative U.S. - Colombian project designed to upgrade Colombian agricultural extension work. Both field extension programs and training programs for extension workers were carried out. STACA no longer exists although many of the extension workers who received training in this project are now employed by various agencies throughout Colombia.

⁷The Commission on Higher Agricultural Education, Higher Agricultural Education in Colombia, (Bogotá, Colombia: A mimeographed report by the Commission, 1961), p. 44. (DIA was another government agency responsible for some agricultural programs.)

⁸Ibid., p. 91.

agencies published in 1962 reached a similar conclusion and made eighteen specific recommendations designed to remedy the situation.⁹

A 1964 study of land settlement in Eastern Colombia concluded that:

There is a great need for more effort in the field of technical assistance. The present extension workers know little about agriculture in general and even less about tropical agriculture. Effort in the field of credit is likely to be ineffective unless means are provided for increasing the productive level of the farm — that is, by providing more technical assistance.¹⁰

A 1966 study of the extension service of the Federal Department of Agriculture concluded:

1. That regional offices have used very changeable formats for presenting their monthly reports.
2. That there hasn't been sufficient responsibility in the presentation of these reports.
3. That extension workers have had no knowledge of some extension methods and there has been wide disparity in opinions of how to use some of these methods, such as movies.¹¹

⁹Joseph Di Franco and Roy A. Clifford, An Analytical Study of Five Extension Organizations in Colombia, (Turrialba, Costa Rica: Inter-American Institute of Agricultural Sciences of the O.A.S., 1962), pp. 55-60.

¹⁰Ronald L. Tinnermeier, New Land Settlement in the Eastern Lowlands of Colombia (Madison, Wisconsin: University of Wisconsin Land Tenure Center, Research Paper #13, 1964), p. 50.

¹¹Ana Lucia Garcia de Roman, Evaluación del Uso de Algunos Metodos Utilizados por los Extensionistas del Ministerio de Agricultura de Colombia (Unpublished thesis for degree of Ingeniero Agronomo, Universidad de Caldas, 1955), p. 92, (translation by this writer.)

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A 1966 USAID report suggested that:

There is a great need to train more professional extension teachers at the University level. Extension work must develop a stature and prestige comparable to that of research or university teaching to attract competent people.

Professional extension workers are needed for major administrative posts in existing extension agencies, for university teaching positions in the agricultural universities, for jobs in the agricultural normal and vocational schools and in the vocational training centers.¹²

Other observers point out that, in spite of the limitations of poorly-qualified extension workers, lack of co-ordination among agencies, and insufficient resources to provide extension services in many municipalities, Colombian extension efforts have been, in some respects, fairly successful.

A 1966 study makes the following remark:

Among Latin American professional circles, the C.V.C. Agricultural Extension Service has the reputation of being the best in Latin America. Its contribution toward the development of agriculture and rural living in the Cauca Valley has certainly been significant....¹³

The authors go on to recommend expansion of this service. A 1967 study characterized the extension program of the National Federation of Coffee Growers as the most successful in Colombia.

¹²USAID, "Agricultural Development in Colombia," a report prepared by the Rural Development Staff of USAID, Bogotá, Colombia, 1966, p. 47.

¹³Antonio J. Posada and Jeanne Anderson Posada, The CVC: Challenge to Underdevelopment and Traditionalism (Bogotá, Colombia: Tercer Mundo, 1966), p. 149.

This study suggests that there are several reasons for the greater success of this organization:

First, it works only in coffee areas - this reduces the territory to about one-third of the municipalities in the country. Second, it has moved into the area of building infrastructure which local governments usually fail to provide. And third, it has a stable source of income through a six per cent tax on all coffee export sales.¹⁴

Another 1967 study, reported on extension activities in the municipality of Giradota, State of Antioquia, found that most people in the area were aware of what the Extension Service was doing and were favorably impressed by these activities.¹⁵

Most foreign observers agree that continuing efforts to improve Colombian extension services are desirable and that this institution can play a much more effective role in the development of the country than it is now doing. Administrators of many Colombian extension agencies also appear to adopt this view. The problem arises, however, in deciding what changes are most appropriate, given the existing situation. Earlier recommendations were quite general and appear to have been geared to making the Colombian extension system more like the U.S. system on the implicit assumption that what appears to have worked well in the U.S.

¹⁴Herman Felstehausen, "Fitting Agricultural Extension to Development Needs: The Colombian Problem", Research Paper #39 of the Land Tenure Center, Madison, University of Wisconsin, 1967, p. 13.

¹⁵Ivan Agudelo, "Evaluación de Algunos Labores de Extension en el Area de Giradota, Colombia," Unpublished Master's thesis, Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, 1967, pp. 75-77.

would work well in Colombia. Later studies, like that of Felstehausen, have been more specific and have served to point out why this assumption is not, in many cases, a valid one. Felstehausen emphasizes that much of the rural infrastructure, which provides an appropriate environment for agricultural extension work as it is carried out in the United States, is absent in many areas of Colombia. He also suggests that "neither foreigners nor Colombians know enough about what will work in Colombia."¹⁶

The Environment in Which Extension Operates¹⁷

As a result of its highly variable terrain, which ranges from coastal plains to snow-capped mountains, Colombia boasts a wide variety of climatic zones. Many individual states have almost as many climatic zones as the country itself. However, as the country is situated at the equator, seasonal variation in temperature within all of these zones is slight. The country's total area is about 114 million hectares of which only 27 million is divided into farm units.

¹⁶Herman Felstehausen, op. cit., p. 19.

¹⁷More detail on this particular topic may be found in "Colombian Agriculture", a mimeographed report prepared by the Office of the Agricultural Attache, U.S. Embassy, Bogotá, Colombia; "Notes on Recent Developments in Colombian Agriculture", a mimeographed report prepared by José Americo Castillo and Gerald I. Trant, Agricultural Economics Section, Faculty of Economic Sciences, University of Valle, Cali, Colombia; and "Agricultural Development in Colombia", a report prepared by the Rural Development Staff, USAID, Bogotá, Colombia.

[illegible]

The Eastern half of Colombia (the Llanos) is sparsely populated and most agricultural land in this area is devoted to cattle raising. (About one-third of the country's permanent pasture is located in the Llanos.) It is often suggested that this area has a potential for a much more intensive type of agriculture than it now supports. The Western half of Colombia is divided by three rugged mountain ranges but four-fifths of the present population lives in this part of the country. In this region, sizeable areas of good, level agricultural land are found in the Magdalena and Cauca Valleys, the Savana de Bogotá, and the Magdalena Delta along the Carribean Coast. Some of the larger farms in these areas are now using a number of improved practices including modern machinery. Much of the hilly and mountainous land in this region is also farmed and this accounts for a large proportion of the production of some crops, particularly coffee.

Colombia's gross agricultural product is increasing at about the same rate as her population. However, agriculture's share of gross national product is declining due to the more rapid rate of growth in other sectors. In 1965 agriculture accounted for about 30 per cent of GNP. The principal components of this output were coffee, cattle, corn, rice, sugar cane, plantain, and cotton, although cassava, wheat, beans, potatoes, barley, bananas, cacao, sesame, sisal, soybeans, tobacco, milk, lemons, oranges, pineapples, and various vegetables were also produced in substantial

quantities. Coffee is Colombia's major export commodity, but bananas, sugar, cotton, tobacco, cattle and a few other agricultural products also earn some foreign exchange. Part of the domestic demand for agricultural products is met by imports, principally from the U.S.A. However, in 1966 agricultural exports exceeded agricultural imports by 346.3 million dollars (U.S.) thereby providing foreign exchange to pay for a wide variety of non-agricultural imports.

The rural - urban distribution of population in Colombia as a whole is similar to that in most Latin American countries. Table 1 gives a description of population distribution by size of center in 1964. Most centers of less than 20,000 people have no significant industries and are essentially service centers for agricultural areas.

Table 1.--Population distribution by size of center in Colombia in 1964.^a

Size of Center	No. of People	% of Total
More than 20,000 inhabitants	6,322,984	36.1
Between 1,000 and 20,000 inhabitants	3,244,227	18.6
Rural areas and centers of less than 1,000 inhabitants	7,917,297	45.3
Total	17,484,508	100.0

^aDepartamento Administrativo Nacional de Estadística (DANE), XII Censo Nacional de Población (Julio 15 de 1964), Resumen General (Bogotá, Colombia: Imprenta Nacional, 1967), p. 32.

Many of the income-earners who reside in these towns are either owners of larger farms or farm labourers. Thus, over 60 per cent of the population may be regarded as "rural".

Census data indicate that 46.8 per cent of the economically-active population of Colombia was employed in agriculture in 1964. The distribution of these people among various occupations is shown in Table 2. It is evident from this data that Colombian agriculture relies very heavily on hired manual labour as an input. Moreover, in addition to the 967,826 hired laborers, a large proportion of the 1,074,410 independent workers and family helpers were probably also doing manual work. Thus, although large tractors and combines are found on the sugar plantations and larger rice farms in Colombia, probably about 85 per cent of the people employed in agriculture in 1964 worked as hired manual laborers or as

Table 2.--Distribution of people economically-active in agriculture in Colombia in 1964 by occupation.^a

Occupation	No. of Persons	% of Total
Employer	307,772	12.8
Independent Worker	706,649	29.4
Family Helper	367,761	15.3
Manager or Foreman	48,081	2.0
Manual Laborer (Employee)	967,826	40.2
Others	7,178	0.3
Total	2,405,267	100.0

^aXII Censo Nacional de Población.

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owners or renters of small plots of land where human labor was the principal input.¹⁸ Many of the remaining 15 per cent appear to be involved either totally or partially, in supervising hired laborers.

As illustrated in Table 3, 57.9 per cent of the farm units in Colombia were less than four hectares in size in 1959. These farm units contained only 3.6 per cent of the total land but provided homes for 48.6 per cent of the total farm population. (Probably a large proportion of the 1,074,410 independent workers and family helpers recorded by the 1964 Census were in this group). In the same year, 1.7 per cent of the farm units controlled 55.1 per cent of all agricultural land.¹⁹ Colombia's land distribution problem has received much attention in recent years, but the situation probably has not changed greatly since 1959. Many of these larger farms are devoted to cattle-raising.²⁰ Some of them utilize large tracts of reasonably good agricultural land for pasture, while peasants with small holdings use parts of the steep mountain sides for crops such as corn and potatoes.

¹⁸Of the 1,209,672 farm units recorded by DANE's 1959 Censo Agropecuario, 64.6% relied on human power alone while only 2.5% were classified as mechanized. The other 32.9% used various combinations of human, animal, and mechanical power.

¹⁹Recent studies by INCORA (the National agency in charge of land reform) suggest this is a biased estimate because some of the large holdings exist on paper but not in reality.

²⁰DANE's 1959 Agricultural Census reported that 72.5% of the farm units over 30 hectares raised cattle while only 32.2% of the farms under 30 hectares were involved in this activity.

Table 3.--Distribution of farm units, total land area, and inhabitants by size of farm in Colombia in 1959.^a

Size of Farm	Farm Units		Total Land Area		Inhabitants	
	Number	%	Number	%	Number	%
Less than 4 hectares	698,424	57.9	987,122	3.6	3,187,332	48.6
4 - 30 hectares	385,606	31.9	4,032,233	14.7	2,327,544	35.5
30 - 200 hectares	105,047	8.5	7,271,770	26.6	797,541	12.1
More than 200 hectares	20,595	1.7	15,046,702	55.1	253,867	3.8
Total	1,209,672	100.0	27,337,827	100.0	6,566,284	100.0

^aDepartamento Administrativo Nacional de Estadística, Directorio Nacional de Explotaciones Agropecuarias (Censo Agropecuario), 1960 (Bogotá, Colombia: Multilith Estadal, 1964, p. 40 and p. 89.

The reasons for the existence of this situation are too involved to explain here.²¹ However, the situation itself is both a reason for investing in agricultural extension and a reason why extension's task is a very difficult one.

There are many other aspects to the environment in which Colombian extension programs must be operated. Inadequate transportation networks, restrictive marketing systems, ineffective local government, serious health problems, and low education levels are the rule rather than the exception. Health problems are such that in 1960 average life expectancy for Colombia as a whole was about only 50 years compared with 69.5 in the United States.²² Other parts of the Colombian scene include a highly class-determined social structure, limiting legal codes, and the memory of the Violencia.²³

²¹For an interesting discussion of the evolution of this situation see Colombia: Social Structure and the Process of Development, (Gainesville, Florida: University of Florida Press, 1967) by T. Lynn Smith.

²²United Nations, El Desarrollo Economico de American Latina en la Post - Guerra, A United Nations Report dated December, 1963, p. 61.

²³The "Violencia" is now apparently at an end, although a few murders and acts of banditry associated with "Violencia" activities still occur. The "Violencia" has been described as a "peculiarly Colombian phenomenon" as its origin lay in the Colombian political system and social structure. It involved illegal murders, torture, thievery, and destruction of property. During the past 30 years, approximately 200,000 people lost their life in the "Violencia". Most of these were from rural areas and, as a result, a noticeable migration to cities, such as Bogotá, Cali, and Medellin occurred. For further details see Chapter 13 of Colombia: The Political Dimension of Change (New Haven: Yale University Press, 1967) by Robert H. Dix.

It is within this environment that agricultural extension must function to effect what one writer calls "practical and worthwhile changes given the existing system".²⁴

The Problem

There are two major problem areas associated with using agricultural extension as a tool to effect such "practical and/or worthwhile changes". First, there is the question of whether more (or less) resources should be devoted to this activity. The author does not pretend to attack this problem for it would of necessity, involve an examination of alternative and complementary programs - a task much too large for a doctoral dissertation. Second, there is the problem of how efficiently²⁵ extension agencies utilize existing budgets. This involves questions of what extension workers do and how they should pursue their tasks. It will be recalled that the recommendations of earlier studies usually included, either directly or implicitly, the expansion of extension budgets in spite of their lack of any analysis of alternative or complementary programs. The author believes this to be an error and chooses to attack the problem of extension effectiveness by examining the second problem area listed above - the efficiency of

²⁴Stephen Enke, Economics for Development (Englewood Cliffs, N.J., Prentice-Hall Inc., 1963), p. 148.

²⁵The meaning of the term "efficiently" rests on the conceptual framework developed in the first five chapters of this study and cannot be precisely defined at this point.

extension work. This does not mean to imply that the expansion of extension budgets may not be appropriate or important. However, it does mean to imply that resources in Colombia are scarce and, while better results can be obtained with larger budgets, they may well be obtained at a very high opportunity cost (e.g., fewer schools or roads). On the other hand, any gain in extension efficiency is all net gain.

Unfortunately, no complete, workable, theoretical and methodological framework specifically-adapted to measuring extension efficiency in economic terms has been available to decision-makers who must choose between extension programs or select the means of carrying out these programs. Agricultural extension workers, particularly in North America, have for some time been carrying out formal evaluations of their own work.²⁶ These evaluations have usually been directed at determining extension impact, comparing extension methods, or improving specific techniques. All of these functions are useful but they are also restrictive. They do not, for example, permit the comparison of 4-H Club programs with farm account projects to determine if one should be expanded at the expense of the other.

In recent years some economists have become

²⁶See Chapter 33 of The Co-operative Extension Service, (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1966), edited by H.C. Sanders.

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interested in evaluating extension efforts.²⁷ Such activities have occurred mainly in connection with programs in under-developed countries and have been directed primarily at obtaining rough ideas of the general circumstances under which agricultural extension may be usefully employed as a tool in accelerating agricultural development. These approaches have, on the whole, been quite useful and extremely relevant for development planning (i.e., selecting the size of the extension budget) but they are of little use to extension personnel who must choose between alternative extension programs.²⁸

The main reason why no such structure has yet been developed is that the nature of the benefits resulting from extension work is extremely complex. Agricultural extension work is essentially an educational function and the problems of objectively evaluating the products of educational processes in general are widely recognized.²⁹ However,

²⁷See, for example, "A Case Study of the Economic Impact of Technical Assistance". Unpublished Ph.D. dissertation, University of Chicago, 1958, by Clifton R. Wharton, Jr.

²⁸Perhaps the most relevant and ambitious effort in the area of measuring extension effectiveness was the controlled experiment with intensive agricultural extension work carried out in Michigan in the late 1950's. For more details on this program see The Change Agent and The Process of Change, Research Bulletin 17, Michigan State University, Agricultural Experiment Station, East Lansing, Michigan, 1967 by James Neilson. However, the Michigan study was an extremely pragmatic one and several potentially important conceptual considerations were entirely omitted.

²⁹E.A.G. Robinson and J.E. Vaizey (editors), The Economics of Education, (New York: St. Martin's Press, 1966).

because of the critical significance of agricultural progress in the developing countries of the world, it is essential that resources devoted to extension be utilized as effectively as possible. Thus, it appeared to the author that any small measure of progress in measuring extension efficiency might have far-reaching implications and, for this reason, this problem was selected as the topic of this dissertation.

The Method of Analysis

This problem was approached in two major steps. First, an attempt was made to organize a conceptual framework for analyzing the effectiveness of extension work. Second, with the aid of this conceptual framework, selected Colombian extension activities were examined with the hope that, by measuring their relative performance, hypotheses regarding ways for improving extension effectiveness might be advanced and the usefulness of the conceptual structure might be analyzed.

The thesis is organized in the following fashion. The next chapter begins with the general goals acknowledged by extension workers and legislators who have created extension agencies and then constructs a classification of the usual functions of agricultural extension. Specific definitions of the "outputs" associated with these functions are also developed. In the third chapter, a description of the way in which these "outputs" are achieved is advanced.

This provides a basis for relating particular sets of "outputs" to specific extension activities and permits recognition of the many possible causes of variability in extension performance. In the fourth chapter, methods for measuring extension "outputs" are developed. In the fifth chapter, measures of extension "outputs" are incorporated with costs to arrive at measures of overall extension performance. These five chapters form the conceptual framework which is, to a large extent, an adaptation of some components of existing economic and communications theory to the problem at hand.

Chapters VI through IX describe the empirical analysis which was restricted to a few of the extension programs in operation in Colombia at the time the study was being made. From the point of view of locating opportunities for improving extension effectiveness, this restriction has several obvious disadvantages. One of the most serious of these is that it was not possible to make estimates of costs and returns for programs which might have been carried out had the existing programs not been operated. However, the variety of programs examined tends to compensate for this somewhat. It was decided to work with two agencies in different parts of Colombia, and by so doing, achieve an analysis of a rather limited sample of extension activities in the country as a whole. While this sample was by no means a random one, it was the author's opinion that some useful hypotheses and suggestions about the

effectiveness of agricultural extension in Colombia (and perhaps other parts of Latin America) could be drawn from it.

The Cauca Valley Corporation, from whence the idea for this study originated, offered its co-operation. The CVC's 1967 extension operations are discussed in detail in Chapters VI and VII. The Department of Agriculture of Antioquia was also approached in this regard and reacted favorably to the idea. Chapters VIII and IX deal with extension activities carried out by this agency. Because of data limitations and the methods of operation employed by the two agencies, it was not possible to conduct these evaluations on exactly the same basis. CVC's extension activities were examined by program; extension activities in Antioquia were examined by district.³⁰ This makes comparison somewhat more difficult than if the same basis had been used on both agencies. However, it also points out the advantage of having measurement techniques which can be applied to any set of extension activities and the need to further develop and refine the conceptual structure used in this study. Possibilities for improving extension effectiveness are examined in detail in Chapter X while Chapter XI presents the summary and conclusions.

³⁰Comparison of extension work by district can serve to answer the question "Where should extension work be done?" However, in this particular case, results in this regard were inconclusive.

CHAPTER II

THE "OUTPUTS" OF AGRICULTURAL EXTENSION WORK

Extension Goals vs. Extension "Outputs"

Most agricultural extension agencies suggest, either explicitly or implicitly, that they are trying to achieve one or both of the following goals:

- (a) improvement in the level of well-being of farm people,
- (b) improvement, through gains in agricultural efficiency, in the welfare of the consumers of farm products.¹

¹The two general goals of extension work cited here appear to be common throughout the world. For example, in 1966 Colombia's Minister of Agriculture, José Mejía Salazar, stated in his address to the Congreso Nacional that Colombia's general extension goal is "to increase the agricultural productivity of the country and the welfare of rural people." Another writer, J.N.A. Pender, remarks that "the objectives of rural extension are: to raise agricultural productivity, standard of living of the rural population, and rural welfare." ("Principles of Rural Extension." Methods and Programme Planning in Rural Extension. Wageningen, The Netherlands: H. Veeman & Zonen, 1956). An Indian expert, S.P. Bose, in a paper entitled "Aims and Methods of Agricultural Extension and their Adaption to the Human Factor in Developing Countries" and presented at the Rehovoth Conference on Comprehensive Planning of Agriculture in Developing Countries at Rehovoth, Israel in 1963 suggests that "the basic aim of agricultural extension is to bring about improvement in farming through the application of science and technology." The Smith-Lever Act of 1914, which created the U.S. Co-operative Extension Service, states that this agency was brought into being "in order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage application of the same." Many extension agencies in developing countries appear to have chosen (or been assigned) their goals to some extent on the basis of U.S. or European experience.

These goals provide a useful but in some ways inadequate basis for guiding extension activities. These inadequacies arise for the following reasons.

First, because "well-being" and "efficiency" are not easily measured, especially at the national level, workable extension objectives must be phrased in terms of intermediate goals which are sometimes only vaguely believed to be the best instruments for realizing these two ultimate ends. Secondly, extension work can and often does produce benefits which accrue to persons other than farm people and the consumers of farm products. Thirdly, improving the well-being of farm people and improving the welfare of urban consumers may turn out to be competing goals and the general mandate given extension agencies provides no means of resolving the resultant conflict. Finally, the general goals provide no guidance for extension workers who must choose among programs which benefit different groups of farm people or consumers.

In view of the above three problems it does not appear possible, for the purposes of this study, to consider the achievement of these goals per se as the products of extension work. Instead, it appears necessary to attempt to specify the different kinds of specific benefits which extension programs can produce, describe how these benefits get produced, and develop methods for measuring these benefits. If this can be accomplished it should then be possible to compare the total costs of any particular extension program with its resultant benefits. To facilitate this

sort of analysis, a classification² of extension functions has been constructed. This is an attempt to specify the sorts of things which extension agencies do as they try to achieve the two general goals cited earlier. These functions are distinguished as separate because, at the outset of this study, it appeared that a separate analysis of their corresponding "outputs" would be a convenient way to break the overall problem of evaluating benefits into smaller and essentially additive parts. The functions of agricultural extension are considered to be:

A. Primary Function - Acting as an Agent to
Bring about Beneficial Changes in

1. Agricultural Production Units
2. Rural Households
3. Community Organizations
4. Managerial Structure of Rural People

B. Secondary Functions

1. Influencing Technology Developers or Information Sources.
2. Influencing Institutional Activities Outside of Rural Society.
3. Education of Rural Youth in Accepted Practices.
4. Assisting Farm People in Evaluating Non-Farm Opportunities.

Although agricultural extension can serve as a tool for redistributing income in society as a whole, this has not

²The ensuing classification of extension functions is based on the activities of extension agencies as they have operated in the past. These activities - as well as the general goals - have been determined by the frames of reference provided by the legislative bodies which created the agencies. Thus, some of the functions performed by extension agencies have been omitted because they are widely-regarded as regulatory rather than extension functions. In essence, this classification is a summary of what appears to be generally accepted as agricultural extension education.

been listed as an extension function per se because it is essentially one of the outcomes of the functions defined here.

The Change Agent Function

It appears that the primary function of agricultural extension is one of inducing beneficial changes (either immediate or delayed) in the activities of farm people.³ This is essentially a restatement of the mandate provided to the Co-operative Extension Service of the United States by the Smith-Lever Act of 1914. Most extension literature stresses the change agent function of extension work and the literature in communications and sociology abounds with references to extension services as change agents. Thus, it will be considered here that the primary function of agricultural extension is to act as a catalyst or change agent in rural society.⁴

The alert reader will note that "farm people" and "rural society" are not necessarily synonymous terms.

³In some countries, the U.S. being a notable example, the work of the agricultural extension service is not confined to farm people but also involves other participants in the agricultural production-consumption chain. Such participants will not be specifically considered here because no such extension activity was encountered in the two agencies examined in this study. However, the discussion in general appears to apply to work done with such participants. Indeed, such work is mentioned as a possible alternative to existing programs in Chapter X.

⁴For the time being the reader is asked to interpret the word "change" in its most general way. Specific definitions of changes in rural society are given later in this chapter.

However, as both concepts have slightly different meanings in different countries, it is difficult, if not impossible, to distinguish them precisely. This study will be conducted on the assumption that "rural society" and "farm people" represent approximately the same set of individuals because this appears to apply in Colombia.⁵ A somewhat different approach would probably be required if one were investigating extension services to a rural society where this group was significantly non-farm in nature.

The activities of rural society are usually carried out in three somewhat distinct sorts of organizations: production units, or farms; consumption units, or households; and various types of community organizations such as school boards, township councils, threshing gangs, and so on. While these three categories are by no means mutually-exclusive or precisely-definable they are sufficiently well-recognized and sufficiently different in nature to warrant examining the effect of extension work on each of them separately. However, it can be noted that this classification arises because of the different decision-making processes used to cope with different problems encountered by rural people. Thus, it can be expected to break down when the problems and decision-making processes of any two of the

⁵ It should be pointed out that rural society in Colombia includes a large proportion of farm labourers. These people are very much a part of rural society and will be considered as "farm people" here although they might be excluded in some definitions.

three types of units become heavily interdependent.

Agricultural extension workers may influence the decisions of these three types of decision-making units. However, they normally do not have any power to actually make these decisions.⁶ They usually must rely on the people who control these units to make use of the information and advice that they provide. In fact, the change agent role of extension workers fits Berlo's concept of "communications" so closely that it may be useful to quote a rather succinct and illuminating statement of his here. "In short we communicate to influence - to affect with intent."⁷ When extension workers are acting as change agents they are trying to affect or influence rural people so that they (the rural people) will make changes extension workers want them to make. The problem of objectively evaluating the change agent function of extension work then becomes one of measuring what changes occur and objectively evaluating these changes. Considerable attention will be paid to this problem in Chapter IV of this thesis.

Having accepted the change agent function as the primary duty of extension agencies, it is now necessary to develop specific definitions of changes in each of the three

⁶This refers only to a capitalistic organization of society in which extension workers are public employees and the final decisions of farm people rest with themselves. If "extension workers" included technical government advisors in a communistic society, their power might be considerably different.

⁷David K. Berlo, The Process of Communication, (New York, Rinehart, and Winston, 1963), p. 12.

types of decision-making units which extension agencies may influence: farm firms, rural households, and community organizations. This will be done for individual units in these categories in subsequent sections of this chapter. However, as extension agencies typically attempt to influence (i.e., produce changes in) groups of the three categories of units defined above, the results of extension programs will have to be examined at the group level. Thus, the conceptual analysis which begins with individual units in this chapter will have to be extended to groups of such units later in the thesis.

Technical Changes in Agricultural Production Units

The division of the activities of rural society into production, consumption and community action is somewhat contrived. The artificial nature of this classification becomes clearer if one notes that individual members of farm families often belong simultaneously to a consumption unit, a production unit, and one or more community organizations.⁸ It is therefore immediately obvious that decisions regarding changes in production will be in some way related to decisions about the activities of the household and the community organizations to which the individual belongs. The

⁸In a sense both farms and households are group organizations as they are typically composed of all of the members of the farm family. However, it will be assumed here that both farm and household decisions can be treated as if they rested with one manager.

static economic theory of production handles this inter-relationship by assuming that the entrepreneur has a given amount of resources which he is willing to devote to production and that he then attempts to maximize the returns to these resources. Thus, this theory actually deals with a subset of man's problems on the assumption that it can be usefully isolated from the total problem set. This need not be the case. Experience would suggest that there are many situations where the individual's production problems cannot be readily isolated from the individual's consumption problems and his community action relationships. In these situations production theory by itself is not particularly useful. However, the need for production theory is not then eliminated - an amalgamation of production theory with consumption theory and perhaps other theories as well is required.

The Static Production Situation

For the purposes of this study it is only necessary to summarize the major features of static production theory as it is usually applied to agricultural firms⁹ and modify these slightly for the purposes at hand.

It is usually assumed that the entrepreneur or controller of production for any production unit possesses

⁹Anyone interested in a more detailed analysis is directed to one or more of the many texts which deal with this subject. See, for example, Charles E. Ferguson's The Neoclassical Theory of Production and Distribution, London and New York: Cambridge University Press, 1969.

(owns)¹⁰ limited amounts of one or more resources such as time (labour), capital, land, and skills. These limits can be regarded as being determined initially for any entrepreneur by various rules of society and other such circumstances beyond his control. The entrepreneur must then decide, subject to those rules of society he elects to abide by, how much of these resources he will devote to the activities of production, consumption, or community activities. It is generally assumed that the decision regarding the amounts of resources available for production is made at the beginning of each production period on the basis of expected returns in the various areas. Accordingly, upper limits of owned resources available for production in any production unit in any particular production period are assumed to be fixed.

It is also generally assumed that the entrepreneur's objective in any period is to maximize the returns to this fixed bundle of resources. The returns which he realizes over and above that which he could have obtained by selling or hiring out the resources initially on hand is given by

$$(1) \quad R(t) = \sum_{i=1}^n p_i(t) y_i(t) - \sum_{j=1}^m p_j(t) x_j(t)$$

¹⁰Ownership is not, in fact, a fixed concept but involves certain rights to use which vary among societies and among resources. This will be ignored here for the sake of simplicity but it is significant to note that the nature of ownership may be an important factor in determining resource use and hence the occurrence or non-occurrence of technical changes in production.

where $y_i(t)$ are output levels, $x_j(t)$ are input levels, $p_i(t)$ are product prices and $p_j(t)$ are input prices for period t . The $p_j(t)$ for owned resources are their salvage¹¹ values but if more of these same resources are bought, the $p_j(t)$ of the purchased amounts must be their acquisition prices. All prices are calculated so that no changes, except for changes reflected in $R(t)$, occur in the value of the bundle of owned resources during the period. Because of transportation and marketing charges $p_j(t)$ [salvage] is typically less than $p_j(t)$ [acquisition].

As all of the $y_i(t)$ and $x_j(t)$ are assumed to be market goods, this is a fairly straightforward situation because prices are readily available. It can become complicated somewhat by the fact that, under some circumstances, the prices of the $x_j(t)$ and $y_i(t)$ vary with these same variables. These variations are associated with the well-known economic phenomena of monopoly, oligopoly, and monopsony. However, agricultural firms do not often find themselves in these circumstances and, unless stated otherwise, it will be assumed in this study that the prices of all market goods are independent of levels of $x_j(t)$ and $y_i(t)$. Practical problems also arise in calculating $p_i(t)$

¹¹Ferguson's excellent text on production theory does not distinguish between acquisition prices and salvage values but, as this is accepted practice in analyzing agricultural production activities (see "Resource Fixity and Farm Organization" by Clark Edwards, Journal of Farm Economics, November 1959), this modification of the "neo-classical" theory is incorporated here.

and $p_j(t)$ for items not bought or sold during the period but, on the whole, the situation is reasonably straightforward. Some resources (inputs) are not readily quantifiable. In such cases $p_j(t)$ and $x_j(t)$ are not separately apparent but the total value of the input, $v_j(t)$, is (e.g., veterinary services) usually known.

The limits of $R(t)$ are determined by the levels of owned resources and the technical relation between the $x_j(t)$ and the $y_i(t)$. This relationship is typically assumed to be known and fixed. It is usually expressed as follows in the case of one output.

$$(2) \quad y(t) = f [x_1(t), \dots, x_j(t), \dots, x_n(t)]$$

Ferguson describes this production relationship as follows:

A production function is a schedule (or table, or mathematical equation) showing the maximum amount of output that can be produced from any specified set of inputs, given the existing technology, or 'state of the art.' In short, the production function is a catalogue of output possibilities.¹²

Therefore, in his view, all points underneath the production surface are also feasible. Thus, if one accepts this view - which is common in most economic texts - it is necessary to acknowledge that a good deal of technology lies beneath the surface itself. This being the case, it is quite possible for a good deal of technical change, and hence improvement in $R(t)$, to occur without changing the amounts of $x_j(t)$ as

¹²C.E. Ferguson, Microeconomic Theory (Homewood, Illinois: Richard D. Irwin Inc., 1969), p. 116.

they are typically defined.¹³

For now it can be noted that, in the situation just outlined, the entrepreneur who possesses perfect knowledge of prices and technical conditions will, if he wishes to maximize profits, act in a very predictable fashion. Firstly, he will discard all points lying underneath the function as obviously inferior to those on it. Secondly, if perfect competition prevails in factor and product markets, he will select levels of inputs so that:

$$(3) \quad \frac{\partial y_i(t)}{\partial x_j(t)} \cdot p_i(t) = p_j(t)$$

for all i and all j except where some x_j was owned at the beginning of period t . In this case it is permitted that:

$$(4) \quad p_j(t) \text{ [salvage]} \leq \frac{\partial y_i(t)}{\partial x_j(t)} \cdot p_i(t) \\ \leq p_j(t) \text{ [acquisition]}$$

Where $p_j(t) \text{ [salvage]} > \frac{\partial y_i(t)}{\partial x_j(t)} \cdot p_i(t)$ then some of all of the resource j would be sold or rented out until relationship (4) was achieved. Of course, if $\frac{\partial y_i(t)}{\partial x_j(t)} \cdot p_i(t) < p_j(t) \text{ [acquisition]}$ more of the resource would be acquired

¹³Of course, by changing the definition of inputs to distinguish the effects of timing, sequencing, and mode of application within the production period, one can describe a production surface with no feasible points underneath it.

until relationship (4) was achieved.

The static production model describes the situation where the entrepreneur possesses perfect knowledge of prices and technical relationships. However, for the purposes of this study, it is necessary to relax the assumption of perfect knowledge. Only then will it be possible to explicitly define technical changes in production units.

Production Under Imperfect Knowledge

In practice there are several reasons why the entrepreneur may not select the set of $y_j(t)$ and $x_i(t)$ which maximize $R(t)$. First, he may be in such a poor state of knowledge about the total possible production relationship that he may choose deliberately, or through ignorance, not to use some inputs or produce certain outputs at all. Secondly, he may believe that certain inputs and outputs are profitable to incorporate in his operations and he may do so, but he is not yet at the stage where he has found the optimum total quantity combinations, rates of use, or modes of application. Thirdly, he may not have control over some of the factors affecting output - their control may lie with other persons or with nature.¹⁴ Finally, price information may be less than perfect and, as a result, price expectations (upon which decisions are presumably based) may not coincide with actual prices. These circumstances create a dynamic situation and

¹⁴Such phenomenon are sometimes referred to as technical externalities. In agriculture, a common example is weather, which can be regarded as a group of uncontrollable "inputs".

make it necessary for the entrepreneur to manage the firm's operation rather than to mechanically select the optimum combination of inputs and outputs. It is interesting to note that all of these circumstances come under the heading of imperfect knowledge - even the third one. For instance, it would be possible for the producer to maximize profits, given the level of the uncontrollable factors, if he knew what this level were going to be.

The first problem area is, of course, covered in the static theory of production by the assumption that the state of the arts is fixed. In reality it is not; it is highly variable - at a price. Many resources have been devoted in this past century to discovering new inputs and outputs, new techniques for combining old inputs, and different rates of use of combinations of inputs over time. Indications are that this can be a highly profitable pursuit,¹⁵ even though it often involves what appear to be relatively high nominal costs. It should also be pointed out that the state of the arts - as it is called - is not necessarily the same for all producers. As will be seen later, some producers may be using new technology quite effectively while others have not yet discovered it.

The second possibility is covered in the theory by the implicit assumption that optimal combinations of inputs

¹⁵ Zvi Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovations," The Journal of Political Economy, Vol. 66, October, 1958.

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(for any given state of the arts) are known to all producers. This is not necessarily the case in reality. The existence of new producers, new inputs, new outputs, and new production techniques obviously means that some producers are at times learning about the production surface. Such producers are unlikely to know it sufficiently well to select the set of $y_i(t)$ and $x_j(t)$ which maximizes $R(t)$ for each value of t . Furthermore, one would intuitively expect the location of economic optima to be difficult for farmers to determine due to the complex nature of the production relationships they face.

The fact that producers may not control all of the inputs and outputs in their production units is sometimes overlooked. In crop production, rainfall, insects, diseases, and various other yield-affecting factors are determined not by the producer, but by nature. These "inputs" are not within the producer's control except by introduction of other inputs such as irrigation, insecticides, herbicides, fungicides, or others. These uncontrollable inputs make it necessary for farmers to base decisions on output distributions rather than deterministic values.

Finally, price uncertainty has always been a problem for producers trying to maximize profit. Agricultural producers often have very good estimates of input prices but, when making production decisions, their estimates of the prices they will receive for their products are usually poor

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because of production lags. However, they typically use these price estimates anyway, although, when they realize that they are poor estimates, they may adopt different decision models and/or criteria than they would have otherwise.

All of these problem areas become more complicated when the phenomenon of multi-period planning is introduced. Many inputs used in agricultural production processes are not used up entirely in one period and they must be purchased with a view to the returns possible in a number of production periods. Thus, prices and production surfaces for several periods must be analyzed to make the decision to buy or not to buy.

In conclusion, it seems reasonable to classify four types of changes in the set of $y_i(t)$ and $x_j(t)$ associated with the production process of an individual production unit:

- (i) movements to previously unused parts of the total production set in an effort to increase $R(t)$ by utilizing inputs which were not previously being acquired by the firm. This essentially means a change from a zero level of use to a positive level of use.
- (ii) movements to previously unused parts of the total production set in an effort to increase $R(t)$ by using inputs already being acquired by the firm. These changes may involve changes in total quantities, $x_j(t)$, changes in use rates, and changes in techniques of application for old inputs and/or the introduction of new inputs.
- (iii) technical changes not controlled by the producer (e.g., random variations in rainfall, insect levels, etc.).

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- (iv) price-induced technical changes made by the producer. These may or may not involve new knowledge of the set of production possibilities, but one would intuitively expect them to involve only changes in the quantities of inputs used per production period, not changes in production techniques or rates of use within production periods.

The first and second of these are of primary concern in this study although the third also affects $R(t)$ and must be considered in conjunction with management and managerial changes. The fourth provides a variation which is manifest in production adjustments but not in a strictly technical sense.

Managerial Changes¹⁶

It is evident from previous discussion that, if any controlled technical changes are to take place in agricultural production units, someone must decide to make them. Thus, it is also evident why it may be profitable for individual producers to devote resources to management - the process whereby they decide whether they should or should not make technical (and managerial) changes. But the process itself is not quite so clear.

The Management Process

Various descriptions of the decision-making process have appeared in scientific literature over the years. Most

¹⁶This discussion is meant to apply to managerial changes in the three types of decision-making units distinguished in this study. It will relate heavily to agricultural production units because the economic theory for this category of units has just been discussed.

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of these appear to be very similar in general concept although detailed specification varies considerably. It appears generally agreed, however, that the making of decisions is part of a much broader function which may be referred to as management.¹⁷ Johnson regards management as a "problem-solving activity of a firm [household] which controls the production [consumption] process."¹⁸ In his conception it is a separate controlling unit and not part of the production process per se, even though (as he undoubtedly would acknowledge) the management activity does utilize one of the same resources (the manager's time) as is usually used in the production process. It appears useful to adopt this concept of management here, and, in addition, to extend it to the analysis of changes in community organizations. Johnson has described the following five managerial functions:¹⁹

- (i) Observation: This term is used "in its broadest possible sense, including the

¹⁷It is perhaps necessary at this point to distinguish between management and skill. Skill may be regarded as the ability to perform some repetitive task, albeit (at times) a highly complicated one. Many of the functions performed by tradesmen and professional people fall into this area. Management, on the other hand, refers to decision-making (which is usually of a non-repetitive nature). Professional people often find themselves performing managerial functions as well as employing skills. Both the performance of skilled tasks and managerial functions utilize the same resource, human time.

¹⁸Glenn L. Johnson, "Methodology for the Managerial Concept," The Management Input in Agriculture, a study sponsored by the Agricultural Policy Institute, Southern Farm Management Research Committee, Farm Foundation, April 1963, p. 9.

¹⁹Ibid., pp. 9-10.

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perceiving and recording of both normative and positive experiences generated by controlled and uncontrolled events."

- (ii) Analysis: This function determines the meaning of information acquired by observation. "Concepts derived by deduction are checked against each other for internal consistency. Concepts derived inductively from observation are also checked against each other and against those derived from deduction for logical consistency. The result is the conversion of uninterpreted 'analytic' systems into interpreted or 'synthetic' systems."
- (iii) Making Decisions: "It seems that the crucial aspect of a decision to solve a problem is that the decision-maker arrive at an appropriate compromise among the relevant concepts of goodness and badness per se in view of positivistic concepts of what has been, what is, what will be, if various actions are decided upon and carried out. The decision-maker following some decision-making process within some decision-making structure and following some basis for choice (such as the minimax, maximize average expected net return, 'satisficing,' etc.), decides upon the best action to be taken."
- (iv) Execution: "Decisions are not really final until steps are taken to place them into effect." The distinction between execution of decisions and the previous three functions is somewhat analogous to the military distinction between tactical and strategic decisions. A number of tactical maneuvers must occur to implement a strategy.
- (v) Bearing Responsibility: As the responsibilities which the decision-maker bears affect the specifications for his choice, the responsibility-bearing function is an essential part of the managerial process.

Recent thinking has expanded this list to six functions by including "problem definition". This logically precedes the other five functions in any problem situation. It can be

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noted that, like the previous classification of human activities, this classification is somewhat contrived. It nevertheless appears to be a modestly useful structure upon which to rest this discussion.

It may be useful to categorize decision situations into two groups; those where the decision-maker believes he has perfect knowledge of the outcomes of the various possible alternatives, and those where the decision-maker recognizes some uncertainty with respect to some outcomes. In the first case, the decision-maker's observations and analysis have led him to his beliefs and now he must merely choose the alternative with the preferred outcome. He must utilize his concepts of "goodness" and "badness" - to paraphrase Johnson's terminology - to determine the preferred outcome. Given these concepts, his decision is always right for him,²⁰ unless his original beliefs about the various outcomes were false (i.e., unless his observations and analysis were in error) or he has applied these concepts incorrectly.

Decision situations in the second group are more complicated, and probably more common into the bargain. Here, the decision-maker is not certain what will happen as a result of some or all of the alternative actions open to him. His observations may be inconsistent with one another or, factors beyond his control may be set at levels unknown

²⁰ This assumes that the individual's concepts of goodness and badness reflect what is actually good and bad for him. It also assumes that he is the only one affected by any outcome and thus the effects of alternative actions on others do not complicate the analysis.

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to him when he has to decide. Thus, unless all possible outcomes of one alternative are preferred to all possible outcomes of all other alternatives, he can make a wrong decision. If he does so, he suffers a loss in welfare in that he is worse off than he would have been if he had known the eventual state of nature at the time of the decision and acted accordingly.

To adequately describe such decision situations, stochastic or probabilistic models are necessary. Indeed, fairly complicated models are required to describe many of the day-to-day decisions people make.²¹ Many of these are naive in that the alternative of delaying the decision is not considered to be relevant. Once such an alternative is introduced, the problem can only be analyzed with some sort of sequential decision-making model.²² This might incorporate searching for additional information or experimentation as new alternatives. Furthermore, in the previous discussion only a few possible criteria were mentioned. Actually, many criteria are possible. In addition, managers' concepts of goodness and badness may lead them to attach

²¹For a discussion of such models the interested reader might refer to Chapter 9 of John E. Freund, Mathematical Statistics, (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1962), or Abraham Wald, Statistical Decision Functions, (New York: John Wiley & Sons Inc., 1950), or Howard Raiffa and Robert Schlaifer, Applied Statistical Decision Theory, (Cambridge, Massachusetts: The M.I.T. Press, 1961).

²²An elementary discussion of sequential decision models can be found in Chapter 15 of A.M. Mood & F.A. Graybill, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Co., 1963).

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different values per unit to gains or losses depending on the size of these gains or losses.²³ In such cases, the relevant valuations of outcomes would not be given by net monetary values. Finally, there are undoubtedly a large number of problem situations that man faces which are repetitive and can be resolved by habit once an initial decision has been made. For example, most of us do not go through a complicated decision process in order to determine whether or not to go to work every day - although there are occasions on which we may. Generally, the decision to go to work or not is an automatic one based on the original decision to take the job. Only in the case of unusual circumstances (e.g., a broken leg) do we break the habit. Habits can be both useful and dangerous. They are useful in that they reduce decision-making costs but they are dangerous in that, by deliberately avoiding the decision-making process, we may overlook advantageous alternatives.

Managerial Changes Defined

Managerial (or cognitive) changes can be defined as changes in the managerial process. Thus, they include new observations, new observation-making skills, changes in analytical procedures, changes in values, and changes in beliefs about non-normative matters. Indeed, a change in the way any one of the six steps described earlier is

²³ Milton Friedman, Price Theory: A Provisional Text, (Chicago, Illinois: Aldine Publishing Co., 1962, pp. 68-73.)

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performed may be regarded as a managerial change. Although this definition of managerial change is far from precise, it is sufficient to enable us to note that there are many things which can be included in this general category. Perhaps the most controversial of these are changes in values.

Concepts of goodness and badness per se appear to be used explicitly or implicitly in all decisions. It is known that these vary from individual to individual and from society to society. It is also known that this variation is often a source of conflict among individuals and societies. For example, Brewster formulates the following general problem:

Why are people in economically backward societies so reluctant to abandon age-old techniques and latch onto the gadgets of progress, such as higher-yielding seeds, more productive animal breeds, contour farming, steel-beam ploughs, pesticides, chemical fertilizers, sanitary wells and the like? ²⁴

While Brewster appears to overlook the possibility that such techniques may not be profitable at the moment for many such farmers, he certainly appears to have a valid point. People in economically backward societies sometimes do seem reluctant to change even when the techniques appear to be profitable and the people themselves are clearly aware of their existence. Sociologists, anthropologists, economists,

²⁴ John M. Brewster, "Traditional Social Structure as Barriers to Change," in Agricultural Development and Economic Growth, edited by H.M. Southworth and Bruce F. Johnson, (Ithaca, New York: Cornell University Press, 1966).

and others have advanced various explanations for this. These include lack of technological creativity, lack of achievement motivation, a strong distaste for work, lack of an experimental frame of mind, the high subjective risk level associated with new techniques where the old ones provide a sure but low level of living, and the lack of recognition of needs or wants. There is undoubtedly some element of truth in all of these explanations. And, implicit in most of them is the theory that there are value differences between people in economically backward and economically advanced societies. Given this situation, the question arises as to whether extension workers can change values and, if they can, are they justified in doing so? (i.e., are they really improving managerial capabilities if they do?).

It appears that some concepts of goodness and badness are connected with man's basic drives such as hunger, sex, self-preservation, rest, diversion, and recognition in society.²⁵ Satisfaction of such drives are generally regarded as good per se although in circumstances where such drives are competitive, one or more may fall into disrepute relative to others. It appears that other concepts of goodness and badness have been developed from the group of concepts connected with man's basic drives. They appear to

²⁵This is not meant to be a complete or mutually-exclusive classification of basic drives.

be analogous to habits which originated from some previous decision on the part of the individual. For example, as bananas satisfy man's hunger, and are viewed by most individuals as tasty, they may conveniently be regarded as good in decision procedures directed at choosing the composition of the family food basket. Such derived concepts of goodness and badness may be wrong because of faulty reasoning. For example, if one eats bananas and becomes sick, he may conclude that the bananas made him sick (even though they did not) and therefore, bananas become regarded as bad per se. Such concepts may also be wrong because, over time, new considerations become relevant and, even though the original conclusion was correct, it no longer holds. For example, certain foods may be regarded as bad per se because at one time they spoiled very quickly and were a source of illness. However, such an oversimplification would no longer be valid if improved methods of preservation were available to prevent rapid spoilage. Instead, it would be necessary to retreat to more basic concepts of goodness and badness to determine whether or not it would be right or wrong to actually eat the food in question. It appears that many value differences among individuals and societies may be found in derived, rather than basic values and can be attributed to faulty reasoning and the failure to re-evaluate derived concepts of goodness and badness under changed circumstances. This being the case, it would appear that extension workers can and

should influence the derived values of rural people whenever these values are in error.

This conclusion appears to be in conflict with the assumption that the informed individual is the best judge of his own welfare, an assumption which has long been popular among economists.²⁶ However, if an individual is making decisions on the basis of derived value concepts which have been arrived at through reasoning from basic normative concepts, his derived concepts of goodness and badness may not reflect what is actually good or bad for him. The reasoning itself may be in error. Where such a situation exists, it is possible for someone else, given superior knowledge of reality and information about the individual's basic normative concepts, to be a better judge of the individual's welfare. Unfortunately, problems arise because of the difficulty in distinguishing between basic and derived values. Nevertheless, it appears that, given basic values, derived value concepts can be acquired and changed through logical reasoning. Where such reasoning has been in error it is possible to change such concepts for the better in the sense that when the faulty reasoning is corrected, the new derived concepts will better reflect the individual's basic value concepts. In this sense, there is no conflict with the assumption that an informed individual is the best

²⁶As the consumer's preference function is regarded as being determined by the consumer himself (see Ferguson, p. 14) and the consumer's welfare is generally regarded as being directly related to his achieved level of utility (see Ferguson, Chapter 16) the existence of this assumption (which is often implicit) is readily apparent.

judge of his own welfare as the individual may lack information on either normative or positive matters and hence err in his judgement.

Changes in Rural Consumption Units (Households)

The economic theory of consumer behaviour is well-known. It is assumed that each household attempts to maximize satisfaction or utility by allocating its money income among a known selection of goods and services. In addition the following assumptions are made:

- (a) Each consumer [household] has exact and full knowledge of all information relevant to his consumption decisions - knowledge of the goods and services available, and of their technical capacity to satisfy his wants, of market prices, and of his money income.
- (b) Each consumer [household] has a preference function that (i) establishes a rank ordering among all budgets; (ii) for pairwise comparisons, indicates that A is preferred to B, B preferred to A, or that they are indifferent; (iii) for three-or-more-way comparisons, indicates that if A is preferred to (indifferent) to B and B is preferred (indifferent) to C, A must be preferred (indifferent) to C; (iv) states that a greater budget is always preferred to a smaller one.²⁷

Under these assumptions utility (or satisfaction) is regarded as at least an ordinal function of the amounts of goods and services consumed. It can be expressed mathematically as:

$$(5) \quad U = h(x_1, \dots, x_n)$$

²⁷ Charles E. Ferguson, Microeconomic Theory (Homewood, Illinois: Richard D. Irwin, Inc., 1969), p. 14.

where U is a measure of utility and $x_1, \dots, x_n$ represent quantities of goods or services. (If one so desires it is possible to regard all sources of satisfaction as being included in the set of x_i , $i = 1, \dots, n$. However, the analysis of non-market and/or abstract goods and services in this framework is often not particularly enlightening.)²⁸ It can be readily shown that the consumer maximizes²⁹ satisfaction or utility subject to a fixed income if he (or she) selects goods and services so that:

$$(6) \quad \frac{\partial U}{\partial x_i} / \frac{\partial U}{\partial x_j} = P x_i / P x_j \quad i, j=1, \dots, n \quad j \neq i$$

and P denotes price.

Thus, for a fixed income and a given utility surface a consumer's satisfaction cannot be increased as long as condition (6) holds.

²⁸It will be noted that, because of its formulation, consumption theory, like the production theory described earlier, says nothing about the production of non-market goods and services, a function in which the typical household is usually heavily involved. Because of this fact, it is necessary to include these activities implicitly in this discussion. Thus, some of the technical changes in consumption defined later actually belong to this area and not to the classic consumption model per se.

²⁹Actually, the condition shown applies only to cardinal utility functions as ordinal functions do not possess derivatives. However, if g is ordinal it can be regarded as a set of cardinal functions which are monotonic transformations of one another. If these are denoted $h = \{h_k\}$ where $k = 1, \dots, m$ utility will be maximized if:

$$\frac{\partial h_k / \partial x_i}{\partial h_k / \partial x_j} = P x_i / P x_j \quad i, j=1, \dots, n \quad j \neq i$$

(of course, m need not be finite.)

Corresponding to the technical changes in production units discussed earlier it is also possible to distinguish technical changes in consumption units. One crucial difference is that outputs are not measured physically and output prices are not found in the market place. Instead, utility serves as the common denominator of man's values. Technical changes in consumption units can then be classified as follows:

- (a) changes in the amount of utility derived from a specific set of acquired goods and services because of a change in the way they are consumed.
- (b) price-induced changes in the relative amounts of different goods and services consumed.
- (c) changes in the amounts of different goods and services consumed due to random, uncontrollable influences on the household.
- (d) movements along indifference curves towards (or away from) optimal points in an effort to correct previous errors.
- (e) changes in the amounts of different goods and services consumed because of the introduction of new goods or services.

The first of the above technical changes is analogous to a change in the technical process of production described for production units. For example, if a housewife discovers a new way of preparing food which eliminates waste, she is incurring a change of this type.³⁰ A change of this nature enables her to get more utility out of a given income if it

³⁰ This is actually production of a non-market good but, within the framework used here, it is classified as improved consumption efficiency.

can be achieved with no additional expense. Such changes might be adopted by a person at any income level.

Price-induced changes and random, uncontrollable changes in consumption are not of major importance in this study. However, extension workers can probably provide a useful service by showing rural consumers how to adjust to price changes - this may require a movement to a previously-unknown part of the utility surface for some - and illustrating how to handle random influences on consumption (e.g., insurance against medical expenses).

Movements along indifference curves in an effort to correct previous errors can be expected where recent adoption or price changes have occurred and consumers have not yet managed to find the optimal point through experimentation. These mistakes could be expected to arise for complicated (difficult-to-understand) consumption goods. For example, it might require some time for a household to determine whether or not a new good was actually providing the expected satisfaction (e.g., vitamin pills might have to be taken for several weeks before their effects were noticed.)

It can be readily seen that most of the managerial changes discussed earlier apply directly to consumption activities. It is in the consumption unit or household that development of an appropriate set of derived values becomes crucial. In production of marketable commodities only a few of such values are necessary because profit reduces so many considerations to a single common denominator. In the

consumption unit every good and service which might be purchased has to be analyzed by the consumer in order for him to formulate his utility function. This problem becomes particularly complicated in a highly-developed economy where many consumer goods are available. It may be relatively simple in an economy where few goods and services are sold to consumers. However, in the latter case, mistakes may be much more costly to the individual because the very nature of such an economy dictates that most consumption is directed at satisfying basic physical wants. Thus, while changes in any part of the management process may produce significant changes in consumption efficiency, knowledge of the values of various consumption goods available and within the budget of the consumer appears to be of key importance.

Changes in Community Organizations

Although academicians have long been interested in the economics of collective human activity, there is no widely-accepted theory of choice in this area comparable to that which exists for either individual consumption or production activities. This is not surprising when one reflects upon the widely-varied forms of government which have developed throughout history as mankind has attempted to find a practical solution to this same problem. Actually, both consumption and production theory are extremely relevant to the economics of community action. Their main drawbacks lie in the difficulties of arriving at social welfare functions

and in creating functional markets for public goods. While it is widely-acknowledged that men banded together may often achieve their ends more efficiently than if they act as individuals, the problem of exactly when they do (or should) join together in common cause has confounded the best minds to tackle it.

One writer states the problem as follows:

When will a society composed of free and rational... individuals choose to undertake action collectively rather than privately? On what grounds can the individual decide that a particular activity belongs to the realm of social as opposed to private choices?³¹

Another describes the problem as:

What criteria can be employed to judge the optimal size and scope of the governmental sector?³²

As shall presently be seen it is those very characteristics of activities which causes them to be placed in the realm of public responsibility that also causes them to be difficult to evaluate. Thus, both these writers are essentially voicing the same question.

While at first glance the rather weighty issues in which this discussion has become involved may seem to be unrelated to the topic of this study, it must be noted that

³¹James Buchanan and G. Tulloch, The Calculus of Consent, Chapter 6.

³²John F. Due, Government Finance: Economics of the Public Sector, (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. 4.

public activities involve basically the same conceptual problems of choice whether they are local, regional, national, or international in nature. Agricultural extension is unlikely to influence public bodies in the latter two areas - although U.S. extension services have had "policy" programs on national issues. However, extension workers can and do influence local and regional bodies both directly and, indirectly, through the individuals (who through election or otherwise) control these bodies. Some noted writers in this area differentiate between agricultural extension and community development.³³ This is not of importance here. The important thing is that extension can and does influence changes beyond the individual farm or rural household. It is this influence on public decisions which is deserving of attention in this study. But, as no comprehensive theory is available to serve as a frame of reference, only a few isolated points regarding the nature of changes in this area can be made.

Firstly, it can be noted that, in the absence of externalities, markets which serve to equate private marginal costs and marginal revenues could eliminate the necessity of public activities. Of course, externalities do exist and market imperfections, much more complicated than the textbook cases of monopoly and oligopoly, do inhabit the real world.

³³ Arthur T. Mosher, Varieties of Extension Education and Community Development, Comparative Extension Publication No. 2 (Ithaca, New York: New York State Agricultural College at Cornell University, 1958).

Market rules must be established. Non-market goods demand much more of our attention and income distributions can never likely be fixed to people's satisfaction. As man's environment changes it would seem that there would be ample opportunity for new, justifiable public activities to arise and old ones to disappear. Such changes could be influenced advantageously by extension workers. For example, if new technology made irrigation economically feasible in an area, extension workers might point out the need for legislation to ration water so that disputes might be avoided. They might even work with local people to get an acceptable set of by-laws drawn up and passed.

Secondly, it must be pointed out that many community activities just will not function on a voluntary basis. One of the problems here is what is known as the "free rider" effect. If an individual stands to benefit from a program (such as fire protection) whether he contributes or not, he will have no incentive to contribute. Other problems - such as individuals refusing to give up their property at market prices for public purposes - also arise. In any event, some means of making non-Pareto decisions is almost essential for any significant amount of public activity to occur. Changing circumstances may mean that changes in the nature of these decisions is appropriate. Again, agricultural extension may perform a useful function by pointing this out to farmers and assisting them in

resolving specific problems. The fact that extension agencies have representatives in many communities may mean that they may be in a position to pass the lessons learned in one area on to many others.

Although the distinction is not as clear as with production units, it is possible to classify the activities of community organizations into both production and management. That is, associated with all public action projects there are both "decision-to-act" and "action" functions. The management process here is indeed a complex one because not only must a decision be reached by many individuals, a community decision rule must also be decided upon. Majority rule, concensus, dictatorship and others are all possible alternatives, none of which have any absolute claim to being correct. And, even when public decisions are reached, the administration of public projects is complicated by the nature of the responsibility-bearing function.

Given all the problems that exist in the area of public action,³⁴ it is not surprising to find that a

³⁴An excellent practical example of the public decision-making process at the local level in Colombia was the Co-operative Electrification Project in the municipalities of Sevilla and Caicedonia in the Cauca Valley. This has been well documented by James Ross in his Ph.D. dissertation entitled "Implications of Co-operative Rural Electrification for Economic and Social Development in the Department of Valle, Colombia, South America" completed in the Department of Agricultural Economics, University of Illinois, 1965. His study illustrates some of the difficulties encountered in making non-Pareto better decisions, the importance of environmental factors in determining the success of public projects, the necessity of public action in such an instance, the interrelationships among innovations, and many other of the phenomena discussed here.

tremendous potential exists for useful extension work. However, as will be seen later, the fact that possibilities for useful work exist does not mean this work can be carried out economically or that it will even be recognized as useful. The talents required to do this work and the costs of doing it may differ substantially from work done with agricultural production units or rural households.

Secondary Extension Functions

Although the principal function of extension agencies is that of a change agent, such agencies usually perform other functions which are, in general, complementary to the change agent function and are often regarded as essential features of extension work. These other functions produce what will be referred to here, for convenience sake, as "secondary outputs." As noted earlier in this chapter, these include (a) influencing technology developers or information sources outside of rural society, (b) influencing institutional activities which have a bearing on, but are not part of, rural society's activities, (c) providing vocational education for rural youth or new farmers in practices already adopted in their areas, and (d) assisting in the adjustment of rural people to occupations other than farming.³⁵

³⁵Other secondary extension functions are also possible although these four seem to be the main ones. The others will be briefly mentioned in the sections on aggregation problems in Chapter IV because they appear to come under the heading of externalities.

The fact that agricultural extension can exert a useful influence on technology developers and information sources is widely-acknowledged. Most extension agencies usually attempt to develop a close working relationship with experiment stations and other information sources. This permits them to obtain the most recent research results as soon as they are available. The flow of information which develops from these contacts is usually not a one-way affair. Research agencies often learn useful things from extension workers and, as a result, research can become more problem-oriented and more relevant to the potential users.

In addition to influencing technology developers and information sources, agricultural extension services can influence other institutions as well. They appear to have influenced university curriculum significantly in the United States. Agricultural policy-makers often find them a useful source of information about the current farm situation. Credit and marketing agencies may find that extension personnel are useful sources of information for planning purposes. Regional development agencies and regional governments may use information gleaned from interaction with extension workers. This function of agricultural extension contributes indirectly to both of the general extension goals cited earlier and perhaps some others as well.

Agricultural extension can function as a training agency to bring young people and farmers new to an area up

to the technological and managerial levels already achieved by existing decision-makers. This is cited as a different function from introducing changes to rural society because it does not involve introducing changes to existing units - it involves facilitating the natural replacement of the decision-makers of these units. Agricultural extension has undoubtedly performed this function in North America. Farm young people in both the United States and Canada have often learned things in 4-H Clubs which their fathers and mothers already knew. Indeed, local farmers and farm wives are often used as 4-H Club leaders and, in these positions, they often rely heavily on practical experience. (This sort of extension activity might be classified as either "influence on a community organization" or a performance of a "secondary extension function.")

The function of assisting rural people to evaluate jobs outside of the agricultural sector is particularly relevant when the agricultural sector becomes of declining proportionate importance in society's economic structure. This phenomenon is almost always associated with economic progress. Agricultural extension, by improving the managerial ability and technical skills of rural young people - and perhaps some of the older folk as well - may significantly improve their ability to take up new positions outside of agriculture, although not necessarily outside of the local area. Perhaps the most important contributions in this area

have been made by 4-H leadership programs and farm management projects. However, it should be noted that extension workers sometimes emphasize the advantages of agriculture so heavily that they overlook the fact that benefits may be realized by assisting some people to transfer to other endeavours. Thus, this function of agricultural extension may not be acknowledged by extension agencies even when it is actually being performed (either consciously or otherwise).

As the benefits associated with these four functions are quite difficult to analyze and the two agencies studied in this research project were not heavily involved in these activities, relatively little consideration will be given to them throughout this study. However, they have been identified because they can, under certain conditions, be rather useful functions and thus they do represent possible avenues for useful extension work in both developed and developing countries.

CHAPTER III

THE PROCESS WHEREBY EXTENSION "OUTPUTS" ARE ACHIEVED

Now that the "outputs" of agricultural work have been defined, it is necessary to examine the process whereby these "outputs" are produced. This will then permit relating specific sets of extension activities to their associated "outputs", a step which is essential if an operational method for measuring extension efficiency is to be devised. Included in this discussion is a general description of those factors other than extension activities themselves which influence the results of extension programs. Recognition of these will permit later analysis of some of the managerial problems facing extension agencies and an understanding of environmental limitations on extension effectiveness.

As agricultural extension work produces "outputs" in only a very general sense, it is not useful to apply the standard economic model of production to the analysis of extension work. In order to formulate a conceptual model which may offer operational possibilities for analyzing extension activities, it is necessary to turn to a more general and comprehensive technique. The technique chosen for this purpose is systems analysis.

The Systems Approach

Systems analysis has recently become a popular phrase in North America although its meaning is far from precise. To persons working in engineering and the physical sciences, it refers to a group of mathematical techniques which have been developed for coping with the quantitative models that are necessary for designing and controlling some of the complicated real-world phenomena now being dealt with in these disciplines. A more general interpretation of systems analysis is used by persons working in government and business. To them systems analysis is usually regarded as a comprehensive approach to problem-solving wherein all significant relevant factors are considered in choosing among a group of proposed actions. These two interpretations of the technique are, of course, related. The latter can (and sometimes does) become reduced to a mathematical model if sufficient information is available to write the necessary equations. It is this latter interpretation of the systems approach which applies here because the phenomenon being studied is not sufficiently well-understood to permit modelling it mathematically.

The typical systems model is often portrayed graphically in the manner shown in Figure 1. Essential characteristics are input, output, environment, and the endogenous components of the system itself. Inputs are those controllable factors which influence the system (and hence the system

output) but are generally not influenced by the system. Where the system influences the inputs, either through system output or through some intermediate variables, this phenomenon is known as feedback and requires special analytical techniques. Environment is also independent of the system but can affect output; it is distinguished from input because it is exogenous and not controllable. In Figure 1 a dotted line shows the influence the system can exert on its environment. For analytical purposes it is

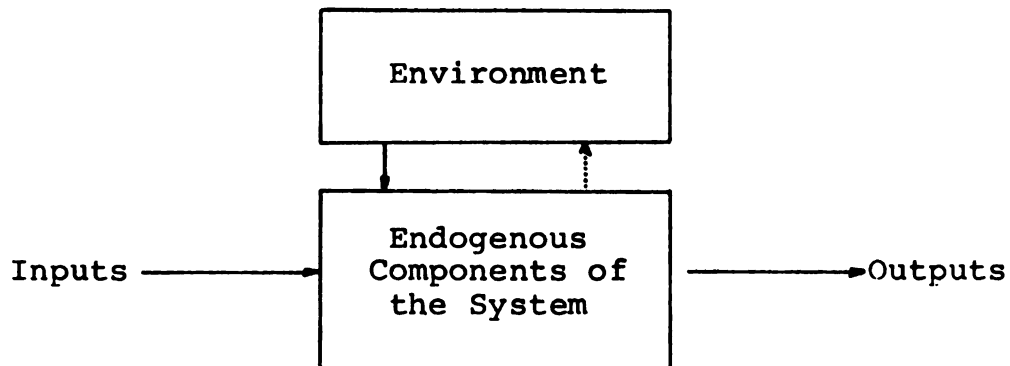


Figure 1.--A graphical illustration of a system model.

desirable to define the boundaries of the system model so that this particular feedback relationship is weak or non-existent. Outputs are the relevant products or results of the system. They need not be desirable entities but usually many of them are. For example, one of the by-products of many production systems is waste material which has to be disposed of at a cost. The endogenous components of any system are those internal relationships which exist between input, output, and environmental factors. In a mathematical

formulation they appear as equations. Variables whose values are determined simultaneously within the system are referred to as endogenous variables. Typically, output variables will be endogenous while input and environmental variables will be exogenous. However, systems often include several intermediate endogenous variables which are not of interest as final outputs.

In order to approach agricultural extension in a systems framework, it is necessary to regard certain aspects of extension work as components of the general system model. All extension activities will therefore be regarded as system inputs. The nature of these will be discussed in the next section. The "outputs" of the system were defined in Chapter II. These now have to be described in a way in which they can be associated with a particular set of extension activities (inputs) applied to the system. Environment can be divided into several component parts for easier analysis. These will be discussed in detail later in the chapter. Endogenous components of the extension system model would describe how extension activity influences extension outputs under given environmental conditions.

Extension Activities as System Inputs

Extension agencies are not unlike the three types of decision-making units discussed in Chapter II in that their activities can be divided into two groups, technical and managerial. The former group may be usefully referred to as

"program operation" activities for they include the actual performance of functions which directly influence the decision-making units in rural society. It is the managerial activities which determine the nature of the program operation activities. This relationship is shown in Figure 2.

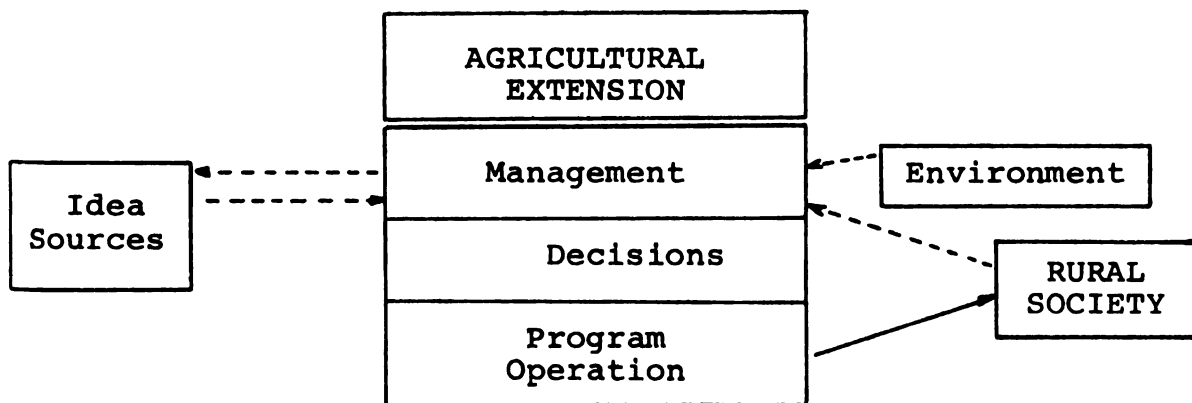


Figure 2.--The extension agency component of an extension system model.

Extension Management

Extension management activities involve:

- (a) detecting problem areas in local communities.
- (b) assimilating information on
 - (i) new ideas which might be useful to members of rural society,¹
 - (ii) performance of current and past programs, and
 - (iii) new and existing extension methods.
- (c) analyzing and interpreting this information as it applies to local conditions, then using it to plan (design) extension programs.

¹The sources of these ideas include agricultural experiment stations, farms, private companies, foreign agencies, etc.

- (d) evaluating program proposals and selecting promising ones.
- (e) administering the selected program proposals (this includes the tactical or day-to-day decisions necessary for administration).
- (f) accepting responsibility for the program results.

While changes in rural society are produced only through "program operation" activities, some secondary extension outputs arise as by-products of extension managerial activities. Three of the dotted lines in Figure 2 indicate the messages or observations which influence extension managers. The feedback effect from extension to idea sources is shown by a dotted line in the opposite direction to that which illustrates extension observations.

Because of the nature of extension work it is impossible for public representatives to give extension workers complete mandates.² Extension agencies often have a wide range of programs which they can operate as well as a variety of ways in which each of these programs can be carried out. In order to make intelligent choices among these alternatives, they must devote a good deal of time and effort to planning and selecting programs. Because of the limited understanding of social relationships this general problem is usually reduced to one of designing a promising, feasible set of discrete alternatives. Furthermore, it is

²The fact that extension decision-making is not vested in a single person or even at a specific level in the public decision-making chain makes the responsibility-bearing component of management difficult to achieve.

usually not desirable (because of the time and costs involved) for an organization to evaluate a very large number of programs. In doing this, it is usually necessary to use estimates of costs and/or benefits which have sizeable possible errors and may therefore lead to incorrect choices. It is also possible that highly effective programs may be overlooked. In an effort to keep managerial costs low and avoid overlooking highly effective programs, program planning often is left to field personnel who are familiar with the needs of rural society and the environment in which they and rural people must work.

Extension Program Operation

Extension program operation may be usefully discussed under the headings of extension personnel, extension methods, and supporting services. The analysis of extension personnel is complicated by the fact that, as mentioned earlier, the same people who plan and choose programs often operate these programs in the field.

Perhaps the two most significant characteristics of extension personnel for program operation purposes are communications ability and technical competence.³ How one measures either of these characteristics is not immediately

³This assumes that extension workers are promoting changes which are advantageous to their clients. The discussion of Chapter II and III indicates that, the determination of net advantage is not a simple matter and may require talents different from those embodied in communications ability and technical competence. This, however, is a managerial function - not a program operation function.

evident. Neither is it obvious as to how one acquires them. To be sure, formal training programs help and most extension agencies rely heavily on these both before and after employment begins. However, experience can also produce similar results. One of the interesting features of North American and European extension work has been the employment of well-trained extension personnel with backgrounds quite similar to those of extension clients. Thus, it is not clear to what extent their effectiveness has been determined by their advanced training or by their intuitive knowledge gained outside of their formal training program. Nevertheless, one would expect that different sorts of capabilities of extension personnel would be appropriate for different characteristics of program participants (e.g., age, education, values, etc.) and different types of programs.⁴ One alternative that is often open to extension agencies which are trying to get the most out of a fixed budget is to hire personnel with lower qualifications and thus minimize costs per day of extension work. This can be done as long as the personnel with lower qualifications produce the same results. However, one would not expect this to be the case in general and some assessment of the extra productivity balanced

⁴For some changes in rural society, the requirements of extension personnel may be well-established; for others this may not be the case. For example, teaching farmers how to cultivate new varieties of rice is a very specific task with particular, established requirements. Getting farmers to improve their managerial process is not. Little is really known about the managerial process let alone about how to change it effectively.

against the added cost must be made.

A variety of extension methods are available. These include group meetings and discussions, tours, individual farm visits, result demonstrations, method demonstrations, movies, radio and television programs, pamphlets, contests, and others. To date no large body of information on the specific effects of these variables under specific conditions is available although many isolated studies have been carried out in this area. Unfortunately, a review of these would lead one to believe that the appropriate method to use depends on the audience to be reached, the message to be carried, and some environmental conditions as well. Thus, extension workers will often have to choose not only the message but the communication vehicle as well.

Supporting services for extension programs include such items as transportation, materials and supplies, communications, subject matter specialists, and so on. These are often highly complementary to personnel time and specific extension methods. Thus, some programs may be infeasible without them.

Representation of Extension Outputs

Changes in Groups of Similar Decision-Making Units

Extension programs are typically directed at groups of similar decision-making units on the assumption that if a change is appropriate for one unit, it should be appropriate for others which are similar in nature. Thus, it would

be convenient to have some device for representing the effect of an extension program on a group of such units.⁵ For some changes in rural society recent research in the area of the adoption of innovations provides at least a partial answer.

This answer applies to those changes which spread through a given social system or geographical area over time and permit construction of a time distribution of adopters.⁶ For any given social system⁷ it has been shown on numerous occasions that the number of adopters plotted against time produces a bell-shaped curve which often approximates a normal density function.⁸ On the basis of this observation, Rogers⁹ has classified adopters as innovators, early adopters, early majority, late majority and laggards as is shown in Figure 3.

⁵The reasons for this will be more clearly seen in Chapter IV when aggregation problems are discussed.

⁶In some areas extension work may concentrate heavily on changes which cannot be usefully represented by adoption distributions. Movements towards economic optima which differ from farm to farm or from year to year on the same farm are examples.

⁷A social system is defined by Rogers as a "population of individuals who are functionally differentiated and engaged in collective problem-solving behaviour". However, this definition is neither precise nor widely-accepted.

⁸Gwyn E. Jones, "The Adoption and Diffusion of Agricultural Practices," World Agricultural Economics and Rural Sociology Abstracts, Vol. 9, No. 3, September 1967.

⁹E. Rogers, Diffusion of Innovations. (New York: The Free Press of Glencoe, 1962), p. 162.

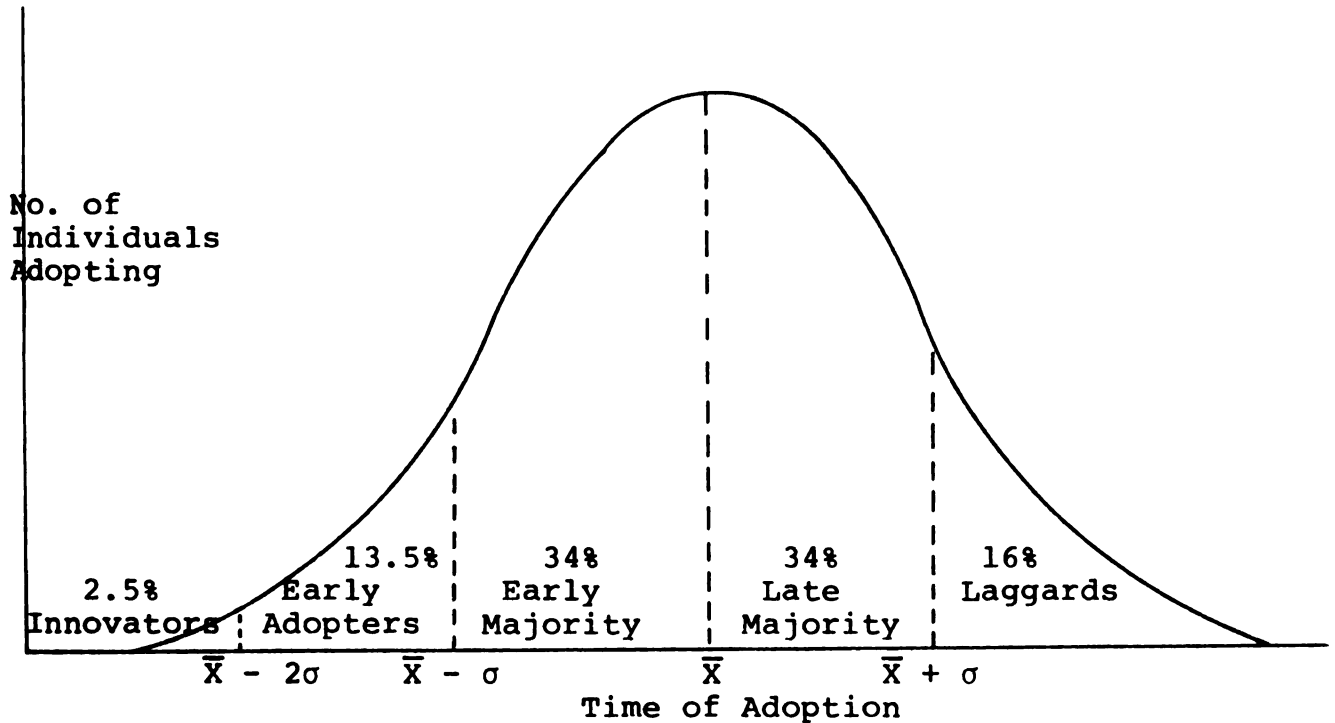


Figure 3.--Classification of adopters on the basis of a normal density function.

It is, of course, an easy task to convert the normal density function of Figure 3 into a normal distribution function.¹⁰ Having done this, one can readily see that the likely effect of successful extension work would be to shift such a distribution upwards and to the left — from $A_o(t)$ to $A_E(t)$ — as is shown in Figure 4. Of course, in practice it will only be possible to observe one of these distributions in any given situation, and, as a result, the

¹⁰As a normal distribution can be completely specified if its mean and variance are known, it would be quite legitimate to regard extension work as changing the mean adoption time and perhaps its variance as well, if the normality assumption holds.

detection of the precise effect of extension work is not an easy task.

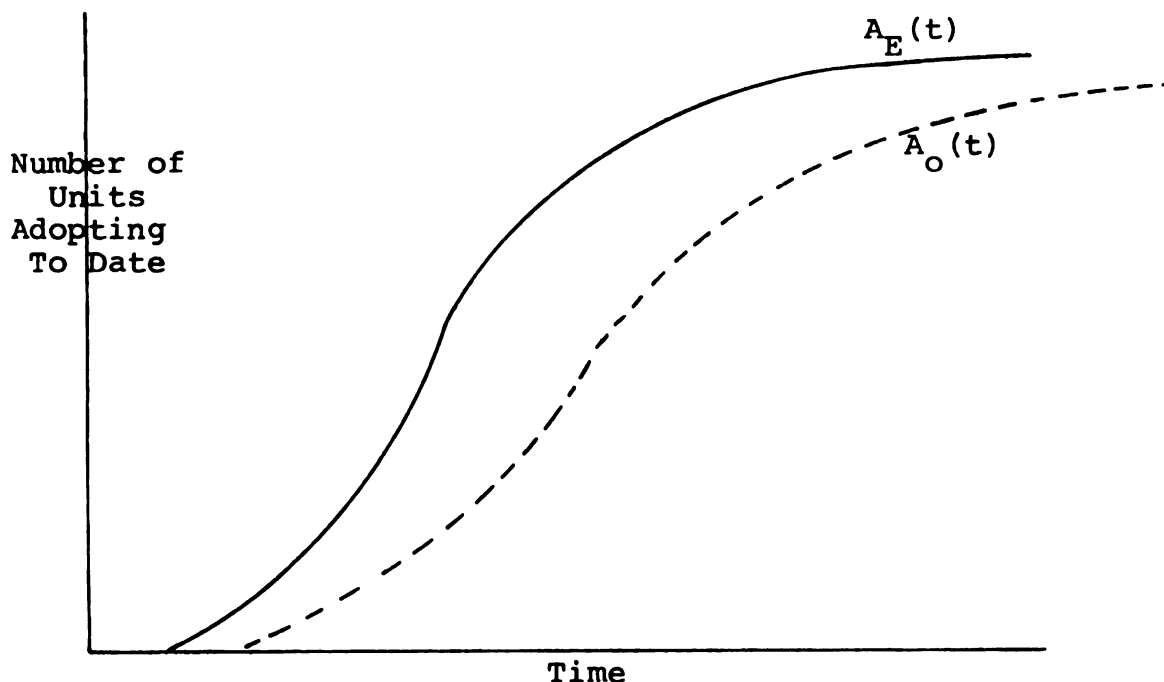


Figure 4.--Illustration of the influence of extension efforts on the adoption of a hypothetical innovation.

It is important to note that there are four characteristics of the adoption distribution which extension may influence.

These include:

- (1) starting date
- (2) average rate of adoption
- (3) shape of the distribution
- (4) total number eventually adopting¹¹

¹¹The normal distribution has one flaw in terms of its ability to approximate observed adoptions over time. Observed adoptions begin and end - the normal curve does not. Thus, a truncated normal distribution would perhaps be a better model. The "number eventually adopting" should be interpreted as if a truncated normal model were used. Thus, the two curves in Figure 4 do not necessarily approach the same upper bound.

A priori, many possibilities exist regarding the nature of the differences between $A_O(t)$ and $A_E(t)$. Shape, starting date, average adoption rate, and total number of units eventually adopting could each be affected in several different ways. The net effect of extension influence could be, for example, to increase starting date and lower average adoption rate while leaving shape and total number adopting about the same. This might be expected to occur where innovators are in a position to change long before they would hear about the idea if only non-extension sources were available, but late majority and laggards cannot be speeded up because the group of factors which would have held them back without extension influence also holds them back at the time extension effort is applied. On the other hand, it may be possible to speed up both starting date and average adoption rate by an extension program. $A_E(t)$ may also involve a larger total number of units adopting a given change. This could be expected to happen where extension introduced a change to an area much sooner than it would have happened without extension and the environmental characteristics of the area are so much different then than they would have been later that the change will spread to many more units than otherwise.

If extension effort does change an adoption distribution, benefits per decision-making unit may be different in the extension-influenced distribution than in the alternative

distribution. In fact, extension may be able to produce benefits even if it does not change the adoption distribution at all by simply making sure that changes are made correctly - not just adopted. This would appear likely to happen where an innovation is quickly adopted but requires considerable time to be incorporated in the technical operation of the adopting units at optimal level.

It can also be noted that any one extension program may affect more than one adoption distribution. This would likely be the case where interactions are present in adopting units which make a composite change more advantageous than the sum of the several component changes made separately.

Other Extension "Outputs"

Although adoption distribution curves provide an intuitively-appealing method of representing the net influence of extension of specific changes in a given geographical area, it has already been noted that they may not be able to describe some sorts of changes which extension effort may inspire. If the changes made by individual decision-making units are unique to those units, adoption curves obviously do not exist. For example, an extension agent might aid a farmer in designing a new barn - a rather unique change which would not be applicable to any other farms (i.e., even if other farmers were building new barns, the appropriate constructions for them might all be

quite different). Extension workers can help farmers and rural housewives move closer to the optimal combinations of inputs or goods and services for their situation. Such results might possibly be described by adoption distribution curves but, to the author's knowledge, this has not been done.

Extension agencies can aid farmers in making decisions on rejecting innovations as well as adopting them. Where innovations which are not worthwhile are being promoted by private companies, farmers may find that extension advice is quite useful because it helps them avoid losses they would have incurred otherwise. Adoption distribution curves are not likely to be useful for describing this potential result of extension work.

Thus, for secondary extension "outputs", and for some changes in rural society as well, it appears to be necessary to examine all individual results or changes and evaluate these one by one on their own merits (based on the criteria outlined in Chapter III) to arrive at some measure of total extension benefits. This may well be a tedious and cumbersome task but where the adoption distribution technique cannot be employed, no other method is readily apparent.

Environmental Influences on Extension Work

The results of the application of a given set of extension activities to any particular rural society will depend rather vitally upon a number of environmental factors.

The factors of relevance will probably vary somewhat from one situation to the next. However, it is possible to distinguish four groups of environmental factors which appear to be significant in most cases. These are:

- (i) Physical Conditions
- (ii) Product and Input Markets
- (iii) Non-Extension Information Sources
- (iv) Institutional Framework

Physical Conditions

Physical resources include such factors as soils, climate, buildings, machinery, roads, telephone systems, electricity systems, and so on. Both natural and man-made physical resources play an important role in determining the usefulness of many changes to rural society and thus are an important set of environmental variables for the extension system model.¹² If physical resources are appropriately priced, their effects on the usefulness of new ideas can be analyzed in terms of profitability of proposed changes. (Of course, some obvious technical limitations and advantages can be detected without having to incorporate prices into the analysis.) Nevertheless, the price mechanism, when it works effectively, is an immense aid in reducing the complex set of physical environmental features affecting the utility of a new idea to a more convenient indicator of that utility.

Not only is the character of physical resources

¹²In some cases, physical conditions may be the object of change by means of an extension program (e.g., a conservation program). In such a case, those physical factors affected would be output variables rather than environmental variables.

important but also their variability among decision-making units may be critical. It may well be that, because of existing resource endowments, techniques which are profitable on some farms in an area are completely irrelevant for other farms producing the same products. This would lower the extent of applicability of a given change and reduce the potential pay-off of a given extension effort. It could also have important implications for income distributions. It is fairly evident that agricultural extension has been able to achieve little improvement in farming in some areas simply because natural physical resources were so poor relative to competing areas that few or no useful changes could be promoted. Apalachia in the U.S. and parts of the Maritimes in Canada are cases in point. As one writer notes, "the acceptance of improved farming practices is determined largely by economic considerations (advantages)"¹³ and these, in turn, are determined by physical resources and prices. Thus, it is evident that physical resources indirectly affect the relative advantage of farm people remaining in agriculture versus changing to some other occupation. Where physical conditions are severe, agricultural extension workers may find that assisting in the adjustment of rural people out of agriculture is the most beneficial function they can perform.

¹³E.A. Wilkening, Acceptance of Improved Farm Practices in Three Coastal Plain Counties, Technical Bulletin 98, North Carolina Agricultural Experiment Station, Chapel Hill, North Carolina, 1952, p. 5.

The effects of physical conditions can be significant in determining the net advantage of changes in all three types of rural decision-making units (i.e., farms, households, and community organizations), although they are perhaps most evident in the first and last of these. In some cases, community organizations may be able to overcome physical limitations which are not within the control of individual farmers. An example of this is the construction of drainage ditches which can serve as outlets for tile drainage on a number of farms in a given area.

Sometimes individual farms and households may have to change certain physical characteristics of their operations before other technical changes can occur (e.g., the advent of tractors and electricity opened up many possibilities for further technical changes). However, there are many physical conditions which are essentially uncontrollable (e.g., climate, soil). Whether physical conditions can or cannot be changed, they are certainly going to have an influence on input-output relationships in all three types of rural decision-making units and hence, as will be seen in Chapter IV, on benefit flows attributable to extension work.

In addition to influencing the actual net advantage of any particular technical change in rural society, past experiences with physical conditions may have influenced the beliefs of rural people to the extent that key managerial changes must occur before certain technical changes can be accepted. For example, if farmers believe that fertilizer burns plants because they have seen some plants wither under

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other chemical treatments, it is unlikely that they will believe extension agents who promote the use of fertilizer. The physical environment in which people live undoubtedly influences their beliefs about both normative and non-normative matters and it is with this managerial structure which extension agents must begin their work.

Another important way in which physical conditions can enter the extension system model is through their effect on the costs of doing extension work. The physical environment of an area may influence travel time per farmer, transportation costs, and/or the cost of applying other extension techniques such as mail circulars, radio, television, and so on. These effects can be so great as to completely eliminate the feasibility of using some extension techniques in some areas.

Product and Input Markets

The effect of market structure on extension efforts is sometimes overlooked by extension workers, particularly those not trained in economics. As societies become more developed, farmers in most communities find that their local price levels are determined as part of national or even international market adjustments. Thus, the profitability of any change in local agricultural production units, and perhaps local households and community organizations as well, is determined by influences beyond the boundaries of the local area. This has been particularly striking in

some less-developed countries where shifts have been made towards specialized cash crops for exports and away from diversified food crops for home use. Once the shift has been made, fixed assets and/or changes in technical knowledge may place the adopters in a situation of high risk. What may have looked like a big pay-off to extension effort can suddenly turn into a disaster under such conditions.

Price stability and market dependability become significant considerations as the shift to a market economy occurs. Farmers may be entering a high-risk operation if they commit themselves to technology which requires inputs whose future availability is questionable. Extension workers may find that changes in managerial structures or changes in community organizations must occur if such risks are to be adequately analyzed or coped with by rural people. On the other hand, they may find that changes in the market structure itself must occur before the risks to farmers are reduced sufficiently for them to make advocated technical changes.

Extension work with all three types of decision-making units is likely to be influenced by markets. Rural households are unlikely to adopt recommended sanitary practices if the inputs required to implement these are priced beyond their incomes or are not available locally. Community organizations may find similar barriers to change as they attempt to improve roads, schools, or other community

projects. Thus, market structures, and particularly prices of products and inputs are important determinants of potential benefit flows from extension efforts. Also, past observations of markets may have provided rural people with beliefs which must be overcome if these beliefs are barriers to change and are, in fact, no longer valid.

Non-Extension Information Sources

In almost any rural community there are a variety of non-extension information channels linking farm people to information sources outside the area. The number of these channels, the messages they carry, and the sources they tap will have an important bearing on the effectiveness of extension work. It appears as though they can both complement extension activities and substitute for them. Some of these channels exist because of deliberate attempts to create changes; others do not. Some may reach quite a different subset of the rural population than the subset reached by extension workers; some of them may reach essentially the same subset. The principal categories of non-extension information channels appear to be agribusiness firms and the mass media.

It is fairly obvious that, in technically-advanced societies a substantial substitution relationship exists between agricultural extension activities and the efforts of agribusiness. Farm input suppliers find it to their advantage to promote their products vigorously and they often

provide the farmer with useful (although perhaps one-sided) advice in so doing. (Even a fair amount of competition in this area does not necessarily ensure the release of all of the information a farmer might find useful.) Private farm management consultants are not uncommon and where they and agribusiness substitute as a link between farmers and information sources it would appear that the potential returns to extension effort are likely to be much lower than where they are non-existent. Accordingly, it would appear appropriate to curtail extension efforts somewhat when such substitutes arise.¹⁴

The mass media, which include newspapers, radio, periodicals, and television, often perform an educational function independent of extension work. Thus, even if extension agencies never utilize these channels of communication, their possible effects may be quite different depending on the nature of the messages which the mass media carry and who these messages reach. For example, if the mass media keep farmers informed of market conditions, the results of some extension efforts to influence production technology may be quite different than if farmers are in a high risk situation because of lack of market knowledge. Of course, extension agencies often utilize the mass media directly and, in such cases, the character of their messages together with the cost of producing these messages is likely

¹⁴ However, it is unlikely that non-extension information sources will invest enough in disseminating useful information, particularly in cases where diffusion occurs, as they cannot capture all of the benefits to be gained from such an activity.

to be different than if some other extension method were used. Where such non-extension information sources complement extension work, the pay-off to a given extension effort will likely be enhanced.

Institutional Framework

The institutional framework forms the third major set of environmental variables of relevance for the extension system model. The term "institutional framework" includes a wide variety of formal and informal organizations and customs which provide the set of rules and public facilities essential for the resolution of conflict when men pursue individual objectives in contact with one another.¹⁵ Perhaps the most widely-noted feature of the institutional framework in an agricultural development context is land tenure patterns. Although much research has been devoted to this topic, many of the effects of different types of land tenure on technical and managerial changes are not well understood. Of course, many other factors are included in the term "institutional framework". Credit arrangements, market institutions, social customs, legal facilities for

¹⁵Of course, some of these institutions may be within the control of the local community and may thus be modified by extension influence as suggested earlier. Similarly, extension can have a feedback effect on institutions outside of the local community. However, for most individual changes in farms, businesses and rural households, the institutional framework is rigid - changes in this framework are likely to occur only if it becomes evident that they are necessary to facilitate a significant number of changes in individual decision-making units.

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protection of the individual, the structure whereby community decisions are made, and others are of relevance. For example, the approval of local religious leaders in some areas, is absolutely essential for change agents to be accepted by the local community.

The ways in which the institutional framework can influence the extension system model are many and varied. Institutions may either thwart or facilitate changes in farm businesses and rural households. For example, credit institutions which provide rural people with adequate, dependable sources of low cost funds for making technical changes obviously have a much different effect than those which do not. Similarly, national institutions may have either a restrictive or encouraging affect on the activities of local community organizations. For example, national policies which do not allow local communities either the funds or the authority to build roads or schools will have a much different affect than those which do.

As much of the institutional framework of any society is a result of a variety of governmental activities, it is perhaps appropriate to regard agricultural extension as a component of a system of governmental activities which itself is part of the environment in which extension must work. As has already been noted, the benefits of individual changes are largely determined by physical conditions and prices but these in turn are influenced heavily by institutions. Roads, schools, market institutions, and

land tenure arrangements are cases in point. Thus, governments are faced with the difficult task of balancing and sequencing extension expenditures with those of other programs in order to ensure that the return to the total public budget is as high as possible. As noted at the outset of this discussion, this general problem is beyond the scope of this study. At this point, it is only possible to note that other governmental activities¹⁶ may create an environment where extension can be extremely productive - perhaps essential to the total success of the project. For example, government irrigation and drainage projects may change local physical conditions so greatly that a drastically different set of techniques are necessary for farmers to cope with these. Land tenure changes may do the same. Conversely, lack of changes in regressive tax structures, oppressive land ownership policies, restrictive trade practices, and various other institutional conditions may so limit the possibilities of useful extension work as to make the expenditure of extension funds a complete waste.

¹⁶It would, of course, be a mistake to assume that a favourable institutional framework can be provided without an adequate tax base. Some such services are useful as both consumption and intermediate production goods. In the latter case they will likely generate further incomes; in the former they will merely use up existing ones. Many of the services available in advanced societies today have only attained their current character because incomes have increased to the levels where these services could be afforded. The services did not always generate incomes to pay for themselves.

Idea Sources and Extension Activity

There are a variety of idea sources which extension workers may draw upon to define useful changes for promoting in rural society. These include basic agricultural research work in government and private industry both locally and, in some circumstances, in foreign countries; experiences of farmers in local and distant areas; and applied or practical experiences of extension personnel gained as they pursue their daily duties. There is often a significant lag between the time when discoveries are first made and the time when extension people start to promote them. The practices being promoted by extension services in most parts of the world today were largely developed by governmental and private research expenditures 5, 10, or even 20 or more years ago. Such a lag is often necessary to allow time for ideas to be evaluated and tested under field conditions. But it may also occur because extension agencies are not keeping informed of, or recognizing, worthwhile ideas.

On the other hand, extension work will become barren unless useful, relevant, new ideas are supplied to extension workers in a fashion which they can readily understand and interpret for the rural people in the communities they serve. There is little hope of extension workers achieving significant results unless they are promoting changes which are "practical and worthwhile given the existing system".¹⁷

¹⁷See footnote 24, Chapter I.

Because of the wide variability in physical conditions, prices, and institutions influencing rural societies, this means that research must often be designed to discover relationships that apply under very localized conditions. It also means that extension personnel can, as mentioned earlier, perform a useful function, by influencing research workers along these lines.

Thus, it is rather apparent that research and extension work are highly complementary in the efforts to bring about beneficial changes in rural society. This relationship probably applies to all those categories of decision-making units defined earlier although it is most commonly associated with farm firms. Thus, it is difficult to assess the benefits attributable to one or the other of these independently. Should one be lacking, and another present, rather high returns could be attributed to the provision of the missing link.

An Extension System Model

It seems obvious that, if extension workers are to induce and inspire changes in the activities of farm people, they (extension workers) must create changes in farm people themselves. These changes include improved knowledge of agricultural production techniques, home economics, farm management practices, and group activities; changes in attitudes towards new ideas and the usefulness of community action; and new, improved abilities or skills acquired through

practice or observation. Some of these changes are quickly translated into specific technical changes; others have a much slower utilization and perhaps apply to many technical changes. All such changes in farm people are created by out-of-school educational programs. As one writer points out:

The essence of American extension is that it is an out-of-school educational process:

- (1) working with rural people along those lines of their current interest and need which are closely related to gaining a livelihood, improving the physical level of living, and fostering community welfare;
- (2) utilizing particular teaching techniques;
- (3) conducting with the aid of certain supporting activities; and
- (4) carried on with a distinct spirit of co-operation and mutual respect.¹⁸

It appears to be the opinion of many informed individuals that this essence is applicable to extension programs throughout the world.

Of course, the mechanics of extension work usually must differ from country to country - or perhaps more appropriately, from area to area. As Mosher points out, "We could have a study of comparative extension education in the United States alone!"¹⁹ The needs and interests of rural people vary from area to area. Because of the variations in

¹⁸ Arthur T. Mosher, Varieties of Extension Education and Community Development, Comparative Extension Publication No. 2 (Ithaca, New York: New York State Agricultural College at Cornell University, 1958), p. 12.

¹⁹ Ibid., p. 10.

environmental conditions discussed earlier, the methods by which rural people gain their livelihood, the factors which contribute to an improved level of living or community welfare, the teaching techniques which are effective, the supporting activities which are useful, and the means by which co-operation and mutual respect are achieved may be vastly different in one area than they are in another.

In order to specify the set of endogenous relationships in an extension system model, one would have to amalgamate a great deal of knowledge, both conceptual and empirical, from many disciplines. This knowledge is not available at present and, even if it were, the task of assembling it in a useful form would be enormous. Thus, no attempt will be made to build such a model here. However, it may be enlightening to very briefly outline its general nature and discuss some of the probable building blocks in such a structure.

Figure 5 expands the rather naive model of Figure 2 by incorporating the main features of the preceding discussion. The solid directional lines indicate significant, direct influences whereas the dashed directional lines show observations and/or feedback effects. A translation of "rural people" into "decision-making units" is shown to illustrate both the diffusion and managerial processes. The dotted lines show where extension costs and benefits occur and emphasize how these must be compared in this study in order to evaluate extension activities.

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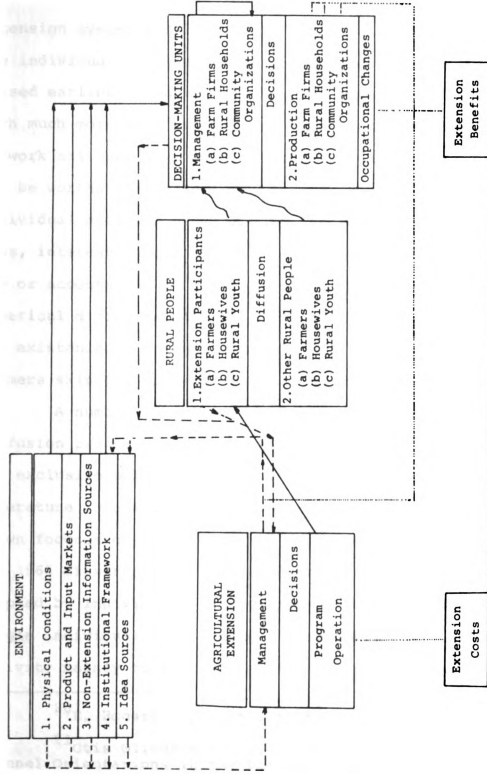


Figure 5.---A general view of an extension system model showing the relationship between extension costs and benefits.

One of the essential building blocks of the extension system model would be a realistic description of the individual adoption process. The management process discussed earlier includes this but, as management is concerned with much more than adoption, and as a considerable amount of work has been done with reference to the latter area, it may be worthwhile examining it. Rogers has described an individual adoption process which includes six stages: awareness, interest, evaluation, trial, adoption, and continued use or acceptance.²⁰ This has come to be known as the "Americal diffusion model",²¹ but not all research supports its existence in the usual form. Some findings note that farmers skip one or more stages, especially the trial stage.²²

A number of attempts have been made to model the diffusion process quantitatively. These do not appear to be the exclusive subject matter of any one discipline and the literature is numerous and diverse in nature. For example, Brown focuses on the efforts of geographers in this area in his 1966 dissertation. His concern is with innovations adopted by individuals or decision-making units acting as single individuals and, being a geographer, he limits his activity mainly to spatial considerations. However, he

²⁰E. Rogers, op. cit., p. 81.

²¹Otis Oliver-Padilla, "The Role of Values and Channel Orientations in the Diffusion and Adoption of New Ideas and Practices: A Puerto Rican Dairy Farmer's Study". Unpublished Ph.D. dissertation, Department of Communication, Michigan State University, 1964, p. 12.

²²Ibid.

points out that the "availability of the innovation to potential adopters may be quite invariant with the spatial pattern of the availability of information."²³ At times, knowledge of an idea precedes the facility to use it and inspires individuals to search out this facility; on other occasions the reverse is true. Brown pursues this idea and develops a model which, in essence, states that "the probability that a randomly selected resident of place i adopts the innovation in time $t+1$ equals the probability that adoption did not occur by that individual before time $t+1$, that he receives sufficient information about the innovation during time $t+1$, that this information is accepted because he is neither socially or economically resistant to adoption, and that during time $t+1$ he comes into contact with at least one distributor of the innovation."²⁴ It can be readily seen that extension workers can influence the probability that an individual receives sufficient information about an innovation but they may have little or no control over the other probabilities in the chain.

It has often been suggested that the nature of the change being promoted would be important in determining the success of a given extension program. Rogers²⁵ suggests

²³ Lawrence A. Brown, "Diffusion Dynamics: A Review of the Quantitative Theory of the Spatial Diffusion of Innovation," Unpublished Ph.D. dissertation, Northwestern University, Evanston, Illinois, 1966, p. 3.

²⁴ Ibid., p. 81.

²⁵ E. Rogers, op. cit., p. 124.

that relative advantage, compatibility, complexity, divisibility, and communicability are characteristics of innovations which appear to be important in determining adoption rates. Relative advantage is defined as "the degree to which an innovation is superior to ideas it supersedes".²⁶ Compatibility is "the degree to which an innovation is consistent with existing values and past experiences of the adopters".²⁷ Complexity "is the degree to which an innovation is relatively difficult to understand and use".²⁸ Divisibility is "the degree to which an innovation may be tried on a limited basis".²⁹ Communicability is "the degree to which the results of an innovation may be diffused to others".³⁰

Unfortunately, none of these factors are properties of the change per se. They all depend to some extent on other factors such as existing managerial structure, expected price levels, and existing income levels. Even divisibility is not entirely a property of the change by itself. Bulk milk tanks are cited by Rogers as being indivisible but, on a very large dairy farm (say, one having 5,000 cows) they would be no more indivisible than a new variety of corn on a very small farm (say, one acre).

²⁶Ibid., p. 125.

²⁷Ibid., p. 126.

²⁸Ibid., p. 130.

²⁹Ibid., p. 131.

³⁰Ibid., p. 132.

As examples of the many and complex endogenous relationships that may exist in an extension system, it may be useful to use two communication studies which were done in Colombia. Ramos³¹ took note of the fact that rural people may form preconceived images of the characteristics they feel extension agents should possess. (Such images might be formed on the basis of previous experiences with persons who are regarded as sources of information, or figures of authority in the community.) If the extension agent does not fit these preconceived images, his credibility, favourability and extent of contact in the local community may be lower than it would have been if he did fit them. Ramos' study suggests that, in Colombia, experience, age, and social distance³² appear to be important considerations influencing these factors. Thus, Colombian extension agents who do not possess these characteristics to the extent that rural people feel they should, will likely be less effective than those who do. In terms of the model used here, a change agent who is, a priori, less acceptable to rural people will likely have less effect on an adoption distribution than ones who are, a priori, more

³¹Eduardo Ramos, "Client-Change Agent Relationships in Three Colombian Villages", Unpublished M.A. thesis, Dept. of Communications, Michigan State University, 1966.

³²Social distance has been defined as the difference in sympathetic understanding that exists between persons, groups, or between a person and a group. It apparently is possible to obtain useful measures of this concept.

acceptable.³³ A study carried out by CIRA³⁴ in 1967 investigated the effectiveness of the press, radio, fliers, and loudspeakers in a diffusion campaign in the areas of Cundinamarca-Boyaca and Antioquia-Caldas. The results showed that loudspeakers alone or in combination with other techniques were the most effective means to get campesinos to take the action desired. How the cost of loudspeakers compared with other methods and how loudspeakers would work with other sorts of changes or in other areas of the country was not known.

The literature in the social sciences abounds with studies such as those already discussed. However, not only are there disagreements as to the nature of the relationships between key variables, there is much contention as to which variables are key ones and how they are to be measured. For example, Whittenbarger³⁵ developed and tested an "attitudes - towards - social - change" scale. He stated that such a scale "should be a valuable tool for change agencies as it would "enable agencies to be appreciably more efficient and

³³Of course, if agents who are regarded a priori by rural people as less acceptable are cheaper than ones who are regarded a priori as acceptable, this information by itself does not provide any basis for choice.

³⁴Centro Interamericano de Reforma Agraria Estudio Sobre la Eficacia de Divesos Medios de Comunicacion en La Realizacion de una Campaña de Divulgacion (Bogotá, Colombia: Instituto Interamericano de Ciencias Agrícolas OEA, 1967).

³⁵Robert Lee Whittenbarger, "Attitudes Toward Social Change in a Rural Colombian Community: An Attempt at Measurement", Unpublished Master of Arts thesis, Rural Sociology, University of Wisconsin, 1966.

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effective by permitting them to make a rapid and more meaningful selection of communities among which to allocate their all too scarce time, money, and effort ..."³⁶

As this exercise was carried out in Colombia it would have been convenient for this writer if his scale had been validated in the field. Unfortunately, it was not.

³⁶Ibid., p. 2.

CHAPTER IV

METHODS OF MEASURING EXTENSION "OUTPUTS"

In order to measure the efficiency of agricultural extension work it is necessary to measure those "outputs" of extension programs which were identified in Chapter II. As will be seen in Chapter V, choices among programs are much more readily made if all "outputs" can be reduced to a common denominator. It is particularly convenient if the common denominator is the same for "outputs" as it is for "inputs". Thus, this chapter discusses possible ways of measuring extension "outputs" in monetary terms. In order to attach monetary values to extension-inspired changes in groups of decision-making units in rural society, it is necessary to have (a) some way of valuing such changes for individual units, and (b) a method of aggregating these values for all units affected. Thus, the first topic of interest is the individual units themselves.

Measuring Changes in Individual Decision-Making Units

Technical Changes in Farm Firms

If the return to the owned resources of the entrepreneur in period t is given by $R(t)$, then the change in this

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quantity from one period to the next is given by:

$$(1) \quad \Delta R(t) = R(t) - R(t-1)$$

Now, if there are no external effects, no associated managerial changes of value, and the changes¹ in $x_j(t)$ and $y_i(t)$ which give rise to $\Delta R(t)$ are directly inspired by extension influence, then $\Delta R(t)$ can be regarded as a complete² monetary measure, for that production unit in period t , of the results of the extension effort which produced the changes in $x_j(t)$ and $y_i(t)$. However, several problems arise in trying to utilize this measure of the results of extension effort. These are:

- (1) Exactly what changes in $x_j(t)$ and $y_i(t)$ are attributable to extension effort?
- (2) How can $\Delta R(t)$ be used to calculate the total value for that production unit of the extension influence which resulted in $\Delta R(t)$?
- (3) How should managerial costs incurred by the decision-making unit be allowed for?

In answering the first question it is necessary to recall that several different types of changes in $x_j(t)$ and $y_i(t)$ are possible. Extension-influenced changes include only the adoption of some innovations and some controlled adjustments in input and/or output mix. They may be difficult to distinguish in practice from random changes in

¹The variables $x_j(t)$ and $y_i(t)$ were defined in Chapter II. The reader will recall that, given the usual interpretation of the production function defined there, it is possible to have changes in $y_i(t)$ without changes in $x_j(t)$.

²"Complete" means that no other results are of relevance.

$x_j(t)$ and $y_i(t)$ and controlled changes in these variables inspired by some other influence such as changes in price expectations or information provided by other change agents. Variations in $y_i(t)$ due to weather conditions are especially common in agriculture and, only in rare circumstances, will one find situations where price expectations are fixed and other change agents are entirely inactive. Thus, it seems appropriate to ask the question, "What happened because of extension effort that would not have happened otherwise?"³ This view is analogous to the marginality approach in production analyses. Other factors may have some influence on whether a given change is made or not and may actually act concurrently with extension. However, the value of the change attributable to extension is the difference between that which actually results and that which would have resulted if the extension effort was not present.

In order to resolve the second problem mentioned above it is necessary to refer to the expression for $R(t)$ established in Chapter II. From this, it is possible to see $\Delta R(t)$ is given by:

$$\begin{aligned}
 (2) \quad \Delta R(t) = & \left[\sum_{i=1}^n P_i(t) y_i(t) + \sum_{i=n+1}^{n+k} P_i(t) y_i(t) - \sum_{j=1}^m P_j(t) x_j(t) \right. \\
 & \left. - \sum_{j=m+1}^{m+h} P_j(t) x_j(t) \right] - \left[\sum_{i=1}^n P_i(t-1) y_i(t-1) \right. \\
 & \left. - \sum_{j=1}^m P_j(t-1) x_j(t-1) \right]
 \end{aligned}$$

³This is the micro equivalent of the "shift" in the adoption distribution described earlier.

where there are k new outputs and h new inputs in period t . If the levels and prices of $x_j(t)$ and $y_i(t)$ remain the same in future periods, a benefit flow results with the constant per period value being equivalent to $R(t)$. The length of this benefit stream will be the period between the time when the entrepreneur makes the change in question due to extension influence and when he would have made it without extension influence. This latter date is not readily observable in practice and presents a difficult estimation problem. (Whether this is any more difficult than estimating the useful economic life of something more physical in nature such as a hydro-electric project is a point of contention.) It would seem useful to try simultaneously to estimate this date and solve the problem of whether a given change is attributable to extension or not by asking "When would this change have been made without extension influence?"

These conclusions raise two further questions:

- (a) what is the appropriate length of the benefit stream if the change would never have been made at all without extension effort?
- (b) if the prices and levels of $x_j(t)$ and $y_i(t)$ vary over time, should the benefit stream incorporate these variations?

The entrepreneur will likely⁴ continue to retain his improved combination of $x_j(t)$ and $y_i(t)$ until (a) he retires from business, (b) other improved technical changes are discovered, or (c), price changes make it unprofitable for him

⁴Of course, if he does not correctly assess what has actually happened, he may discard a worthwhile technical innovation.

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to retain it. If price changes make it necessary for the entrepreneur to stop using the new techniques, the benefit flow stops. If other improved technical changes are discovered, their value must be based on further improvements in the combination of $x_j(t)$ and $y_i(t)$ and, therefore, the benefit flow in question does not end even if such changes are made.

The question of the length of the benefit flow for decision-making units which cease to exist is not as readily answered. As far as the entrepreneur is concerned, new techniques will produce benefit flows only as long as he is farming. (This may explain, to some extent, why older farmers tend to be less inclined⁵ to adopt new practices than younger ones - the present values of the changes are lower for them because of the shorter expected benefit flow period.) However, when the farm is transferred to another operator, he too may use the technique in question. If the new operator learns from the original operator (or in some other indirect fashion from the extension effort), the benefit flow continues. In essence, each technical innovation produces a permanent benefit flow⁶ even if it becomes obsolete (i.e., is supplemented by another innovation) providing it is passed on to future generations.

⁵Herbert F. Lionberger, Adoption of New Ideas and Practices, (Ames, Iowa: Iowa State University Press, 1960), pp. 96-97.

⁶The permanent benefit flow may take on a zero value at some future time. This would result from price changes - not from technical obsolescence.

Except for the cases where innovations produce shifts in supply or demand curves and thereby affect price,⁷ prices will be independent of the technical change itself. Therefore, the appropriate benefit stream should be calculated using the actual prices for each period. Price-induced variations in the levels of $x_j(t)$ and $y_i(t)$ should also be incorporated by using the actual values of these variables. Thus, price changes can easily make the benefits in future periods much different from that in which the change is made. Presumably, they will not likely make benefits negative as producers can be expected to discard the innovation if this situation arises. Of course, if the innovation involves the acquisition of capital assets, it may not be possible to realize sufficient funds from the sale of these to avoid a loss. However, producers may not initially⁸ adopt innovations at optimal levels. They may simply adopt and move towards optimum over time as they learn more about the innovation. Where this is the case the appropriate calculation of the benefits in any period would again have to be based on actual prices and quantities. As actual prices and quantities for individual units are likely

⁷These will be discussed later in the chapter.

⁸In fact, some innovations may not be profitable at all even though they are promoted by extension personnel and adopted by some farmers. In this case, $\Delta R(t)$ would be negative for adopters and zero for non-adopters.

Costly to obtain in practice, they may be usefully approximated by assuming optimization and using average prices or projected price trends. However, this practice is obviously inappropriate for valuing extension efforts directed at assisting farmers to move closer to optimal combinations.

If the costs of additional resources which were devoted to managerial activities by the farm manager in order to make the change are not already incorporated in $\Delta R(t)$ they should be added.⁹ These may include lost earnings when attending meetings, transportation expenditures, and so on. Unfortunately, it may be difficult to assess the managerial costs associated with any particular change. Also, changes in decision-making costs due to extension effort may be either positive or negative. It can be noted that even if no change occurs in the extent of decision-making activities of farmers as a result of extension influence, these activities will likely occur at a different time than they would have otherwise and this may well represent an added cost.

Technical Changes in Rural Households

The discussion of consumer theory in Chapter II implicitly suggested that, if there were no externalities,

⁹Presumably all production costs of making the change have been included. This would include physical changeover costs, special input acquisition costs, etc. These and added managerial costs might be "once-and-for-all" costs and, if such is the case, $\Delta R(t)$ would take on a different value in the adopting period than thereafter. The cost of replaceable capital items would be prorated over the useful life of assets according to standard accounting procedures.

the differences in utility attributable to technical changes in households would be appropriate measures of their worth. Thus, corresponding to the change in $R(t)$ defined in the last section, $\Delta U(t)$ can be defined as:

$$(3) \quad \Delta U(t) = U(t) - U(t-1)$$

However, as with agricultural production units, several problems arise in trying to employ this as a measure of the value of the extension effort which inspired the change.

These include:

- (a) determining what technical changes occur because of extension effort,
- (b) how does one handle costs of managerial activities and/or "once-and-for-all" technical activities associated with making the change?
- (c) who is to judge the household's welfare or utility level?
- (d) regardless of who judges welfare, how can it be measured?
- (e) how should changes in preferences over time be allowed for?
- (f) how does one use $\Delta U(t)$ to arrive at an estimate of the total value of the effort which inspired the change?

Problems (a), (b), and (f) are essentially the same as the ones encountered in valuing technical changes in production units and can be handled in essentially the same way. Costs of managerial activities and/or "once-and-for-all" technical activities of the decision-making unit in order to make the change are essentially capital costs which should be deducted from benefits (or added to extension



expenditures) in the period in which they occur. Problems (a) and (f) can be attacked simultaneously by asking, "When would this change have occurred if extension effort had not been applied?"

In the earlier discussion of consumer theory it was assumed that the informed individual is the best judge of his (or her) own welfare (i.e., the utility function for any consumption unit is given by the family's own preferences). This need not have been the case. The analysis could have been applied to anyone's construction of the household's utility function providing such a construction actually reflected appropriate values for that household. But what is appropriate? It has already been argued that an individual's derived value scheme may not represent what is best for him if he is not thoroughly familiar with and able to evaluate all possible effects of the goods and services available to him. Indeed, this appears to be the rationale behind the policy (which is generally-accepted in most societies) that children and mentally-ill people should not be allowed free choice in a variety of circumstances even when such choices have no external effects. Of course, the problem under discussion disappears if everyone concerned arrives at essentially the same utility index for a given household. However, in extension work conflicts can and often do arise between extension workers and their clients. And, where the clients are relatively uninformed about a

particular topic¹⁰ extension workers may, in fact, "know best". As some position has to be reached on this point here, the author accepts the assumption that the informed individual is the best judge of his own welfare providing he is well informed on both normative and positive matters. This position appears to be consistent with both the discussion of basic and desired values in Chapter II and the usual position taken by economic theorists.

The problem of measuring the utility or preferences of individuals is also a difficult one. Von Neumann and Morgenstern¹¹ have developed an operational utility theory and this has been applied by several other workers.¹² However, these applications typically involve measuring the utility of one or two items under risk conditions. They do

¹⁰In such cases it would seem that extension activities directed at managerial changes could eliminate such conflicts providing extension workers are both highly-informed about the topic and capable of effecting managerial changes. Nevertheless, where extension workers have difficulty convincing their clients of the value of some proposed change, they may be well-advised to re-examine their own analysis of it. This applies to households, production units, and community organizations. Apparently some extension workers make re-evaluation a common practice while others adopt more of a "missionary" philosophy which precludes such questioning of their own values. Another factor of relevance here is the cost of creating managerial changes to eliminate the conflicts. Where this is high the best strategy may be not to promote the change which is in conflict.

¹¹J. Von Neumann and O. Morgenstern, Theory of Games and Economic Behaviour, New York: John Wiley & Sons, 1964.

¹²See, for example, Albert N. Halter, "Measuring the Utility of Wealth Among Farm Managers", Unpublished Ph.D. thesis, Michigan State University, 1956.

not provide a basis for arriving at a utility function for all choices facing the consumer. Furthermore, they are not sufficiently well-developed to permit accurate measurements to be made at a low cost. Thus, trying to estimate complete individual preference surfaces is not feasible in this study. Nevertheless, the ranking of some alternatives may be enlightening and will be used.

The problem of allowing for changes in preferences over time is not independent of either of the two preceding problems. By now it is obvious that preferences can change as new information is acquired and/or new methods of evaluating old information are developed. But, if an individual changes his (or her) preferences from one period to the next, should the $\Delta U(t)$ be evaluated with the new preference function in period t and the old one in period $t-1$, or should some other method be used? Presumably the old preferences existed because the individual was uninformed and, if he had been informed, he would have actually had the new preference function in period $t-1$. This being the case, the new preference function would, according to the reasoning on the problem of who judges the individual's welfare, be the appropriate one to use in both cases. This position will be adopted here although there are some rather deep philosophical issues associated with this problem which have been entirely ignored.

Because of these difficulties it is not feasible to

use utility theory directly to measure the value of technical changes in rural households. However, it can be used indirectly in many ways. The fact that any worthwhile technical change occurring in a rural household can be regarded as an increase in utility from a given income is particularly useful in making evaluations of changes. When income is fixed, increased expenditure on some goods or services necessarily implies decreased expenditure on others. Thus, any reduction in the cost of producing a given amount of utility by making more efficient use of some goods frees funds for other uses and this freed expenditure can be used as a measure of the value of the change. For example, if a new cooking technique produces less waste and, as a result, food expenditures can be reduced by 10 per cent while the family remains equally well-fed, the cost reduction could be regarded as a measure of the value of the change. Similarly, if a housekeeper becomes able to provide a service that is available in the market place, the market price of this service less the costs of producing it would be an appropriate measure of its value. This would apply whether the family had previously purchased the service or not as long as it is now produced at home. Programs directed at instructing housekeepers to diagnose minor illnesses can be valued in this way.

Nutrition and health programs, which will be discussed later, are examples of extension activities which are

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often designed to produce a higher utility at an equal or higher cost. Where higher costs are incurred, some other expenditure must be reduced and the loss in utility from these must be less than the gain from the goods acquired through the increased expenditure if the net gain is to be positive. In both these sorts of programs there often exist objective criteria for the increased welfare due to adoption. Nutritionists and medical scientists know a good deal about the loss in physical well-being which results from poorly-balanced diets and poor health practices. However, there is no easy way to balance the loss in utility which will result if purchases of other goods must be reduced in order to improve diets and hygiene.

Because of these difficulties it may be useful to adopt a few rules-of-thumb for evaluating changes in rural households. These are:

- (1) Assume that the value of ideas rejected by rural households when they are well-understood is zero less the costs of learning about the ideas.
- (2) The value of technical changes which involve no additional expense on the part of the household may be usefully assessed on the basis of empirical evidence of their affects on physical well-being.
- (3) Established scientific evidence may indicate the potential benefits of better nutrition and like improvements but it should not be assumed that this necessarily makes these changes worthwhile when the recommended practices do require added expenditures.
- (4) In communities where income or prices are changing extension effort has greater opportunity



to perform valuable services for rural households than where they are constant, other things being equal and income distribution considerations being neglected.

Changes in Community Organizations

Most of the problems associated with valuing changes in the operations of rural households are also associated with valuing changes in community organizations. In addition, the problem of getting some sort of community preference function arises. (This was ignored in the case of households because, even though a household is made up of several individuals, it usually exhibits some obvious preference pattern either through authority or consensus.) Thus, it is necessary to acknowledge that the possibility of applying any formal structure similar to that used in the case of the farm firm is remote, and a less direct means must be devised.

If a community organization produced a particular bundle of services which either could be acquired by other means or actually saves members of the community time, effort, or some monetary outlay, these related benchmarks can be used as prices. Then, it is simply a matter of aggregating returns and deducting costs to get an estimate of net benefit flows. To the extent that the community activity in question can be regarded as a result of extension effort these net benefits would be a measure of the value of this effort. Again one would ask the question,

"When would this change have occurred in the absence of extension influence?"

However, as noted earlier, the effects of extension efforts directed at establishing or assisting community organizations may not be readily detected. Most of it may be related to facilitating the collective decision process and may not directly influence any specific technical change. While the possibilities for worthwhile work in this area may be quite great, little is known about how to do it let alone how to determine what changes are inspired by specific efforts.

Managerial Changes

As managerial changes may often be significant consequences of extension work, it is necessary to attach some value to them if one is to reduce all of the outputs attributable to specific sets of extension activities to the chosen common denominator. In terms of the framework of analysis used in this study it seems that managerial changes, whatever their nature, can only be valuable if they eventually influence, either directly or indirectly, technical changes in farm units, rural households, or rural community organizations.¹³ This obtains because returns

¹³For the sake of completeness two other possibilities should also be mentioned. First, it may be that extension program participants get some measure of satisfaction (increase in welfare) out of participating in extension programs or out of simply possessing new knowledge. Such a phenomenon might be regarded as a result of managerial changes but, perhaps more appropriately, it could be described

to owned resources in farm firms (and utility in households) can only be increased by changing the levels of the inputs (or goods) used¹⁴ and the ways in which these are employed. Direct influence can be said to arise if, as a result of a specific managerial change, different decisions about technical matters are reached than would have been otherwise. Indirect influence can be said to arise if the managerial change in question gives rise to further managerial changes which in turn influence decisions on technical matters.

It is readily apparent that there is a very great potential for managerial changes. Exponential chain reactions

as the consumption component of extension work. As extension legislation and policy statements typically pay little or no attention to this as a valuable output of their work it will be ignored in the discussion of valuing managerial changes. (Of course, this phenomenon is often a quite important consideration in choosing particular extension programs to achieve other ends because some methods may be more readily accepted than others because of their consumption component.) Second, in some instances, agricultural extension may, by supplying information to rural society, confirm in the minds of farm people that their existing ways of doing things are the best available. This would possibly produce intangible benefits (non-market goods) in the form of increased assurance, confidence, and/or satisfaction for the farm people involved. It might also produce tangible benefits in the form of reduced search for better ways if, in fact, this is an unprofitable activity. However, the intangible benefits appear to be essentially the same as the consumption component of extension work and will be ignored for the same reasons. The possibility of the situation existing where farmers are spending too much time searching for better ways of doing things also appears remote to this writer or, at least, self-correcting and will be ignored.

¹⁴The usual assumption that different qualities of a good are regarded as different goods is made throughout.



are obviously possible. Furthermore, even if these do not occur, a single managerial change may influence many technical decisions. For example, a soils short course might change a farmer's image of how plants acquire nutrients from the soil and thereby influence many decisions in the area of fertilization and soil care. Basic information on nutrition might influence many aspects of food preparation and use. A farm management program might inspire people to take courses in technical agriculture which could eventually influence decisions in many diverse areas. While this potential is great, it is also extremely difficult to analyze and it can be easily under or over valued.

To be consistent with the conceptual framework already developed one would have to say that the value of a managerial change can be obtained by taking the present worth of all the technical changes it influences. Such a statement has little practical meaning until ways are devised for detecting the technical changes which specific managerial changes actually do affect. In general these are not available. One would intuitively expect increased basic knowledge in an area to influence technical changes in that area (e.g., a soils course would influence fertilizer decisions). However, by-product effects are common because of man's ability to imagine or extend his knowledge from one area to another on a hypothetical basis. For example, hybrid sorghum was more quickly accepted than hybrid corn in the U.S.A. because farmers were familiar

with hybridization through their use of hybrid corn. It is even difficult to tell when a managerial change occurs. Two people attending the same extension meeting may be affected differently and may make different decisions about similar technical matters because they assimilated the same messages into their image of reality in different ways.

Also, it is significant to note that, just because a managerial change occurs, its value does not necessarily have to be positive.¹⁵ A farmer may, because of some new information, make an unwise decision he would not have otherwise, even if his information is correct. For example, if a farmer learns that variety K outyields old variety M by 10 per cent in field trials, he may adopt variety K on this basis. Whether this is wise or not depends upon whether K actually does outperform M for him. It may not for various reasons. If it doesn't then the new, correct¹⁶ information has produced an unwise decision. Although it seems

¹⁵This observation is relevant to the previous discussion on the value of technical changes. As all technical changes must have some managerial change associated with them, at least in the form of a new observation if nothing else, there may be some question as to whether it is possible to have worthwhile technical changes without simultaneously incurring worthwhile managerial changes. However, it seems likely that many managerial changes associated with specific technical changes are of little or no value beyond that, although the total value of all of the managerial changes associated with many technical changes may be significantly greater than the value of all specifically-associated technical changes because they may interact to lead to a variety of indirectly-associated technical changes.

¹⁶The information is correct if variety K did actually outperform variety M by 10% in field trials. The inference made by the farmer is incorrect if K does not outperform M on his farm.

generally-agreed that better-informed people make better decisions, this example indicates that the old adage "some knowledge is a dangerous thing" has empirical support.

One managerial change which extension workers often promote is increased managerial effort - "consider the farm as a business" it is sometimes said. This may be a valuable change if the added effort required to do so produces results which outweigh the added costs associated with this effort. Lost time in production activities plus costs of accounting services and so on may be greater than the returns they produce. Thus, it is not always wise for the farmer to increase the resources he devotes to management.

Another point which seems of relevance in valuing managerial changes involves the time dimension. If a managerial change occurs at time t but is not useful (i.e., does not influence any decision on technical matters) until time $t+k$, the cost incurred in making it could have been lower by delaying it until time $t+k$ and, there would have been no loss in the associated benefits.¹⁷ Thus, other things being equal, managerial changes which produce technical changes immediately will be preferred to those with delayed effects.

On the basis of this discussion three rules-of-thumb

¹⁷ This assumes that costs are calculated on the basis of positive interest rates and that there are no other foregone returns.

may be established:

- (a) Managerial changes which cannot be directly linked to specific and potentially-valuable technical changes should be discounted heavily because they may have zero value.
- (b) Managerial changes which will not likely lead to technical changes in the near future should be discounted as they could have been postponed without loss of benefits.
- (c) Managerial changes will have a greater value if they occur in a decision-maker with a long career of management ahead of him (or her) than in a person nearing the end of his (or her) career.

In addition, two hypotheses suggest themselves:

- (a) It is advisable for extension services to promote related managerial and technical changes together rather than in separate programs.
- (b) The benefits of technical changes are likely to be more obvious to program participants than those which may accrue to managerial changes.

Aggregating Benefits Across Decision-Making Units

Problems in aggregating benefits across individual decision-making units can arise for two reasons. Firstly, there may be considerable difficulty in arriving at a common denominator among units. This will occur where the benefits of changes in individual units have been measured in non-monetary terms. Secondly, there may be substantial external effects for which an allowance must be made. Externalities arise mainly through (a) the diffusion phenomenon, (b) changes in the supply and demand curves for market goods and services, and (c) managerial changes.

The common denominator problem is evident in several areas. Changes in utility in rural households, even if they are generally-regarded as positive, cannot be readily aggregated in terms of utility because of lack of a method of making valid inter-personal utility comparisons. And, even if they could, they would eventually have to be translated into monetary terms in order to be aggregated with other extension outputs. One way of getting around these problems is to assume that a given change is equally valuable to all households and, by valuing it at the cost of providing an equivalent level of utility as suggested earlier, a monetary aggregation can be made. However, as will be seen later, there are circumstances in which this method breaks down. The same reasoning applies to common denominator problems arising in other areas such as managerial changes or changes in community organizations.

In the sections of this chapter devoted to valuing changes in individual farm firms, rural households, and community organizations it was assumed that there were no external effects associated with the change being valued. Where this assumption is correct, the total benefit flow attributable to changes inspired by extension effort can be calculated by summing the benefit flows accruing to the individual decision-making units directly influenced by extension work. Where it is not, some adjustment for externalities must be made.

The diffusion of ideas from decision-making units which participate in extension programs to others which do not is essentially an externality. Representing extension outputs as shifts in adoption distributions wherever appropriate, permits explicitly accounting for this externality. Thus, the appropriate method for deriving an aggregate benefit flow for the promotion of a specific innovation requires aggregating over all decision-making units in the area described by a new adoption distribution - not just over program participants. Providing no other external effects are present and measurements of the value of the change for individual units can be made, the appropriate aggregation method is simply the summation of all benefit flows for all of those individual units specified by the shift in the adoption distribution. There also exists the possibility that, under the extension-influenced adoption pattern, managerial costs incurred by decision-making units which do not participate in extension programs will be different than they would have been under the alternative adoption pattern. Such cost differences can be accounted for by adjusting benefits accruing to these units in the same way as for adopters which participate in extension programs.

Changes in supply and/or demand curves for market goods and services may result when an extension agency successfully promotes change(s) in groups of decision-making

units. These changes have implications for this study both from the point of view of who receives the benefits from extension effort and how these benefits should be evaluated. The movements which may occur in the supply curves for farm products are illustrated in Figure 6. In period zero, the actual supply curve is given by $S_A(0)$ but, as an innovation spreads through the group of adopters, it tends to move downward and towards the right ending up at $S_A(m)$ in the period m . If agricultural producers do not increase total profits from period 0 to period m , then the total per period benefits attributable to the innovation

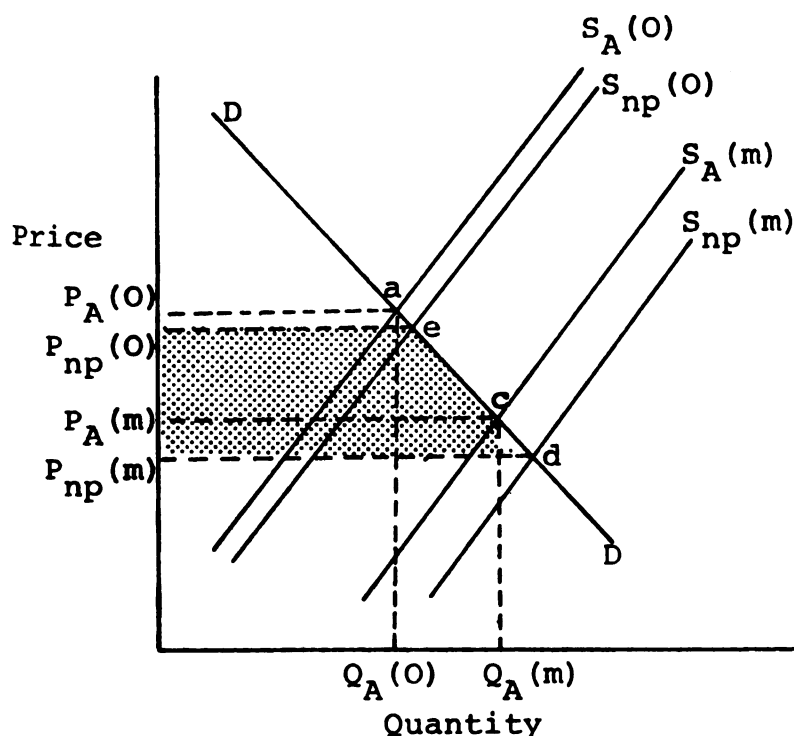


Figure 6.--Illustration of the effects of a shift in the supply curve resulting from the adoption in an innovation.

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after it is adopted by all producers will be given by the increased consumer's surplus¹⁸ area $P_A(0) a c P_A(m)$.

However, if producer's surplus is larger¹⁹ in period m than in period 0, then the total per period benefits would include both the change in consumer's surplus [area $P_A(0) a c P_Q(m)$] and the change in producer's surplus which is given by area $P_A(m) c d P_{NP}(m)$ less area $P_A(0) a e P_{NP}(m)$ where supply curves $S_{NP}(0)$ and $S_{NP}(0)$ represent the supply curves which would exist if all factors in the agricultural sector were being paid their opportunity cost. Thus, the shaded area $P_{NP}(0) e c d P_{NP}(m)$ would represent the total per period benefit after period m . Of course, where the group of decision-makers influenced by the change do not constitute a significantly large share of the market, the shift in the supply curve can be ignored and it can be assumed that the innovation does not directly influence price. In this case, total per period benefits whenever the

¹⁸This analysis assumes that the demand curve for the product remains unchanged while the supply curve shifts, the usual net result being that larger quantities will be sold at lower real prices. The gain in consumer's surplus shown in Figure 6 assumes constant marginal utility of money. [For an explanation of the implications of this assumption, see William S. Vickery, Microstatics, (New York: Harcourt, Brace & World, Inc., 1964), pp. 66-67.] Where markets for products approach perfect competition as is often the case in agriculture, the shift in the supply curve will automatically occur as more and more farmers become willing and able to produce at lower real prices. This, of course, applies only if there are no artificial barriers such as price or output controls in the product market.

¹⁹Presumably it would not decline although this is not an impossibility.

innovation is fully adopted will be given by the change in producer's surplus, whatever that may be.

Figure 7 shows the effects of a shift in demand for farm inputs or consumer's goods resulting from a widely-adopted innovation in the agricultural sector. A shift in demand for farm inputs could result from new uses of old inputs or from complementarity in production between new inputs and other old inputs for which new uses have been found. A shift in demand for consumer's goods could result from innovations in household operations (e.g., the introduction of sewing machines might increase the demand for cloth) or increased incomes from production innovations.

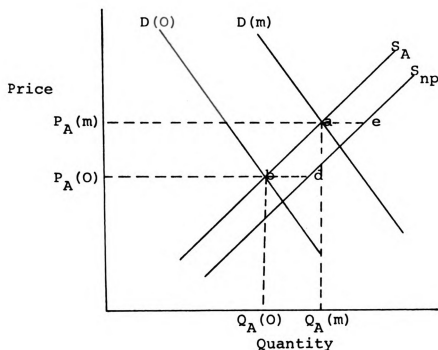


Figure 7.--Illustration of the effects of a shift in the demand for farm inputs or consumer's goods by the farm sector.

Although the demand shift shown is towards the right, this need not be the case in reality. The introduction of tractors in North America completely obliterated the derived demand curves for many inputs complementary to horses. Furthermore, in some cases entirely new demand curves will arise and, for capital items, these may be much greater in early periods than later when stocks have been accumulated. If the shift in demand corresponds to that shown in Figure 7, the benefits accruing to the supplying sectors will be given by area $P_A(m) a b P_A(0)$. The change in producer's surplus accruing to farmers (or consumer's surplus accruing to rural households) will be given by the difference between the area under $D(0)$ and above the line $P_A(0) b$ and the area under $D(m)$ and above the line $P_A(m) a$. Of course, if rent was accruing to factors in the supplying industry, S_{NP} would be the appropriate curve to use in estimating the change in producer's surplus accruing to that sector. Again, if the group of farms or rural households influenced is an insignificant part of the total market, price will not be related to the innovation itself and only the changes in the units influenced are of relevance.

All of the externalities discussed here can be related to the income distribution effects of different extension programs. For example, an extension promotion effort which succeeds in getting a new innovation widely-

adopted may leave aggregate profits in agriculture unchanged in the long-run, although in the early part of the adoption process some farmers may be making added profits and in the later part others may be getting lower incomes. These effects will be discussed in the next chapter.

A wide range of externalities may arise through managerial changes in individual decision-making units. These are complex and poorly understood but it would appear that they can be classified into three areas:

- (1) externalities resulting from dealings with public agencies,
- (2) externalities resulting from dealings with private businesses,
- (3) changed participation in public decision-making processes.

All of these exemplify themselves through changed attitudes and/or different decisions on the part of individual farm people.

A few examples of external effects of managerial changes resulting from dealings with public agencies can be noted. A farmer or a housewife who has worked with one government agency may, as a result, possess a favorable (or unfavorable) attitude towards government work in general. It has already been noted that, if a farmer is willing to make changes on the basis of extension recommendations, these changes can be made at lower cost than if he had to be convinced. Similarly, if farmers are technically competent, they may reduce the future extension efforts

required to achieve some changes.

Managerial changes in farm people may affect their dealings with private businesses. A farmer who is familiar with the basic concepts of soil fertility may reduce the sales effort required to get him to buy fertilizer. (It may also change the nature of his fertilizer purchases which may actually mean less profits for fertilizer companies.) Similar effects may result for other farm input suppliers and for sellers of consumer goods to rural people.

Managerial changes in farm people may affect the value (or cost) of people in a society. It is generally regarded that better-informed people tend to make better choices in public matters. Some extension agents boast that no 4-H Club member from their area has ever gone to prison. If 4-H actually has some influence in reducing crimes, it obviously reduces the cost of the individual to society. Development of "good" citizens and leadership ability are often emphasized in 4-H work. The principal benefits of these tend to accrue when the individuals involved play a role in public decision-making - not when they tend only to their own farms and households. These benefits tend to be widely-diffused and difficult to measure.

Estimating Aggregate Benefit Flows Due to Changes in Rural Society

If there are no externalities other than the diffusion phenomenon and benefits per adopting unit are constant over all units and all periods, the aggregate

benefits due to the extension effort directed at promoting a given change accrue entirely to adopters and can be calculated as:

$$(4) \quad B(t) = \{A_E(t) - A_0(t)\} V$$

where $A_E(t)$ and $A_0(t)$ are the total numbers of units having adopted by period t (with and without extension influence respectively) and V is the per unit value of the change for one period.²⁰ These are rather restrictive circumstances and thus (4) is not likely to be applicable to a wide range of extension programs. In the case of production units V would only be the same for all firms and all time periods if identical levels of $x_j(t)$ and $y_i(t)$ were used on all farms and prices were constant over time.

If V varies over time independently of the adoption pattern, $B(t)$ is given by:

$$(5) \quad B(t) = \{A_E(t) - A_0(t)\} V(t)$$

In the case of production units, this would occur if input and/or output prices for a given area are changing over time and $V(t)$ is the same for all units. The movements in the supply and demand curves which give rise to these changes in prices would have to be unrelated to the change being adopted for equation (5) to be appropriate. These price

²⁰ V is equal to $\Delta^u(t)$ for farm firms and a monetary estimate of $\Delta^u(t)$ for households with appropriate adjustments for "once-and-for-all" managerial and physical change-over costs in period one of adoption for each adopting unit.

changes would also have to induce the same changes in $x_j(t)$ and $y_i(t)$ in all units for the assumption of a constant $V(t)$ across units to apply. Given the same initial conditions and assuming profit maximization in farm firms, this might not be unreasonable providing large random influences do not create different choice situations. A similar analysis would apply to households and community organizations.

If the movements in supply and demand causing price changes over time were entirely caused by the innovation under consideration, price levels and subsequent adjustments in $x_j(t)$ and $y_i(t)$ would produce a $V(t)$ dependent on $A(t)$. Writing this as $V_D(t) = f\{A(t)\}$ it can be seen that the benefits accruing to the agricultural sector are given by:

$$(6) \quad B_A(t) = A_E(t) \cdot f\{A_E(t)\} - A_0(t) \cdot f\{A_0(t)\}$$

If both independent and related price movements are occurring, this can be acknowledge by writing:

$$(7) \quad B_A(t) = [A_E(t) \cdot f\{A_E(t)\} - A_0(t) \cdot f\{A_0(t)\}] V_I(t)$$

where $V_I(t)$ is the net unit return per period independent of the change. To arrive at the total benefits, the effects on the consumers of farm products and the suppliers of farm inputs and consumer goods sold to farm people would have to be allowed for in both cases. As it was shown in the last section that, in the case of small shifts in supply and demand curves, only very modest changes in prices occur, the

variable $V_D(t)$ can be regarded as constant for all t in such cases. As this study is mainly concerned with small segments of markets, these circumstances probably hold and $V_D(t)$ will be assumed to be constant. Thus, where $V(t)$ is constant among units, aggregate benefits can be approximated by equation (5).

However, it is probably unrealistic to assume that $V(t)$ is constant among units. It is likely to vary with size of operation. Furthermore, research in the adoption of innovations shows that, in the case of farm firms, producers with larger outputs are likely to be early adopters.²¹ Similarly, high income families may be early adopters and greater users of some innovations in the consumption unit. Thus, a relationship between $V(t)$ and $A(t)$ may arise for these reasons. Should this be the case, equation (6) would be appropriate and, if prices are unrelated to the adoption of the innovation in question, this expression could be considered as a useful approximation of the total benefits accruing from the change. There is also the possibility that extension effort, while creating a new adoption distribution, actually changes the order of adopters significantly. Where this is the case the relationship between $V(t)$ and $A(t)$ would differ between $A_E(t)$ and $A_0(t)$. However, as this is difficult to ascertain in practice and probably would not influence the results substantially, it

²¹Rogers, op. cit.

will be ignored here. Thus, it would seem advisable to use equation (6) to calculate $B(t)$ in this study.

A rather significant problem arises in that the nature of $f\{A(t)\}$ is not readily determined. An approximation of it can be constructed if the volume of production or input use is related to $A(t)$ and benefits per adopting unit are directly related to either of these factors. This is often approximately the case in practice. For example, a new fertilizer may represent a saving of a constant amount per acre or per bushel over a limited range of production.²² If such an intermediate measure can be found, it is possible to express $B(t)$ as:

$$(8) \quad B(t) = [A_E(t) \cdot g\{A_E(t)\} - A_0(t) \cdot g\{A_0(t)\}] V(t)$$

where $V(t)$ is the benefit per unit of the intermediate measure and $g\{A(t)\}$ gives the number of units of this measure for each period.

Consider the following rather simple example.

Suppose $A_0(t)$ is given by:

$$(9) \quad A_0(t) = \begin{array}{ll} 0 & t < 5 \\ 50t - 250 & 5 \leq t \leq 17 \\ 600 & 17 < t \end{array}$$

Assume extension effort shifts the adoption starting date by five years and increases the annual rate of adoption by ten

²²Of course, much more sophisticated models would be required for analyzing the effects of some innovations on the firm's profits.

units per year. Then $A_E(t)$ can be written:

$$\begin{aligned}
 (10) \quad A_E(t) &= 0 & t < 0 \\
 &= 60t & 0 \leq t \leq 10 \\
 &= 600 & t < 10
 \end{aligned}$$

Furthermore, if the first firm to adopt produced 200 units of the commodity affected and average production per firm declines linearly with $A(t)$ to 140 when all units have adopted, $g\{A(t)\}$ can be written:

$$(11) \quad g\{A(t)\} = 200 - \frac{1}{10} A(t)$$

Finally, assume that because of independent price declines $V(t)$, which represents net benefits per unit of the commodity affected, is given by:

$$(12) \quad V(t) = .5 - .02t$$

In this case, benefits can be calculated as follows:

$$\begin{aligned}
 (13) \quad B(t) &= 0 & t \leq 0 \\
 &= 6000t - 420t^2 + 7.2t^3 & 0 \leq t \leq 5 \\
 &= 21875 - 1375t - 45t^2 + 2.2t^3 & 5 \leq t \leq 10 \\
 &= 70125 - 9055t + 375t^2 - 5t^3 & 10 \leq t \leq 17 \\
 &= 0 & 17 \leq t
 \end{aligned}$$

A tabulation of all relevant variables for seventeen discrete periods is shown in Table 4. This rather naive example illustrates several of the phenomena discussed so far. First, had the adoption not occurred without extension influence, $A_0(t)$ would have not existed and the benefit flow would have lasted as long as profits existed (i.e., to period 25). After period nine, this would have amounted to

Table 4.--Example of the calculation of the benefit flow resulting from a hypothetical set of extension activities.

t	$A_E(t)$	$g\{A_E(t)\}$	$A_0(t)$	$g\{A_0(t)\}$	Units of Output ^a	V(t)	B(t)
1	60	194	0	-	11640	.48	5587.2
2	120	188	0	-	22560	.46	10377.6
3	180	182	0	-	32760	.44	14414.4
4	240	176	0	-	42240	.42	17740.8
5	300	170	0	-	51000	.40	20400.0
6	360	164	50	195	49290	.38	18730.2
7	420	158	100	190	47360	.36	17049.6
8	480	152	150	185	45210	.34	15371.4
9	540	146	200	180	42840	.32	13708.8
10	600	140	250	175	40250	.30	12075.0
11	600	140	300	170	33000	.28	9240.0
12	600	140	350	165	26250	.26	6825.0
13	600	140	400	160	20000	.24	4800.0
14	600	140	450	155	14250	.22	3135.0
15	600	140	500	150	9000	.20	1800.0
16	600	140	550	145	4250	.18	765.0
17	600	140	600	140	0	.16	-
18	600	140	600	140	0	.14	-

^aUnits of output = $A_E(t) \cdot g\{A_E(t)\} - A_0(t) \cdot g\{A_0(t)\}$ In this example, units of output would be the number of acres affected that would not be affected otherwise.

\$84000 $V(t)$. Second, a constant $V(t)$ would have made a significant difference in $B(t)$, especially in later periods. The benefits shown accrue to the agricultural sector but, in this example, late adopters receive lower total benefits than early adopters for two reasons - their production units are smaller and their benefits do not start as soon. For example, the first adopter has already received \$720 in benefits before the last adopter adopts.²³ At an interest rate of 5 per cent, this would make the first adopter better off by \$941.23 in period ten. Furthermore, in period ten the first adopter receives \$60 whereas the last adopting unit receives only \$24.²⁴ If there had been a product price decline and/or input price rise as a result of supply and/or demand curve shifts due to this innovation, the late adopter would have been affected in much the same way as by the exogenous decline in $V(t)$ used in the example.

While this example is somewhat naive in several ways, it is believed that it illustrates the essential features of

²³Total benefits to the first adopter for the first nine periods are given by:

$$\sum_{t=1}^9 200 (.5 - .02t) = \$720.$$

²⁴Total "intermediate" units in the extension-influenced adoption as a function of time are given by:
 $A_E(t) [200 - \frac{1}{10} A_E(t)] = 200 A_E(t) - \frac{1}{10} [A_E(t)]^2$ Thus, the average number of intermediate units produced by the last adopting group is given by:

$$\frac{d [200 A_E(t) - \frac{1}{10} [A_E(t)]^2]}{dt} = 200 - 0.2 A_E(t) = 80.$$

the phenomenon under consideration. Further realism could be achieved by using an S-shaped adoption distribution and a more sophisticated model of the firm to calculate $V(t)$. However, in any given situation the determination of the empirical nature of these structures would likely be quite costly. Thus, models similar to this example will be used in this study.

Secondary Extension Outputs

The secondary extension outputs defined in Chapter II defy easy evaluation. Thus, they too can be easily under or over valued. However, some general ideas do suggest themselves and they will be mentioned here. In the subsequent empirical analysis, the worth of secondary extension outputs will not be reduced to monetary form directly.

The feedback phenomenon described earlier as "influencing technology developers and/or information sources outside of rural society" will be valueless unless specific actions are taken by research agencies or other information sources to change their activities. If such actions are taken, the value of the feedback effect would be evident in improved effectiveness of these organizations. This is not easily measured but presumably it can, over time, be detected. As the estimation of benefit flows attributable to research requires at least as much attention as this study gives to extension, formal measurement of the extent

of the benefit flow due to the feedback effect will have to be ignored. However, some informal attention will be paid to the extent of extension-research interaction. The influence of extension on other information sources and other institutions will be handled in the same way.

When agricultural extension services function as training agencies in order to bring young men and women (and newcomers to an area) up to the technological and managerial levels already attained by existing decision-makers, they may perform a valuable service.²⁵ The value of this service may be most readily estimated by calculating the cost of performing it by some other means. Presumably, if it were not done by the extension service it would be done by the young people's parents or by some other agency. When technological and managerial skills become complicated to the extent that they have to be learned, an investment in learning is always necessary. This naturally involves costs in terms of the time of the learner and of the teacher. There are often economies of scale and specialization to be gained by establishing some sort of formal training program to handle this function rather than letting it occur naturally. Agricultural extension may produce benefits by realizing some of these economies. It would intuitively appear that such economies would increase as the state of the arts progresses and, therefore, possible gains would be larger in developed than in underdeveloped societies (i.e.,

²⁵ Raising individuals beyond these levels would come under the heading of "managerial change".

the level of knowledge in developed societies requires more learning). It would appear that the gains to be realized here are relatively small, particularly when one considers that other types of organization (such as regular schooling combined with in-the-home-training) can also realize similar economies.

When agricultural extension performs the function of directing rural people to jobs outside of the agricultural sector it may produce benefits which are spread among many groups and, as a result, are not readily measureable. In economic terms one could view the result as being a lowering of the wage differentials between agriculture and non-agricultural employment. Such differentials presumably arise because of differences in the quality of labor, lack of information, and equalizing differences which account for differences in non-monetary benefits associated with the different types of employment (e.g., different types of degrees of risk, type of environment, etc.). An analysis of the extent to which extension effort actually does improve information about alternatives elsewhere relative to those in farming and/or improves the quality of labor together with some measures of wage differentials and the number of people effected could lead to a value measure of this secondary extension output. Needless to say, it would be too costly to do here. Furthermore, the value of this output is probably significant only at a much more aggregate

level than is involved in this study. Thus, where this function is noted in the subsequent empirical analysis, no measurements of the benefits in monetary terms will be attempted.

CHAPTER V

MEASURING EXTENSION PERFORMANCE

There are several factors other than extension "outputs" which must be considered in measuring overall extension performance or effectiveness. Extension program costs must be measured and compared to measures of extension "outputs" to assess the "net" value of the "production" component of extension work. To usefully make such a comparison it is necessary to have some decision procedure for choosing among alternative extension programs. Furthermore, to assess the overall performance of an extension agency it is also necessary to consider "managerial" efficiency as well as "production" efficiency.¹ Measurement of both "production" and "managerial" efficiency is the concern of this chapter.

The first four sections of the chapter deal primarily with the former by analyzing the problem of selecting acceptable procedures for choosing the best set of extension programs that can be operated on a fixed budget.

¹It makes little sense, for example, to say that an extension agency is necessarily doing a good job if it operates one very successful program but spends 80 per cent of its budget planning and selecting that program. The agency might have been better off to have operated more programs and done less planning. Thus, these possibilities also have to be considered in evaluating overall performance.

The procedure which is selected is operational in that it can be applied, as is demonstrated later in this study. It is not recommended for formal application by extension agencies because it is probably too costly to implement on a formal basis (i.e., it appears to be an inefficient managerial practice). However, it is believed that it would be useful for extension decision-makers to apply this procedure on an informal or intuitive basis.

The fifth section of the chapter deals primarily with ways of assessing "managerial" efficiency and the characteristics of the trade-offs between "management" and "production" when the total budget is fixed. The result of this discussion is somewhat less satisfying than that directed at "production" efficiency. The general conclusion is that theory, methodology, and empirical knowledge in this area are probably insufficient to enable one to construct a formal analytical structure that would be superior to the rules of thumb and intuitive procedures in common use.

The last section of the chapter discusses more traditional measures of extension performance and relates them to the measures used in this study.

A Decision Rule for Choosing Among Alternative Extension Programs

As most extension programs probably produce some products which can be readily reduced to monetary terms and others which can not, and different extension programs often

have different income distribution effects as well, it might appear that the only way programs can ultimately be compared is to leave the decision entirely to the subjective judgement of extension decision-makers. However, this only avoids the basic problem which is one of objectively choosing among a variety of possible programs. If no satisfactory method is available to anyone, extension decision-makers may be just as badly off as everybody else - perhaps even worse because they will likely substitute their own ideas and values for the appropriate but unknown concepts, even though these ideas and values may be quite inaccurate. In view of this situation, it would appear useful to try to select a single rule or technique for comparing extension programs on the basis of monetary costs and benefits with the hope that most, if not all, extension outputs can eventually be placed on this basis.² If a rule for comparing extension programs on the basis of monetary costs and returns can be selected, and extension "outputs" can actually be measured in such terms, then only the problem of incorporating income redistribution effects into the

²As noted elsewhere in this study, the principle of opportunity cost often provides an excellent means of reducing seemingly unmeasurable extension "outputs" to a monetary basis. Furthermore, those individuals who say such reductions are impossible and proceed on some other basis are, indirectly, achieving the very reduction they say is impossible. For example, the extension administrator who maintains that a 4-H Club program (which achieves certain "intangible" benefits) is superior to extending a new wheat variety whose benefits are more easily measured directly in monetary terms, is implicitly placing a minimum monetary value on the 4-H Club benefits.

decision procedure remains in order to objectively choose among such programs.³

Several criteria suggest themselves for selecting an appropriate decision procedure. Firstly, it should agree with the marginal productivity rules supplied by the theory of the firm should the situation arise where they could both be applied. Otherwise, it would be inconsistent with a well-developed and widely-accepted body of knowledge concerning economic decisions. Secondly, it should be designed to choose among a limited number of discrete alternative programs because this appears to be the sort of choice which typically faces extension agencies.⁴ Thirdly, it should be able to account for the fact that project benefits are often not realized in the same period in which costs are incurred. Fourthly, it should be able to by-pass the requirement of physically quantifiable inputs, outputs and functional production relationships as these are, in general, unknown. Fifthly, because of the difficulties

³This ignores the problems created by imperfect knowledge (i.e., estimates). These are dealt with in the second section of this chapter.

⁴If a method for choosing among a number of discrete programs were available, many possible alterations in program design could, technically-speaking, be evaluated as separate programs. Thus, the discreteness of the programs is perhaps more important from a theoretical point of view than the "limited number" condition. The latter arises from the practical necessity of efficient "management".

usually encountered in measuring social costs,⁵ it would be convenient if the chosen technique could limit the extent to which these must be estimated. And finally, as suggested at the outset of this study, it should be suitable for selecting the best group of programs to be operated with a fixed amount of funds.

This final criterion is adopted because upper limits on extension funds are often beyond the control of extension decision-makers. In the long-run extension agencies can be expected to influence the size of their budget, but, in the short-run, it appears that they are, at best, concerned with (a) designing a set of promising, feasible programs, and (b) operating the most effective subset of these programs that existing resources will permit. This is only reasonable because, as also noted at the outset of this dissertation, the effectiveness of both alternative and complementary programs must be analyzed in order to objectively decide upon extension budget allotments. Extension agency personnel cannot be expected to perform this analysis.

The decision rule which meets the above criteria

⁵As funds for extension work are almost always provided through taxation, and most taxes are welfare-reducing, extension expenditures would have to be adjusted for this welfare loss if social costs were to be estimated. A more relevant cost estimate might be the marginal return on resources in other public uses. Although this is seldom readily available in even approximate form, its use will be discussed later in this chapter to illustrate the basis for the decision procedure actually selected.

can be stated as follows:⁶

- (i) Rank all projects on the basis of the numerical value of the ratio of PVB to PVC for each project where

$$PVB = \frac{B(0)}{1} + \frac{B(1)}{(1+i)} + \frac{B(2)}{(1+i)^2} + \dots + \frac{B(n)}{(1+i)^n} \text{ for all } B(j) > 0$$

$$PVC = \frac{B(0)}{1} + \frac{B(1)}{(1+i)} + \frac{B(2)}{(1+i)^2} + \dots + \frac{B(n)}{(1+i)^n} \text{ for all } B(j) < 0$$

i = the "appropriate" rate of interest

n = the number of periods in which benefits and/or costs occur.

$B(j)$ = the net benefits (if positive) or costs (if negative) in period j ; $j=1, \dots, n$

- (ii) Select projects from the top of the list until the total budget is exhausted.

The problem of determining gross extension benefits in future periods was discussed in previous chapters. Estimates of extension expenditures can serve as estimates of extension costs⁷ and can be deducted from gross benefits to get estimates of net benefits.

The problem of determining the "appropriate" interest rate deserves further comment.⁸ There seems to be little

⁶The complete rationale underlying the choice of this rule can be found in Appendix A. The possibility of using different interest rates for different periods is discussed there.

⁷These can serve as estimates of extension costs without biasing choices among programs as one can readily assume that expenditures have the same factor of proportionality to social costs for all programs.

⁸See also Appendix A.

alternative for many public agencies but to assume the same time preference for funds indicated by the general capital market even though they are not able to participate in this market. This is probably a reasonable approximation of the rate at which project beneficiaries can exchange benefits among periods by borrowing and/or saving. In individual instances, a case may be made for a different rate but this topic is beyond the scope of this thesis. Thus, the approach taken here will be to utilize rates obtained from the general capital market in Colombia and base rankings on the stated formulation of the "present-value" rule which appears to meet all of the criteria laid down at the beginning of this section.

It should also be mentioned at this point that observed interest rates normally include some allowance for inflation or deflation, whichever is generally anticipated by participants in the capital market. If benefit and cost streams are calculated to include this inflation (deflation), then observed interest rates in the relevant capital market are appropriate. If not, then real (deflated) rates must be used. One problem which arises in connection with the use of real rates is the implicit assumption that the benefit stream will change in monetary value in the same way as the value of money changes. This may not be true for various reasons. However, there will be no way around this assumption unless the change in the monetary

value of the benefit stream over time can be predicted. This would typically involve projection of one or more price series, a fairly expensive chore.

Comparing PVB/PVC Ratios for Alternative Extension Programs Under Imperfect Knowledge

The decision rule selected in the previous section implicitly assumes (as noted in footnote 3) that the data on projected costs, benefits, and interest rates are known rather precisely. Indeed, the rule was stated in terms of single values for all variables, whereas, under usual circumstances, one would likely expect that a range of values could be possible for some, if not all, of these variables. Thus, it may be unwise to look upon the comparison of PVB/PVC ratios as a simple comparison of numbers. It might be inappropriate to select a project with a ratio of 2.0 over one with a ratio of 1.5 simply because the former ratio is larger. The latter project may incorporate considerably less risk and, depending on the preferences of the decision-maker, may be a much more desirable alternative because of this. It has already been pointed out that these ratios may be quite sensitive to changes in the interest rate. They also may be quite sensitive to variations in the periodic benefit values used to calculate them. Thus, it is perhaps more useful to regard them as random variables rather than deterministic values. Furthermore, the basic data used to construct the

PVB/PVC ratios can also be regarded as having probability distributions defined in the Bayesian sense. This view of the problem provides a means of understanding the situation and describing the "risk" attached to individual projects. It also provides a means of illustrating some of the various possible ways of modifying the previously selected decision rule to allow for "risk".

There are two major alternatives open to decision-makers faced with PVB/PVC estimates. One is to avoid risk considerations entirely and concern oneself only with "expected" (in a statistical sense) values. It might be argued that governments, because they tend to be "large" and operate many projects, should adopt this point of view because, in the long-run, one would expect this approach to produce the highest total net pay-off. However, there seem to be several practical arguments against this. Firstly, this strategy could result in short-run losses from which recovery would not be possible. Thus, success is not assured even in the long-run. Secondly, administrators and politicians might find this strategy rather unpalatable in view of the possible effects on their personal future. They might prefer either a more conservative or a more daring approach depending upon their individual goals and preferences. The second is to attempt to make some specific estimates of the risk inherent in each PVB/PVC ratio and attempt to apply a modified decision rule to

these estimates. Such estimates can be constructed in two ways. First, if it is possible to obtain estimates of the distributions of the underlying data, it would then be possible to either mathematically, or by means of a Monte Carlo analysis, obtain the probability distributions of the resultant PVB/PVC ratios. This would be a very useful exercise if it could be carried out because it would permit analysis of the risk associated with any problem and it would also permit testing differences between rates of return to see whether they are likely real differences or whether they are likely due to errors in the underlying data. The second method of comparison is sometimes called sensitivity analysis. This method involves selection of a few underlying variables which are assumed to be critical and permitting them to take on values near their probable extremes. The resulting changes in the PVB/PVC ratios are then examined to give some idea of their probability distributions.

The mathematics of the PVB/PVC ratio are such that direct mathematical calculation of a probability distribution from the distributions of the underlying variables is often quite difficult and sometimes impossible. However, this very phenomenon makes their distributions more deserving of attention. For example, if the benefit flow is constant, positive in value, infinite in duration and begins the period following that in which a given capital

cost $C(0)$ is incurred, the PVB/PVC ratio is given by:

$$(1) \quad \frac{\text{PVB}}{\text{PVC}} = \frac{\sum_{t=1}^n \frac{B(t)}{(1+i)^t}}{C(0)} = \frac{B(t)}{C(0) \cdot i}$$

In this very restricted case, the probability distribution law of PVB/PVC is Cauchy if the distributions of $B(t)$ and $C(0) \cdot i$ are normal and independent. The Cauchy distribution has no mean or variance and the comparison of it with other distributions by means of these statistics is therefore impossible.⁹ Thus, although PVB/PVC is not asymptotically biased providing $\text{plim}^{10} \hat{B}(t) = B(t)$ and $\text{plim} \hat{C}(0) = i \cdot C(0)$, confidence limits for the ratio itself do not exist and the comparison problem completely degenerates. In other cases, highly skewed distributions for the PVB/PVC ratio would not be unlikely. Thus, the individual estimates of this ratio obtained for different projects may, by themselves, say little about relative performance.

It therefore appears that, as both the estimates of the benefit stream and of costs are likely to arise through

⁹Of course, as $B(t)$ and $C(0)$ are defined so as not to take on negative values, there is no possibility of $B(t)$ and $C(0) \cdot i$ having exactly normal distributions. The distributions will be truncated on the lower end. Furthermore, as very large values of either $B(t)$ or $C(0) \cdot i$ are irrelevant, a truncation of the normal distribution would perhaps be made at the upper end as well. The use of truncated normal distributions makes the distribution of the PVB/PVC ratio truncated also although its range may still be quite substantial for practical comparisons.

¹⁰ $\text{Plim} = \text{probability limit}$. If $\lim_{n \rightarrow \infty} \text{Prob}\{|x^{(n)} - x^*| \geq S\} = 0$ for every $S > 0$ where x^* is a finite constant, then x^* is said to be the probability limit of the sequence $\{x^{(n)}\}$.

several multiplicative calculations, the ultimate distribution of PVB/PVC is likely to be difficult to judge unless some sort of sensitivity or simulation analysis is conducted. Unfortunately, a complete simulation is usually a complex and costly job. McKean says, "On balance, the Monte Carlo method and the probability of outcomes that this technique produces, may not be worthwhile in cost-benefit analysis, except in the exhaustive examination of very expensive proposals."¹¹ This is certainly the case if a large number of underlying basic variables are involved and the means and variances of these are estimated from special samples. However, if the estimates of the underlying variables are arrived at in some other fashion, as is often the case, then the variances of these variables may be similarly obtained. This would apply particularly where engineering and/or biological data are used. Thus, the additional cost of the analysis is usually incurred through programming and computer time. These costs vary largely with the mathematical nature of the phenomenon being examined. Simulation is definitely out of the question if a computer is not available but a sensitivity analysis can be conducted without such facilities. Thus, it is this latter approach which will be used in this study.

Once one has available either mathematically-calculated or simulated probability distributions or sets of

¹¹Roland N. McKean, Efficiency in Government through Systems Analysis, New York: John Wiley & Sons, 1958, p. 70.

sensitivity analyses, the problem of the appropriate decision rule once again presents itself. A number of rules are available. A popular text book example is the "minimax" criterion. This requires one to minimize the maximum loss. Thus, instead of choosing projects with high expected values one would choose those which, even if things turned out rather badly, would produce very low losses. Other more sophisticated procedures suggest that one maximize utility which is considered to be a function of both the set of possible outcomes and their set of probabilities of occurrence.

$$(2) \quad V = f(\{E_1, \dots, E_n\} \{p(E_1), \dots, p(E_n)\})$$

where V = utility

E_i = measure of interest for event i ;
 $i=1, \dots, n$

$p(E_i)$ = the probability of E_i occurring.

Most of the previously stated limitations of utility analysis (see Chapter IV) apply to the attempted implementation of this suggestion.

Thus, the problem of an appropriate decision rule for the case of uncertain outcomes appears unresolved. Therefore, this study will not attempt to select a decision rule but instead, will attempt to show how different programs might or might not be chosen depending upon what decision rule is used.

Selection of Extension Programs on a Minimum Cost Basis

In some cases it is not necessary to consider the PVB/PVC ratio explicitly in order to make choices among different extension programs. This situation arises when several different ways of achieving essentially the same results are available. In such cases, extension agencies can make the most effective use of funds by selecting the program which achieves these results at minimum cost. To apply the "minimum-cost" criterion one must establish (a) what are "essentially the same results" and (b) what are the relevant costs to be minimized.

One can immediately see that the PVB/PVC ratio is implicit in the "minimum-cost" criterion. "Essentially the same results" will be achieved by different programs if and only if these programs produce the same PVB value. Obviously, the same PVB value will result from any given set of extension "outputs" with the same changes in adoption distribution(s). Thus, if several extension programs are capable of producing a given set of extension "outputs" with the same changes in adoption distribution(s), PVB will automatically be the same in each case and the one with the greatest PVB/PVC value will always be the one with the lowest value of PVC. Thus, the calculation of PVB can be by-passed.

For example, if it is desired to change the adoption distribution of a new wheat variety in a given area, the

same change might be achieved by a radio campaign, a circular pamphlet, or by visiting a sample of farmers. As has been illustrated previously, the relationship between these various methods and the results obtained will depend on the total environment in which the extension agency is working. But, should each of these three methods produce the same results in terms of the change in the adoption distribution(s), the extension agency can automatically eliminate all but the least expensive of them.

In the case of extension "outputs" which cannot be analyzed in terms of changes in adoption distribution(s), there does not currently appear to be any possibility of making minimum cost decisions except in terms of intermediate goals which can be reasonably assumed to produce essentially the same final results. For example, if it is desired to provide a group of rural youth with a given 4-H Club program, then there undoubtedly exist several possible ways of offering essentially the same program. If the effects on program participants are no different, the least expensive of these should be chosen. These different ways may simply involve different meeting schedules, travelling routes, office locations, or other similar matters. However, there may be significant cost differences among the alternatives.

Another way of looking at the cost minimization problem is to consider it as one of achieving the maximum

amount of some selected physical measure¹² of output for a given cost. If this approach is to be useful, the value per unit of the selected measure of output must be independent of the method and level of producing the output. In other words, the expected value of a unit of output must either be constant or vary with output in the same fashion for all methods of production. (This does not require output to be homogeneous. However, any heterogeneity must be random and not dependent on the method and level of production.) Thus, in the case of 4-H Club work, if the unit of output is one club member who completes a given 4-H program, the costs per club member would be minimized if the maximum number of club members possible were serviced with a fixed amount of resources. Of course, if in the process of trying to increase the number of club members serviced with a given amount of resources the expected value of the benefits per member were to change, this rule would not be applicable.

The relevant costs to be minimized in applying the "minimum-cost" rule are obviously the same costs that would be included in PVC if the PVB/PVC ratio was being calculated. It was established earlier that extension expenditures could serve as a useful measure of extension costs for comparisons of extension programs, although they

¹²The selected physical measure should reflect only the results of the program which have positive or negative values. Results with zero value can be ignored.

do not necessarily represent the costs to society of doing extension work. However, it may often not be necessary to calculate total extension expenditures to minimize costs per unit of "output". As with any other endeavor, only the marginal or variable costs are relevant. In addition, it may be possible to omit cost calculations entirely if it is known by means of physical measures that costs will necessarily be lower with one alternative than another. It might be quite appropriate, for example, to choose among several extension programs on the basis of the amount of extension-worker time involved to produce a given output. However, this choice would rest on the assumption that other costs do not change when time is reduced.

Incorporating Benefit Distribution Considerations Into Program Performance Assessment

Extension work, like most government programs, produces a distribution of benefits among members of society that may be substantially different from the distribution of the costs incurred in carrying out the program. As this study is primarily concerned with the effectiveness of extension work given a fixed budget, it can readily be assumed that the distribution of the costs of funding extension work is the same for all extension programs which might be operated with the given budget. This obtains because the budget will be provided in precisely the same

way no matter what set of programs are operated. Thus, the distribution of such costs can be ignored in comparing programs.¹³

Differences in benefit distributions among programs become important when the benefits received by some individuals or groups in society are regarded as more valuable than the same benefits received by other individuals or groups. This is particularly significant in view of the fact (established earlier) that the results of some extension programs may produce negative benefits for some groups and positive benefits for others.¹⁴ Following this line of reasoning, it would seem that, in order to adequately deal with benefit distribution considerations in choosing among programs, it is necessary to know (a) the distributions of benefits from alternative programs among different individuals or groups, and (b) the appropriate weights to attach to the benefits received by each of such

¹³Cost distributions cannot be ignored when the method of obtaining funds or the size of the total government budget is the problem under consideration.

¹⁴It is assumed here that extension decision-makers are willing to operate non-Pareto-better programs and that both the public representatives who hire them and the society which elects and/or sanctions these public representatives expects them to do so. It would appear that there is substantial accumulated evidence supporting this assumption. Extension decision-makers have made non-Pareto-better choices in the past and, while they may not have been aware they were doing so in some cases, it seems unlikely that they were totally ignorant of the nature of these choices.

individuals or groups.¹⁵

In determining (a) it seems essential to have some acceptable way of classifying members of society because the description of benefit distributions by individual is not likely to be practical. There are a number of different classifications which might be proposed for this purpose. However, it will be noted that the choice of relevant groups requires that something be known about the appropriate weights because it would be pointless to work with such groups unless the weights were approximately the same for all individuals in each group. It also requires that, for each instance of concern, benefits be distributed approximately equally among all individuals in each group. Otherwise, such an analysis could be quite inconsistent with a similar analysis conducted on an individual basis. (For example, a program giving low income families an average annual income increase of \$x/family might be viewed in

¹⁵An alternative to this procedure would be to attempt to utilize Lorenz curves to construct an index of income distribution. This index would then be employed as a variable to be traded-off against the PVB/PVC ratio in the usual indifference curve analysis. However, such a procedure is cumbersome and is fraught with the same difficulties as the procedures suggested above. Even the assumption of income equality being preferable to inequality does not solve these because of the difficulty in comparing crossing Lorenz curves. Gini ratios have been used to circumvent this difficulty [see James Morgan, "The Anatomy of Income Distribution", Review of Economics and Statistics, Vol. 44 (August, 1962)]. However, this can only be done because they contain the implicit assumption that all parts of the area under the 45° line in the usual Lorenz curve diagram should be weighted according to their size. This appears equivalent to the more direct approach suggested here.

quite a different light if the \$x were equally distributed among such families than if it were all given to one family in the group). The only way of classifying members of society which appears to have wide acceptance and appears close to being consistent with the above requirements is a classification based on current income.¹⁶ If benefit recipients are divided into k classes on the basis of current income, the PVB for all projects can be recalculated as follows:

$$(3) \quad PVB = \sum_{i=1}^k L_i PVB_i \quad 0 \leq L_i \leq 1$$

where L_i is the weight attached to the PVB received by the i th group (i.e., PVB_i). Thus, the PVB value is adjusted for income distribution considerations.¹⁷ PVC values need not be so adjusted if they include only the funds expended

¹⁶This is by no means a completely adequate classification for the problem at hand. It overlooks the fact that some people may need higher income levels than others to achieve what is generally regarded as the same welfare (e.g., one person might have very high medical expenses while another has none). Furthermore, it does not completely incorporate net worth (i.e., income earning potential) although income is likely closely related to net worth. Thus, the weights one might intuitively attach to benefits received by a given class may not be the same for all members of the class.

¹⁷This analysis, like most formulations of the traditional trade-off between "equality" and "efficiency", hides a crucial feature of the basic problem at hand. The measure of efficiency which has been used in this study (i.e., the PVB/PVC ratio) is, in part, determined by the prices used in its calculation. These prices are partially determined by the existing distribution of income. Thus, the apparent trade-off is not being made between two distinct and independent alternatives for, if the existing income distribution were different, prices could be different and the PVB would be affected accordingly. No attempt is made in this study to allow for such interactions.

to finance the project. However, if they included losses to some members of society as a result of implementing the project, this portion would require adjustment.

Of course, the obvious problem is to determine L_1 . Presumably L is some decreasing function of current income. It can be presumed to be unity for incomes of zero and to decline to zero as incomes become very large. However, its rate of decline depends on social preferences. Thus, the determination of L_1 is very similar to the problem of determining a social welfare function. This has been investigated by economists on prior occasions without significant breakthroughs for practical purposes.¹⁸

Nevertheless, there are some things to be gained from this analysis. First, it is obvious that programs with (unadjusted) PVB/PVC ratios less than unity may be preferred to programs with (unadjusted) PVB/PVC ratios greater than unity, once the L_1 have been allowed for. (Of course, if this occurs the resultant ratios for both projects would be less than unity.) Secondly, the incorporation of L_1 in the PVB/PVC ratio may, in some cases, leave program rankings entirely unchanged. Thirdly, the chance of program rankings being changed by benefit distribution considerations will likely be greater the wider the difference in current incomes among benefit recipients in different programs.

Because of the nature of the results of extension work it may be that a single extension program will produce

¹⁸ See, for example, Kenneth Arrow, Social Choice and Individual Values, (Cowles Commission, Monograph No. 12; Wiley, 1951).

a benefit distribution which varies over time. For example, if an extension program was directed at promoting the adoption of a new potato variety among a group of commercial potato producers which produced most of the supply for a given market area, and extension workers succeeded in getting this variety widely adopted among producers over a four-year period, the first-year benefit distribution might be highly skewed towards high-income individuals whereas, if virtually everyone consumed potatoes, the fourth year's benefit distribution might be almost even among all income classes. In comparing extension programs the calculation of a value of PVB for each income class automatically takes such differences in benefit distributions among programs over time into account.

Measuring Managerial Performance of Extension Agencies

Extension agencies are faced with the problem of having to decide how much of their fixed budget they should devote to managerial activities in view of the fact that any increase in management's share, while it may increase the effectiveness of extension programs, must surely reduce the funds available for operating such programs. They also face the closely related problem of making management most effective with a given amount of resources. The nature of the relationship between these two problems will

become clear as the discussion proceeds.¹⁹

Analysis of decisions regarding how much of the fixed budget should be devoted to management is the first topic of consideration. Assuming that all programs or projects have the same distribution of benefit flows among beneficiaries and that these benefit flows are measureable in monetary terms, then the relevant measure of the performance of an extension agency is the PVB/PVC ratio calculated on the total extension budget. This can be designated $(PVB/PVC)_T$ and is given by:

$$(4) \quad (PVB/PVC)_T = \frac{\sum_{j=1}^k PVB_j}{\sum_{j=1}^k PVC_j + M} \quad \text{for } k \text{ programs}$$

where M is the present value of the total expenditure on those managerial activities required to initiate and implement the k programs and PVB_j and PVC_j represent the present value of benefits and costs respectively associated with the jth program. Now, if all programs possess only a single cost period and all management activities associated with those programs occur in that same cost period, then

¹⁹Another function which extension managers must perform is that of supplying their superiors with information which accurately describes extension effectiveness and enables them (i.e., their superiors) to determine the extension budget simultaneously with those of competing and complementary programs. (It would seem that such information should include information on the interrelationships among extension and such other programs.)

the total budget for that period is:

$$(5) \quad C(O) = \sum_{j=1}^k PVC_j + M = \sum_{j=1}^k C_j(O) + M(O)$$

It can be readily seen that, for a given budget, the larger the amount allocated to $M(O)$, the smaller the amount available to operate programs. However, if management activities are increased for a given amount of funds devoted to programs, one would intuitively expect that program performance would normally improve - at least, up to some point. Thus, extension managers face a paradox. They can usually improve the returns to a given expenditure on programs by increasing managerial activities but, when they do, they reduce funds available for carrying out programs. It is therefore necessary to find a means of determining the appropriate compromise.

To measure program performance, the ratio $(PVB/PVC)_p$ is defined as follows:

$$(6) \quad (PVB/PVC)_p = \frac{\sum_{j=1}^k PVB_j}{\sum_{j=1}^k PVC_j} = \frac{\sum_{j=1}^k PVB_j}{C(O) - M(O)}$$

The size of managerial activities per unit of investment in programs is given by $M(O)/C(O) - M(O)$. As already noted, a functional relationship (much like the traditional production function) exists between $(PVB/PVC)_p$ and $[M(O)/C(O) - M(O)]$.

$$(7) \quad (PVB/PVC)_p = f[M(O)/C(O) - M(O)]$$

To enhance the argument for the existence of such a relationship, it can be noted that, if it did not exist, then there would be little point in devoting any part of the budget to managerial activities as maximum returns would be achieved when all funds were devoted to program operation.²⁰ It can also be noted that program performance is likely to decline as funds devoted to programs increase, other things being equal. This obtains simply because not all programs exhibit the same level of returns and extension managers will normally choose high pay-off programs first. Assuming there is no interaction between this effect and the effect of $M(O)/C(O)-M(O)$ on $(PVB/PVC)_p$, equation (7) can be re-written as:

$$(8) \quad (PVB/PVC)_p = f[M(O)/C(O)-M(O)] + g[C(O)-M(O)]$$

Now, from (6) and (8), it can be noted that:

$$(9) \quad \sum_{j=1}^k PVB_j = [C(O)-M(O)] f[M(O)/C(O)-M(O)] \\ + [C(O)-M(O)] g[C(O)-M(O)]$$

However, the objective of extension management is to maximize $(PVB/PVC)_T$ which can be expressed as:

$$(10) \quad (PVB/PVC)_T = [1 - \frac{M(O)}{C(O)}] \{f[M(O)/C(O)-M(O)] \\ + g[C(O)-M(O)]\}$$

²⁰This assumes that $PVB_j > PVC_j$ for all possible programs.

Thus, management can determine the optimal proportion of the budget to be devoted to management activities by setting:²¹

$$(11) \quad \frac{d (PVB/PVC)_T}{d [M(O)/C(O)]} = 0$$

Unfortunately there does not appear to be much one can say about the optimal level of $M(O)/C(O)$ unless one knows the nature of the functions "f" and "g".

Table 5 shows the relationship between several of the key variables for a budget of \$100,000. From this table it can be noted that managerial expenditure per dollar of expenditure on programs increases exponentially as the ratio of managerial expenditure to total expenditure increases linearly. This would tend to offset the diminishing returns to management expenditure one would expect to find in equation (7). Another factor which would partially offset the diminishing returns to management would be the declining returns to program expenditures, $C(O) - M(O)$. For example, if $(PVB/PVC)_T = X$ when $M(O)/C(O) = 0.5$, then $(PVB/PVC)_P = 2X$. Now, if $(PVB/PVC)_T$ is to increase above X when $M(O)/C(O)$ is increased to 0.6, then $(PVB/PVC)_P$ must increase beyond $2.5X$ as there is now less money devoted to programs. However, at $M(O)/C(O) = 0.6$, there is \$1.50 expended on management per dollar expended on programs as

²¹This is the first order condition for a maximum. The second order condition would also have to obtain.

Table 5.--The relationship between management and program expenditures and related variables for an extension budget of \$100,000.

Total Budget C(O)	Management Expenditure M(O)	Program Expenditure C(O)-M(O)	Proportion Expended on Management M(O)/C(O)	Management Expenditure Per \$ Program Expenditure M(O)/C(O) - M(O)
\$ 100,000	\$ 0	\$ 100,000	0.0	\$ 0.00
100,000	10,000	90,000	0.1	0.11
100,000	20,000	80,000	0.2	0.25
100,000	30,000	70,000	0.3	0.43
100,000	40,000	60,000	0.4	0.67
100,000	50,000	50,000	0.5	1.00
100,000	60,000	40,000	0.6	1.50
100,000	70,000	30,000	0.7	2.33
100,000	80,000	20,000	0.8	4.00
100,000	90,000	10,000	0.9	9.00
100,000	100,000	0	1.0	

opposed to only \$1.00 when $M(O)/C(O) = 0.5$. If the marginal rate of returns to management were constant, $(PVB/PVC)_p$ would equal 3.0X at $M(O)/C(O) = 0.6$ but, as marginal returns to management likely diminish, $(PVB/PVC)_p$ will probably be somewhat less and it may, or may not, pay to increase $M(O)/C(O)$ to 0.6. As program expenditures are reduced by \$10,000 when $M(O)/C(O)$ is increased from 0.5 to 0.6, $(PVB/PVC)_p$ would likely also increase for this reason and further offset the diminishing returns to management. Thus, it appears that the optimal proportion of the budget to be devoted to management depends critically on the nature of "f" and "g" and one should not rule out any possibility (except perhaps 0.0 and 1.0) without some knowledge of these relationships.

Measurement of the effectiveness of a given amount of resources devoted to management is the second topic of consideration in this section. As "f" and "g" are not known in any useful form, a formal quantitative analysis of this problem is impossible. Thus, it is necessary to rely on a rather informal approach. This involves defining what extension managers must do as they perform the various managerial functions discussed earlier. If such duties do not appear to be being carried out, this would appear to be evidence of unsatisfactory performance. However, this approach has one critical weakness. It does not permit (at this stage) considering the costs and availability of obtaining personnel who would carry out such duties should the situation be encountered where they are not being

performed.

Detecting problem areas in rural communities requires that extension decision-makers be familiar with the current environmental factors described in Chapter III. They must be familiar both with the values and goals of rural people and the non-normative aspects of local conditions. This has typically been accomplished in the past by keeping extension agents resident in the local communities, and by hiring people with considerable familiarity with local conditions or, at least, with the ability to assess the relative importance of local problems.²² Presumably, if these avenues are not followed, some alternative means must be chosen. The lack of any such means appears to be a sign of managerial ineffectiveness. However, a large amount of time spent on this is also a sign of ineffectiveness in that it will reduce time available for other work.

Several methods are available whereby extension agencies may assimilate the sort of information necessary for making decisions. Universities, experimental stations, other research centers (either local or foreign) and agribusiness usually serve as the sources of new ideas. Extension agencies can keep up with these ideas by hiring people trained in technical agriculture and familiar with

²²This could be provided (to some extent) by university courses in the social sciences (sociology, communications, economics, etc.

these sources and also by having them keep in touch through personal contacts, special co-operative meetings, and similar ventures. In the U.S., university employers often have joint research-extension appointments which serve this purpose as well as facilitating the feedback of information on current problems to researchers. The lack of contact of extension workers with sources of new ideas also appears to be a sign of managerial ineffectiveness (unless such sources are not available). Of course, it is possible for extension workers to spend too much time in such pursuits especially if the new ideas are of little relevance to the rural people they serve.

Information on the relative success or failure of programs is important if extension workers are to learn from experience. As this information must relate to the agency, not just to individuals, it should be recorded for future reference. Cost records must be kept in a fashion which permits the costs of specific programs to be derived and cost ratios or indices useful for projecting future program costs to be calculated. Benefit flows corresponding to the same set of specific programs should be observed and measured. Although benefit flows may extend several years beyond program costs, extension workers can often make some estimates of these if they are trained to do so. Lack of appreciation of extension costs can readily lead to incorrect decisions and may be regarded as

a sign of managerial ineffectiveness.

Information on extension methods must be gathered so that extension workers can continue to improve their ability to carry out extension programs. This is often achieved by short courses or additional training in extension education, communications, or sociology. Lack of such in-service training would appear to indicate managerial ineffectiveness.

In addition to detecting problem areas and assimilating information which would suggest solutions to these problems and ways to extend these solutions, extension agencies must be able to evaluate whether new ideas are worthwhile and whether they (the agencies) can successfully promote them among their clients. While research may have provided several solutions to a given problem, one or two of these are likely to be more worthwhile than others and, at the same time, one or two (not necessarily the same ones) may be relatively easy to extend. Distinguishing these is essential if extension workers are to plan good programs. As suggested earlier, planning extension programs is not usually regarded as an optimization process - it is one of designing promising, feasible alternatives. Nevertheless, the more familiar extension people are with evaluating changes in rural society and the relationships between extension inputs and extension outputs, the more likely they are to come up with good feasible alternatives. Lack of such familiarity can therefore be regarded as a sign of

managerial ineffectiveness.

In order to cut down managerial costs, evaluations are often made on a rather intuitive basis before programs are completely planned. Following this sort of evaluation, a set of programs are planned which will exactly exhaust the available budget. To some extent this practice has merit as it avoids using resources to plan programs which are rejected later. However, to the extent that incomplete information on program costs and benefit flows are available, it may lead to poor evaluations.

The function of administering extension programs involves controlling expenditures and making the short-run (or tactical) decisions which are necessary to keep programs operating effectively. Modification of programs in operation, provision of supporting services for personnel, and performance of accounting and communication functions are some of the more common duties of administrators. Where such duties are not being performed, one can reasonably conclude that managerial ineffectiveness exists.

The function of responsibility-bearing is of particular importance in extension work. Each individual extension worker will have his own interests and, if these do not approximately coincide with those of the agency, extension performance may be severely curtailed. This comment takes on particular significance when one realizes that extension workers may often be in a position to do things which further their own self-interest, but contribute

nothing to the extension functions defined earlier. The usual method of reconciling employee and agency interests is to use the price mechanism. For this to be effective, employees must have a clear understanding of what agency objectives are and be willing to attempt to achieve these in return for their salaries. Also, there must exist some mechanism whereby salaries are curtailed if individual performance is not adequate. To avoid the "doctoring" of performance measures by extension workers who typically must make these measurements themselves, this mechanism requires careful design. Lack of mechanism for the reward of good performance and discouragement of poor performance can be taken to be a sign of poor managerial performance.

The preceding discussion suggests several signs of managerial ineffectiveness in extension agencies. It also suggests the following conclusions:

- (a) Detecting problems, analyzing possible solutions, and planning programs would appear to be the function of those extension personnel who are in intimate contact with local communities as they can be expected to develop a better intuitive feeling for such tasks than personnel who are not in such contact.
- (b) Broadly-trained personnel (i.e., personnel who have some training in technical agriculture and some in the social sciences) appear essential for extension field work. (This is supported by at least one empirical study.)²³

However, as noted earlier, consideration of the costs and

²³Alexander Grandison Warren, "A Study of Some Training Factors Associated with the Success or Failure of Co-operative Extension Workers", Unpublished Doctor of Education thesis, Oklahoma State University, August, 1960.

availability of personnel who would be effective managers cannot be incorporated in the framework for assessing managerial performance at this stage. This will be commented on in Chapter X.

Intermediate Measures of Extension Performance

Extension agencies have long been interested in evaluating their own work. They have been assisted in this regard by university departments of extension education, communications, agricultural economics, and rural sociology. Most such evaluations can be grouped into two general categories:²⁴

- (a) Examination of an agency's personnel and/or organizational structure in an effort to detect ways of changing it so that the agency will produce more effective extension work.
- (b) Measurements of the specific achievements of an extension program in comparative or absolute terms, on the basis of program impact, number of changes actually made, number of people influenced or similar variables.

These general classes of evaluations appear to be examining what have been referred to in this study as extension management and program operation activities, respectively. The measures of performance used in such evaluations are more easily obtained than those used in this study but they do not provide as "complete" an assessment of performance.

²⁴Ivan Agudelo S., "Evaluacion de Algunos labores de extension en el area de Giradota, Colombia", Unpublished Master's thesis, Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica, 1967.

Thus, they are referred to here as "intermediate" measures.

The "intermediate" measures used in the evaluation of personnel usually involve measures of personnel qualifications, attitudes, and knowledge about extension methods, objectives, and so on.²⁵ Criteria for evaluating organizational structure are usually "rules-of-thumb" established on the basis of previous experience regarding what will or will not facilitate program planning and operation. As the earlier discussion of measuring managerial performance has indicated, such procedures are probably more useful than any formal analytical structure available at present. Of course, care needs to be taken in using guidelines developed in one part of the world to evaluate managerial performance in another.

Measuring program performance is a different matter. Intermediate measures of program performance may be divided into three categories: indices of work performed by personnel, indices of changes in knowledge on the part of program participants as a result of extension programs, and indices of change made in technical practices as a result of extension efforts.²⁶ The first of these categories usually includes measures such as numbers of visits, phone calls, demonstrations, meetings, and/or other activities

²⁵ An example of this sort of evaluation is a 1962 study entitled, An Analysis of Five Extension Agencies in Colombia prepared by J. Di Franco and R.A. Clifford of I.I.C.A., Turrialba, Costa Rica.

²⁶ The study of Agudelo (see footnote 37) discusses the first of these two categories briefly and uses both of the last two to evaluate extension work in the Girardota area.

carried out in a given period. The second requires the questioning of program participants on specific subject matters in a manner similar to the examinations conducted in formal educational courses. The third incorporates specific information regarding when adopters were made and why they were made. Such technical criteria can, under certain circumstances, be consistent with the economic criteria already discussed. Where this is so, it is desirable to use them because they can usually be measured more cheaply than $\frac{PVB}{PVC}$ ratios.

However, these intermediate criteria can, at times, conflict with the economic criteria developed in this study and, where this occurs, reliance on intermediate criteria can result in the choice of inefficient extension programs. For example, indices of extension work performed do not necessarily have any positive relationship to changes in rural society, let alone to $\frac{PVB}{PVC}$ ratios. Indeed, they may have a negative relationship as there may arise a tendency for field workers to concentrate on the activities being measured as opposed to others which are not measured. This could be expected to result in a decline in productivity. Also, as pointed out earlier, changes in knowledge (managerial changes) are not necessarily valuable. Thus, examinations on subject matter may not measure valuable results. Independent evidence would be required to assess whether or not the knowledge gained was useful.

The fuzzy nature of the connection between "intermediate" criteria and economic criteria can be illustrated by the following example. Agudelo discovered that the attitude of rural people towards the extension service, which is sometimes used as a measure of extension performance, was positively related to adoption of practices in the Girardota area of Colombia.²⁷ As adoption is related to benefit flows in the manner discussed earlier, this would imply that a favorable attitude towards the extension service is positively related to benefit flows. However, it is not clear whether or not this relation is causal and, even if it were, it might be causal in either direction or involve positive feedback effects. Furthermore, no measure of rural people's attitudes can possibly incorporate the negative effect of extension costs into the analysis. Thus, one would seem to be on very shaky ground if one concluded that the efficiency of extension work was positively correlated with the attitude of rural people towards the extension service. (Of course, one might be correct in concluding that extension benefits were positively correlated with this "intermediate" criterion of performance.)

Some extension evaluation studies²⁸ appear to be

²⁷Agudelo, op. cit., p. 79.

²⁸J. Neil Randabdugh, "Evaluating Extension Education", Evaluation in Extension, prepared by the Division of Extension Research and Training, Federal Extension Service, U.S.D.A.

analyzing extension work by attempting to minimize costs per unit of extension output. This procedure necessarily involves the assumption that expected value per unit of output is independent of the method or system employed. In the case where it is desired to speed up a group of technical changes, output might be measured in terms of number of farm contacts or number of changes made. However, such measures of output may easily have different unit values depending on how they are achieved. If, for example, an extension service decides to reduce costs per farmer visited by having their agents concentrate on smaller areas and visit more farmers in those areas with no change in the total amount of resources employed, there appears to be a strong possibility that unit returns achieved by visiting additional farmers would be different from original unit returns. This possibility arises because of the diffusion phenomenon and the fact that the additional farmers visited may not influence the adoption distribution in the same way as the original farmers.

The use of number of changes made by program participants as a measure of output also bears this shortcoming as it completely overlooks diffusion possibilities. (Of course, in a population where diffusion is non-existent, these measures could be useful.) However, while existing evidence suggests that rates of diffusion differ greatly among populations and that in most areas there are a few farmers from which diffusion is virtually nil, there

does not appear to be any evidence to suggest that there are social systems where diffusion is non-existent.) This measure of output also bears the weakness that all types of changes are considered to be of equal value. This appears to be quite an unlikely event and should be investigated before any conclusion is reached in this regard. One might be better off to form a weighted index of changes deriving the weights from extension workers' opinions of profitability and likely extent of diffusion than to assume all changes of equal value.

CHAPTER VI

EXTENSION ACTIVITIES OF THE CAUCA VALLEY CORPORATION

This chapter serves primarily as background for Chapter VII which constitutes the main analysis of CVC's 1967 programs. Most of the data used in the subsequent analysis are presented and/or discussed in this chapter in order to provide a clear picture of both the shortcomings and potential of this part of the study. As some considerable difficulty was encountered in acquiring similar sets of data for all 1967 extension programs, it is hoped that the verbal discussion will make some contribution towards bridging the gap created by this deficiency.

The Setting in Which the CVC Operates

The Cauca Valley Corporation - or the CVC as it is commonly known - is an autonomous public agency created by Colombian Legislative Decree 3110 on October 22, 1954. To some considerable extent it was patterned after the Tennessee Valley Authority of the United States. Its original purpose was described by one Colombian writer as follows:

[The CVC was assigned] the mission of transforming the Upper Cauca Valley and its surrounding regions: that is, to produce more and better

quality foods at lower prices; more electric power for factories, homes, and farms; more and better transportation systems at lower costs; and in general, improved economic, social, and cultural conditions for all the inhabitants, through better and more intensive use of natural resources.¹

For almost fifteen years the CVC has worked in an effort to carry out this mission. It now appears to have become a permanent feature of the Colombian landscape although some of its original objectives have been considerably modified. For example, it was originally intended to be a regional rather than departmental organization. However, its activities are now confined almost entirely to the Valle del Cauca.

Valle del Cauca is located in the west-central part of Colombia. Figure 8, illustrates some of its geographical characteristics. The flat valley floor accounts for a relatively small proportion of the total land area of the region, but about one-third of the land in farm units is located there. This area also supports a large part of the department's population. Cali, Colombia's third largest and fastest growing city, is located at the western edge of the valley floor. Several other small cities are located along the Cauca River. Buenaventura, on the west coast, is primarily a port city with relatively little industry. However, about one-quarter of a million people live in the

¹Antonio J. Posada, "Sentido y Espirita de la CVC," La Nueva Economía, Vol. 1, No. 2 (April 1961), Bogotá, p. 222.

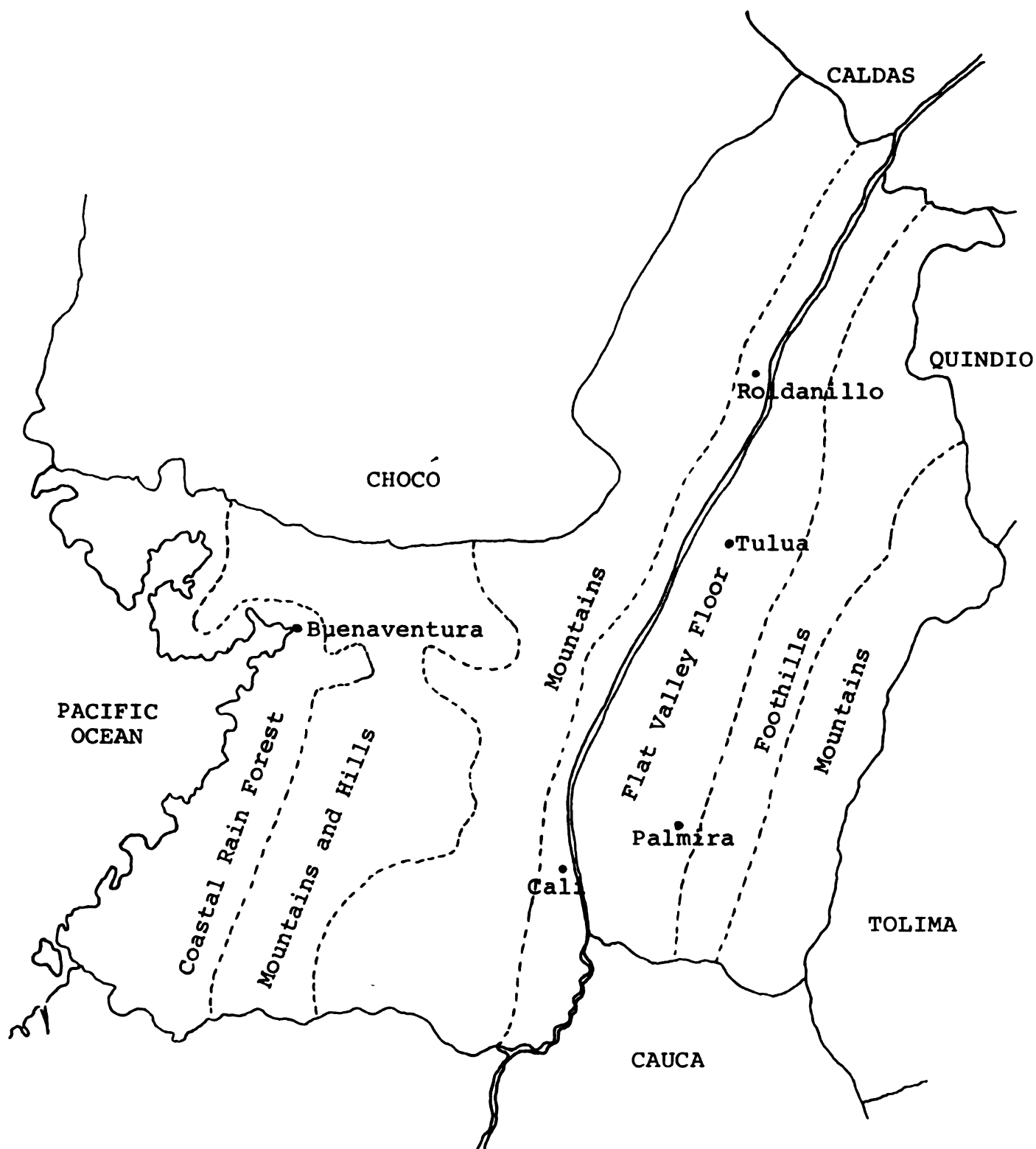


Figure 8.--Map of Valle del Cauca showing principal geographical areas and office locations of the CVC's Extension Service in 1967.

Buenaventura area. Their pattern of life is somewhat primitive and the area is noted for its high unemployment, lack of economic opportunities, and serious malnutrition problems. In general, the mountains and hills are not well suited for intensive cultivation but many parts are used for this purpose by subsistence farmers.

An estimated land use pattern for land in farm units in Valle del Cauca in 1956 is shown in Table 6. A large proportion of the coffee, plantain, and pasture is located in the mountains and hills. Sugar, corn, beans, cotton, rice, bananas, and pasture predominate in the valley. This area has an average temperature of 75 to 80 degrees Fahrenheit. The mountain areas are cooler but frost is unknown in the habited parts. Dry and rainy seasons alternate fairly regularly by three-month periods producing two rather distinct cropping seasons in each year. Agricultural output of the Department and particularly the valley floor, has been increasing somewhat faster than for Colombia as a whole.

The number and area of farm units in Valle del Cauca according to size and main type of activity as they existed in 1959 are shown in Table 7. This table illustrates the concentration of land holdings (which is prevalent in most parts of Colombia), emphasizes the importance of cash-crop farming in the region, and suggests that a large part of the commercial agricultural output of the area, particularly of the valley floor, is controlled by relatively few farmers.

Table 6.--Estimated land use pattern for land in farm units
in Valle del Cauca in 1956^a

Land Use	Hectares	%
Temporary Crops		
- Rice	7,800	0.7
- Barley	1,500	0.1
- Beans	13,200	1.1
- Corn	43,100	3.7
- Millet	3,700	0.3
- Cotton	7,300	0.5
- Potatoes	1,900	0.2
- Tobacco	500	-
- Wheat	900	0.1
- Cassava	4,100	0.4
- Others & Fallow	40,800	3.5
Permanent Crops		
- Bananas	9,000	0.8
- Cacao	1,900	0.2
- Coffee	105,500	9.0
- Sugar	80,100	6.9
- Plantain	31,700	2.7
Permanent Pasture	576,100	49.3
Mountains & Forest	184,400	15.8
Other (Lands, Buildings, etc.)	54,400	4.7
Total	1,167,900	100.0

^aAdapted from DANE's 1965 Encuesta Agropecuaria. (DANE is an abbreviation for Departamento Administrativo Nacional de Estadística which is the official agency for compiling economic and population statistics in Colombia.)

Table 7.--Number and area of farm units in Valle del Cauca in 1959 according to size and main type of activity^a

Type of Activity	Less Than 4 Hectares		4 to 30 Hectares		30 to 200 Hectares		More Than 200 Hectares	
	No.	Hectares	No.	Hectares	No.	Hectares	No.	Hectares
Cropping	22,212	35,902.1	16,935	183,945.4	2,635	159,494.3	212	121,300.2
Dairy	257	513.9	590	8,494.4	859	71,371.1	175	75,775.3
Beef	825	784.8	629	8,590.2	739	63,562.6	228	118,540.5
Mixed Livestock	20	41.6	168	2,791.6	377	32,895.1	193	91,381.4
Livestock and Cropping	169	409.2	1,044	15,747.7	924	70,388.0	195	98,383.3
Poultry	1,260	478.5	51	471.3	14	965.8	1	259.2
Abandoned	38	65.4	34	476.2	33	2,882.1	6	2,035.2
Total	24,781	38,195.5	19,451	220,517.8	5,581	401,559.0	1,010	507,675.1

^aAdapted from Censo Agropecuario del Valle del Cauca - 1959, (Cali, Colombia: University of Valle, Faculty of Economic Sciences, 1963), p. 15.

Some of the social characteristics of the rural areas of the department can be illustrated by Table 8 which shows the percentage distribution of the population by age and education. The high proportion (78.3%) of the population under 34 reflects the low life expectancy, high birth rate, and high out-migration rate in the area. These data suggest that at least 50 per cent of the rural population are, for most purposes, illiterate and that close to 90 per cent of this group have had no more than three full years of schooling. These data also indicate that, while education levels are improving over time, the rate of improvement is slow. Data from the same source show that about 35 per cent of farm operators have less than one year of education, 75 per cent have less than three years, and 95 per cent have less than five years. Thus, while this group is somewhat better educated than most rural people, many farm operators (perhaps 50 per cent) probably cannot read effectively.

CVC's activities since its inception have included land reclamation projects, power generation, transmission, and distribution projects, reforestation programs, agricultural extension work, soils research, mapping and testing, and various small development projects. CVC now owns and operates most of the electric power sources in the Cauca Valley. The history of CVC's activities and the manner in which they have been financed are illustrated in Table 9 which summarized CVC's revenues and expenditures for 1955 and

Table 8.--Distribution of population by age and education levels for rural areas of Valle del Cauca in 1964^a

Age Group	% of Total Population	% of Population in Age Group by Education Level Achieved				
		Less Than 1 year	1-3 Yrs.	4-5 Yrs.	6-8 Yrs.	9-11 Yrs. Others
0 - 4	18.7	100.0	--	--	--	--
5 -14	28.9	59.7	36.2	3.8	0.3	--
15 -24	17.7	21.7	55.7	19.0	2.7	0.7 0.2
25 -34	13.0	26.3	52.0	18.5	2.1	0.7 0.4
35 -44	9.4	30.0	49.6	17.9	1.6	0.6 0.3
45 -54	6.3	34.7	46.3	16.9	1.4	0.5 0.2
55 -64	3.5	42.0	41.1	14.8	1.2	0.7 0.2
65+	2.5	55.1	33.6	9.7	0.9	0.5 0.2
	<u>100.0</u>	<u>51.1</u>	<u>37.1</u>	<u>10.3</u>	<u>1.1</u>	<u>0.3</u> <u>0.1</u>

^aCalculated from DANE's, XII Censo Nacional de Población, (Julio 15 de 1964), Valle del Cauca, (Bogotá, Colombia: Mimeographed, 1967), pp. 208-220. Areas outside of the county seat (cabecera) were considered as rural.

Table 9.--CVC revenues and expenditures: 1955 and 1963^a

Item	1955	1963
Sale of Electricity and Other Services		7,267,216
Real Estate and Liquor Taxes		14,229,667
Appropriations & Grants from Nation	250,000	10,296,048
Appropriations & Grants from State	1,050,000	1,110,468
Appropriations from Municipalities		88,217
Grants from Other Agencies		3,022,500
Bank Loans		70,134,967
Other Credit Resources		262,092
Shares in CHIDRAL Profits		17,682,000
Advances for Miscellaneous Works		13,988,968
Capital Contributions		995,935
Other Incomes		667,409
Total Revenue	1,300,000	139,745,487
Administration Expenses ^b		(3,899,784)
Project Operation and Maintenance	(193,170)	7,045,686
Engineering Studies	664,761	1,045,686
Land Reclamation Projects	17,975	7,508,745
Power Projects	279,762	97,156,101
Subsidies on Debt Payments		
Miscellaneous Works		3,489,534
Agricultural Programs		3,539,242
Regional Studies		335,066
Purchase of Power & Other Projects		18,922,460
Purchase of Equipment	290,628	2,255,380
Total Expenditures	1,233,126	141,707,053

^aAntonio J. Posada and Jeane A. Posada, CVC, Challenge to Underdevelopment and Traditionalism, (Bogotá, Colombia: Tercer Mundo, 1966), p. 169 and p. 189. Costs are measured in Colombian pesos.

^bAdministration expenses have already been pro-rated among other expenditure categories.

1963. A heavy dependence on bank loans (mainly from international agencies) is evident. These funds have, of course, been used primarily for long-term investments such as electric power generation. The figures also show that agricultural programs have represented a relatively small proportion of CVC's total expenditures. About 70 per cent of the funds allocated to agricultural programs have been used to operate the agricultural extension service.

A Brief History of CVC's Extension Activities

In 1956 the CVC assumed responsibility for an extension service which had previously been operated by the Federal Ministry of Agriculture. The Ministry of Agriculture continued to supply funds for this service and, as a result, retained some considerable control over its general policy. In the late fifties and early sixties, CVC also worked closely with STACA and adopted many extension practices used widely in the United States. During this period many extension workers received training through STACA programs and from I.I.C.A. personnel from Turrialba, Costa Rica.

Prior to 1966 the CVC attempted to maintain a fairly complete, general extension service such as that operated in the U.S.A. However, because of limited resources only about ten field offices could be operated. Thus, each field office had to service a relatively large area and some parts of the region were entirely without CVC's extension services. Each

field office was staffed by three to five extension workers. A typical office would include one professional agriculturalist, one assistant working primarily with boys' 4-H Clubs, one assistant working primarily with women's and girls' clubs, and one secretary. The assistants usually had some technical training but were not university graduates. Annual reports during this period usually included statistical summaries of numbers of 4-H Clubs, club members, farm visits, results, demonstrations, movies shown, meetings held, and various other activities. Club work, farm meetings and individual farm visits were the principal extension methods in use. Subject matter specialists were employed to assist field personnel. A fund was created to aid in the financing of various projects, particularly in connection with 4-H programs.

Some effort was made to ensure that the CVC's extension service complemented other such activities in the region. As the National Coffee Federation operated a relatively comprehensive program in the mountainous and hilly areas, the CVC confined their operations mainly to the valley floor. Furthermore, they also avoided working with producers of crops such as cotton, rice, and sugar because these farmers already had access to technical assistance through their Federations.

The CVC extension service has experienced what appears to be a relatively high rate of turnover of personnel

since 1956. A 1961 study indicated that 60 per cent of the people on the staff at that time had been with the service for less than two years.² By actual count, 60 per cent of the people on the staff in January, 1962 were no longer on the staff in January, 1967. Some of these changes occurred because of the number of employees declining from about 55 in 1960 to slightly less than 40 in 1967.³ However, even when this is taken into account it would appear that, for an extension service, the rate of turnover of personnel was undesirably high. A 1961 study pointed out that many of the professional agriculturalists did not remain in the same office for more than one year.⁴ Thus, while the CVC was attempting to follow North American extension practices, it apparently was unable to achieve one important feature of the North American system - continuity of personnel.

Partly because of this reduction in staff and partly because of changes in programs, the CVC has deemed it

²Jorge Ramsey and Roy A. Clifford, "Analisis del Servicio de Extension Agropecuaria de la Corporación Autonoma Regional del Valle del Cauca," A Mimeographed Report of the I.I.C.A., Turrialba, 1961, p. 20.

³This decline took place even though total expenditures in constant pesos (1954-55 = 100) increased from 496,000 in 1956 to 777,000 in 1967. (Expenditures were 540,879 pesos in 1956 and 2,803,578 pesos in 1967). Average real costs per employee therefore approximately doubled during this period. It would appear that this increase was due to both increases in real wages and real increases in costs of associated inputs such as transportation, materials, and supplies.

⁴I.I.C.A., "Informe de Visita al Servicio de Extension de la CVC," A Mimeographed Report by a group of I.I.C.A. students, Turrialba, 1961, pp. 5-6.

advisable to close a number of field agencies in recent years. By 1967 only five office locations were being maintained: Cali, Palmira, Tuluá, Roldanillo, and Buenaventura. In 1968 the Roldanillo office was closed as part of a CVC - INCORA⁵ agreement whereby INCORA assumed responsibility for a number of CVC programs (including agricultural extension) in this area. As this study was being conducted, the Palmira office, which was located at the I.C.A. experiment station, was also closed. The principal reason for this decision was that the Palmira extension workers all lived in Cali and it was considered more efficient for them to function out of the Cali office. Thus, at this writing, only three office locations existed: Cali, Tuluá, and Buenaventura.

About 1966, a significant change took place in that part of CVC's extension operations which were directed at farm production units. Prior to this time much effort had been directed at very small farming operations (minifundia). In 1966, programs were designed to reach larger producers and some of the previous programs were discontinued. According to the head of CVC's agricultural department, it was concluded that previous efforts were having little affect on production and there was little future for the very small producer in agriculture. Therefore, CVC administrators believed greater social returns could be achieved at the

⁵INCORA is Colombia's national land reform agency.

same cost by working with producers who controlled larger volumes of production.

In examining reports and talking with CVC employees, this writer ran across a number of problems which appeared to re-occur frequently over the years during which the CVC has operated the extension service. These included lack or inconvenience of transportation, lack of equipment and materials, low salaries, frequent failure of extension programs, and an excess of reports which apparently did not appreciably aid personnel in solving the previous problems. This writer is not in a position to say to what extent these comments were justified prior to 1967 but they nevertheless provided useful aids for the orientation of this research.

Many CVC extension programs are designed to coincide with the agricultural rather than the calendar year. In view of this circumstance and the way available data had been recorded, it was decided to examine the activities of the extension service for the period April 1, 1967 to March 31, 1968. It was considered that this period approximated the agricultural year sufficiently closely so that a useful analysis could be carried out.⁶ During this period six major programs were operated: a livestock program (Fomento Ganadero); an apiculture program (Fomento Apicolá); a fertilizer and farm planning program (Fertilización y Planificación de Fincas); home economics assistance (Asistencia a la

⁶The two fairly distinct cropping seasons which occur annually in Valle extend from October to March and April to September, respectively.

Familia Campesino); boys' 4-H Clubs (Educación Rural); and special Pacific Coast programs (Fomento y Extension Costa del Pacific). Several minor programs were also operated. Field personnel time was distributed among the five offices as follows: Cali, 29.5 per cent; Palmira, 19.5 per cent; Tuluá, 14.7 per cent; Roldanillo, 12.4 per cent; and Buenaventura, 23.9 per cent. Supervision was handled from the Cali office and involved one professional agriculturalist and one assistant as well as secretarial services. A total of six secretaries and two chauffers were employed by the extension service.

In 1967 several different classes of field personnel were employed in the extension service. Many were professional agriculturalists (ingenieros agronomos and veterinarios) with university training in agronomy and animal husbandry. (Both the agronomos and veterinarios have significantly different training experiences than their North American counterparts.) However, many non-professionals were also employed. These included both male and female personnel. The former group (practicos) were usually involved with boys' 4-H Clubs and the latter group (mejoradoras de hogar) were mainly responsible for home economics assistance. Agronomos were involved in virtually every program because of a rather unique organizational structure whereby both program heads and office supervisors were designated. As the mejoradoras and practicos did not possess university degrees, all such responsibilities fell to the agronomos.

Costs for CVC's 1967 Extension Programs

An expense statement for the major programs in the period under consideration was supplied by CVC's Accounting Division.⁷ However, this statement was found to be unsuitable for the purpose of this study for two reasons. Firstly, the costs of the minor programs which were operated during this period were not separated from the costs of the major programs. Secondly, personnel and transportation costs had not been allocated to the major programs correctly. Therefore, a revised cost statement was constructed (see Table 10).

In the revised cost statement minor program costs have been separated from major program costs. Costs of extension personnel have been allocated among programs on the basis of time spent in these programs. Vehicle operation costs have been allocated on the basis of the number of kilometers recorded in the respective programs. The number of kilometers recorded in each program was based on personnel time (for those who drove cars) and average number of kilometers recorded per day. Costs of chauffeurs were calculated in the same way as those of extension personnel. The resultant total estimates of personnel costs were essentially the same as those supplied by the Accounting Division although

⁷ See Appendix B, Table B-1.

Table 10.--Revised estimate of the costs of operating the extension service of the CVC for the period April 1, 1967 to March 31, 1968^a

Description of Cost Items	General Supervision	Live-stock Program	Apiculture Program	Fertilizer & Farm Planning Program	Home Economics Assistance	Boys' 4-H Clubs	Pacific Coast Programs	Other Programs	Total
Personnel Costs^b									
Wages and Salaries	91,043	144,457	55,751	49,883	201,210	147,579	124,509	182,589	997,021
Fringe Benefits ^c	49,164	78,008	30,106	26,938	108,653	79,694	67,235	96,502	536,301
Professional Fees	-	2,050	-	-	-	-	22,128	-	24,178
Sub Total	140,207	224,515	85,857	76,821	309,863	227,272	213,873	279,091	1,557,500
General Expenses									
Materials and Supplies	8,810	7,927	2,224	2,282	5,407	7,466	53,806	2,500	90,422
Vehicle Operation	-	26,277	42,366	15,143	44,710	67,300	18,974	9,879	224,649
Costs of Chauffers ^d	-	-	14,000	-	11,267	10,567	-	-	35,834
Travelling Expenses of Extension Personnel	1,457	9,781	6,677	3,234	2,515	15,080	6,825	2,007	67,576
Office Rental	3,217	1,200	-	-	1,500	1,500	6,933	-	14,350
Maintenance & Upkeep of Offices and Equipment	3,272	200	470	777	-	-	4,866	-	9,585
Miscellaneous	4,784	3,221	2,730	1,993	864	868	20,087	2,000	36,547
Sub Total	21,540	48,606	68,467	23,429	86,263	102,781	111,491	16,386	478,963
General Supervision Administration	161,747	25,621	9,800	8,769	35,359	25,936	24,406	31,856	-
	-	77,588	44,005	29,121	104,025	94,084	103,542	84,965	537,330
Grand Total	-	376,330	208,129	138,140	535,510	450,074	453,312	412,298	2,573,793

^aCalculated from data supplied by CVC's Accounting Department and CVC field personnel. All costs are in Colombian pesos.

^bDoes not include salaries of chauffers.

^cPrestaciones Sociales.

^dIncludes travelling expenses of chauffers.

the allocation among projects differed significantly.⁸ Transportation costs were originally calculated by the Accounting Division using an average cost per kilometer (including cost of chauffers) of about 1.40 pesos whereas the revised costs were calculated at 0.6088 pesos⁹ per kilometer plus the costs of chauffers actually used by the extension service. As the costs of chauffers represented slightly more than half of CVC's total transportation costs and the extension division used chauffers considerably less than other divisions, a significant reduction in the estimate of total transportation costs resulted. Proportionate allocations of transportation costs among the programs also changed significantly. Accounting data for items other than personnel and transportation costs were accepted with some pro-rating to other programs. The estimates of administration costs provided by the accounting division were also accepted. These represented the extension service's share of the total costs of CVC's administrative structure which included accounting, personnel, and transport divisions as well as various executive positions. The costs of extension supervision were re-estimated along with

⁸ Estimates of the time spent in various programs were obtained from field personnel individually. Salaries paid were obtained from the payroll office. Employee benefits were calculated using a factor of 54 per cent of wages and salaries. This factor was supplied by CVC's accounting division and its make-up is shown in Appendix B, Table B-2.

⁹ The estimate of 0.6088 pesos per kilometer represents all vehicle operation costs except the costs of chauffers. The calculation of this figure is shown in Appendix B, Table B-3.

extension program costs. Supervision costs include the costs of personnel employed full-time in directing the day-to-day operations of the extension service together with the associated items necessary for performing this function. Both administration costs and extension supervision costs were prorated to the various programs to obtain estimates of total program costs. The final estimates of individual program costs may be regarded as estimates of the costs of both "operating" and "managing" 1967 programs, although, in reality, some of the managerial costs attributable to 1967 programs had been incurred in previous years and some of the 1967 costs could be attributable to management activities related to future programs.

Direct personnel costs (salaries and fringe benefits of field and office extension workers) in the revised cost estimate accounted for 60.5 per cent of the total costs. Administration was the next largest item accounting for 20.9 per cent of total costs. Probably 80 or 90 per cent of the administration costs were salaries and fringe benefits of office personnel. Transportation costs represented 13.0 per cent of the total. Data on personnel time for various programs were analyzed¹⁰ to arrive at estimates of the average total costs per day for various classes of personnel. This was further subdivided into "salaries and fringe

¹⁰Appendix B, Table B-4.

benefits" and "other costs".¹¹ These data are shown in Table 11 along with number of days of field personnel time and estimated total costs of employing each class of personnel. Approximately 56 per cent of total costs were attributable to the activities of the agronomos and veterinarios. "Salaries and fringe benefits" varied considerably by class of personnel while "other costs" were approximately the same for all classes except the mejoradoras de hogar. This was accounted for by the fact that their work involved less travelling than the work of either the agronomos or the practicos and they used somewhat less material and supplies.

As the system of allocating administrative expenses ensured that these would increase proportionately with increases in programs and supervision costs, it was not possible to accurately distinguish variable and fixed costs. The marginal cost of employing additional personnel was probably at least equal to direct program costs because additional transportation, materials, and supplies would almost surely be required with each personnel increase. Some increased "administration" might also be required. If it is assumed that both supervision and administration are fixed while all other items are variable, variable costs would be 73 per cent of total costs. Thus, it appears that a large

¹¹ Average "salaries and fringe benefits" per day were calculated independently and "other costs" were calculated by subtracting "salaries and fringe benefits" from total costs per day.

Table 11.--Field personnel time, average daily costs, and total costs by class of field personnel

Class of Personnel	Number of Days	Salaries & Fringe Benefits per Day (Pesos)	Other Costs per Day	Total Costs per Day	Total Costs (Pesos)
<u>Agronomos and Veterinarios</u>	3,354	282	151	433	1,453,254
<u>Mejoradoras de Hogar</u>	1,898	112	109	221	419,610
<u>Practicos</u>	1,763	112	153	265	446,700
<u>Obreros</u>	1,200	50	145	195	233,880
All Classes	8,215	173	140	313	2,573,793 ^a

^aThis column does not add up because the total of the expected costs for the regression equation used to calculate Total Costs per Day does not exactly equal actual total costs. (See Appendix B, Table B-4).

part of the total costs per day would be incurred if the extension service were expanded. However, as perhaps 10 to 20 per cent of total costs are fixed - or at least do not appear to increase linearly - it would appear that a somewhat larger operation would have slightly lower costs per day rather than equal or higher costs.

Description of 1967 Extension Activities

Because of cost restrictions on this research and the nature of the benefits being produced by the various programs it was impossible to evaluate program benefits as precisely as program costs. However, detailed program descriptions were obtained from extension workers and lists of recommended practices were compiled. For three programs it was possible to survey samples of the program participants to acquire information about the services received and how they were being used. For the remaining major programs it is only possible to describe their general nature and suggest possible factors influencing their relative effectiveness. It was necessary to ignore entirely those activities classified as minor programs.

Livestock Program

This program was operated in both the Cali and Roldanillo - Tuluá areas. Costs of operation for 1967 were estimated at 190,832 pesos and 185,508 pesos for activities in these respective areas. Almost all extension work was

achieved through visiting individual farmers and advising them on their operations. Towards this end about fifty farmers were contacted by the extensionists in the Cali area and about forty in the region between Roldanillo and Tuluá. A number of the farmers contacted in both areas were not interested in the program and only about fifty of the ninety farmers contacted could be regarded as participating in the program. Thus, extension costs per participating farm were about 7330 pesos. Most of the farms in the program were medium to large in size (50 to 200 head of cattle - dairy and/or beef) and there was little doubt that size of operation would not be a severe restriction on the possible utilization of new techniques.

A list of recommendations¹² made by extension personnel was obtained from one of the agronomos working on the project and this writer accompanied him to one of the co-operating farms. It was quickly evident that, although some measures of changes made might be obtained, the evaluation of these would prove to be extremely difficult. Many of the practices recommended (e.g., artificial breeding, better selection procedures, improved pastures) would produce returns only after several years of use and would require a number of years of good farm records to detect. Few measures of income or income increases were available from either the

¹²These recommendations covered the areas of feeding, breeding, and herd health care. Most of the recommendations in the area of feeding concerned pasture improvement as pasture constitutes the main part of the ration.

farmers or CVC employees although some production records were being maintained or initiated in a number of cases. Therefore, no attempt was made to interview participants in this project or evaluate actual changes made.

However, the CVC had prepared a project proposal early in 1967 and this is reproduced here to acquaint readers with the project and CVC's method of project analysis.

I. Description of the Project

A. Nature of Project

During the operation of this project live-stock farmers and their employees will be trained and educated in aspects of animal health, better handling of their pastures and cattle and the latest techniques for operating livestock farms; and the credit devoted to these farms will be directed to better uses.

B. Specific Objectives of the Project

1. To familiarize livestock farmers with modern management practices.
 - a) Economic analysis of the livestock farm
 - b) Pasture improvement
 - (i) division of pasture fields
 - (ii) analysis of soils
 - (iii) fertilization
 - c) Systems of livestock records
 - (i) health - vaccination
 - (ii) production (milk and beef)
 - (iii) calving
 - d) Improvement of livestock
 - e) Specialization of the operation
2. To increase the productivity of livestock farms.
3. Better utilization of the resources of the farms.

C. Localization

Department of Valle and the North part of Cauca. Municipalities in Valle; Dagua, Jamundi, Cali, Palmira, Candelaria, Cerrito, Guacari, Buga, San Pedro, Tuluá. Municipalities in Cauca; Santander de Quilichao, Puerto

Tejada.

The operation of the livestock program has been divided into two zones: the northern zone includes Valle from Cartago to Buga inclusive, and the southern zone services the municipalities of Valle from Cerrito to Jamundi: together with the northern part of Cauca.

D. Current State of the Project¹³

Data for the operation of this project are obtained about pastures from I.C.A., about soils from I.G.A.C. and CVC, from reports of the Fondo Ganadero, from the review of the Banco de la Republica, from work of the Livestock Sections of the CVC, from livestock censuses of DANE, etc. With this information and with the visit of the French Mission assigned to C.A.R., their [the French Mission's] system will be adapted to the conditions of Valle.

E. Stages of the Project

Even though the progress of the project depends on the physical condition of the farm, and the economic situation and the attitude of the farmer, the following general stages can be established:

- farm inventory
- determination of problems
- economic study of the farm (at beginning of the project)
- agreement of criteria between owner and extensionist
- work plan
 - a) size of farm and topography
 - b) soil study
 - c) irrigation feasibility study
 - d) pastures
 - seeding
 - improvement
 - subdivision and rotation
 - e) fertilization

¹³I.C.A. refers to the Colombian Agricultural Institute, I.C.A.C. refers to the Institute of Livestock and Crop Producers; C.A.R. refers to a regional agency similar to the C.V.C.

- f) animal husbandry
 - feeding
 - health and sanitation
 - management
 - selection
 - care of calves
- g) livestock records
- h) periodic economic studies for extension project

II. Relation and Influences of the Project with Projects of Other Organizations

- A. In relation to the need for human resources, advice will be available later from the French Mission now assigned to C.A.R., Bogotá.
- B. Influence on projects in operation or to be operated by other organizations.
This project is complementary to those under the auspices of the Livestock Fund of Valle.

III. Justification of the Project

A. Economic Benefits

- 1. Production of exportable commodities
 - production of beef for export in fewer years
 - production of foreign exchange quickly
- 2. Production of commodities for popular consumption: milk and beef
- 3. Increase in productivity
More profits with less investment than at present.
- 4. Reduction of costs as a result of higher productivity per unit of area.

B. Social Benefits

- specialization of labor
- better product for the market (health)

C. Type of Farmers Who Would Benefit

- 20 medium size farms
- 20 larger farms

D. Region Which Would Benefit

- appears in the localization of the project

E. Priority of the Project

- [left blank in original document]

- F. Technical Studies that Back the Project
 Different bulletins about pastures and feeding by I.C.A.; the systems of Program Planning of the French Mission; work experiences of the CVC.

IV. Annual Cost of the Project

Salaries of two <u>Veterinarios</u> , two <u>Agronomos</u> and one secretary	212,900
<u>Fringe Benefits (Prestaciones Sociales)</u>	117,100
Materials and Supplies	30,000
Travelling Expenses and Transportation	197,000
Public Services	1,000
Communication Services	7,000
Printing and Publications	5,000
Office Rental	5,000
Visitors Expenses, Meetings and Exhibits	5,000
Maintenance and Insurance	3,000
Miscellaneous	20,000
Total	603,000 ¹⁴

The Apiculture Program

The objective of this program was to expand honey production (both by increasing the number of honey producers and increasing output per producer) and, by so doing, to increase the incomes of farmers involved in this activity.¹⁵ Advisory work was directed at individual honey producers and at apiculture clubs which included both bee-keepers and other persons interested in learning about honey production. Clubs were sometimes operated in co-operation with rural schools and between 10 and 40 students received instruction when the extension workers visited the school's apiary. The two

¹⁴Unpublished outline of CVC's 1967 extension programs prepared by the Extension Service. Translation by the author. Costs are measured in Colombian pesos.

¹⁵Ibid.

extension workers assigned to the project spent almost all of their time making visits to the individual producers or the clubs. They had established a specific set of demonstrations and instructions designed to show and inform interested people how to produce honey profitably.

In addition to working with the clubs and individual bee-keepers, the field personnel of the project engaged in the following activities:¹⁶

- (1) Organizing a bee-keeper's association with 138 members in Valle and surrounding departments.
- (2) Teaching a course in apiculture to 12 Peace Corps Volunteers working in Valle.
- (3) Organizing the third National Apiculture Conference in Cali. This was attended by 222 people from various parts of Colombia.
- (4) Investigating, in co-operation with the Association of Bee-keepers, the possibilities of developing an export market for honey.
- (5) Assisting bee-keepers in obtaining credit from the Caja Agraria,¹⁷ The total amount of credit granted during the year was 120,000 pesos.

Field personnel indicated that these activities took a relatively small amount of their time but, it was difficult to tell exactly what part they had played in them.

The program was operated out of the Cali office but bee-keepers in many parts of Valle del Cauca were visited. One agronomo and one practico were employed full-time in the program. Average total costs per day of field personnel time were 453 pesos. This was about 100 pesos per day higher than

¹⁶Annual report of the apiculture project for 1967.

¹⁷The national Colombian credit agency.

costs would have been had they been equal to the CVC average for the classes of personnel involved.¹⁸ The high costs were largely attributable to the large amount of travel involved and the fact that a chauffeur was assigned almost full-time to the program. In view of the fact that both apiculture clubs and individual producers were serviced, costs per participant are not a particularly useful measure for this project. Thus, costs per hive have been calculated instead. The total number of hives maintained by all program participants in 1967 was 418. Thus, average total costs per hive were 498 pesos.

It was difficult to establish any precise set of initial conditions for this project as many of the participant bee-keepers and clubs had also received assistance in previous years. It was also impossible to get very much data from participants on income increases due to the assistance received. However, several participant bee-keepers and clubs were visited and informally interviewed. The following information is based on those interviews and talks with extension workers involved in the program.

Most of the bee-keeping operations serviced were quite small by North American standards with the number of hives per bee-keeper varying from three to twenty-five. Most operations were secondary sources of income for the

¹⁸As shown in Appendix B, Table B-4, actual costs exceeded predicted costs by 48,202 pesos.

producers involved, although in some cases this income was quite significant. In a few cases, hives were merely old boxes and extraction procedures were primitive. Honey was usually sold in the local neighborhood or delivered to Cali for sale. Average price received appeared to be about twelve pesos per kilogram for a good quality product. However, some producers were located in areas where most sources of nectar available were sugar cane flowers and the resultant product somewhat resembled molasses. This product commanded a lower price.

Because the bee-keepers lived some distance from one another there was relatively little social contact among them, and little opportunity to exchange information. The bee-keeping clubs brought together people interested in bees but, in any given area, the potential honey production was such that only one or two of the members could actually become commercial producers. (The remainder of the members undoubtedly found that this training contributed to their general educational experience but it would be of little or no direct practical usefulness.) Some bee-keepers visited reported receiving technical assistance from other sources (e.g., the Coffee Federation).

Some bee-keepers reported substantial increases in production and profits as a result of the assistance received; others reported that losses resulted when they followed the advice of extension personnel. Total output of honey varied

from 10 to 40 kilograms of honey per colony per year depending on weather, diseases, and cultural practices followed. Thus, total revenue per colony ranged from 100 to 600 pesos. Costs of production involved mostly labor and this depended considerably on the size of the harvest and problems encountered. Some producers had increased their profits as much as 100 pesos per colony from following extension advice. However, the average increase was probably much less.

The Fertilizer and Farm Planning Program

This program was part of a co-operative project involving CVC, F.A.C. and a Colombian fertilizer company. During the period of 1962 to 1966 field trials were conducted on about 400 farms in Valle del Cauca in an effort to determine what analyses and levels of fertilizer would be profitable for a number of crops in different areas. Similar programs were also operated in other parts of Colombia. This part of the project used the information obtained from these field trials and other recent research in Valle coupled with the knowledge of fertilizers, crops, and soils of the region which CVC personnel had accumulated in their technical training as agronomos or practicos. The program objectives were:

- (a) "to show, by means of farm trials, the worth of adequate fertilizer and [in so doing] to increase its use

- (b) to teach the farmer to consider his farm operation as a business¹⁹

In order to achieve these objectives it was originally decided to take into account the following factors in selecting farmers to participate in the program:

- (a) [participant should have] a tradition as a farmer
- (b) preference to be given to owner-operators
- (c) adequate technical conditions for the crop
- (d) cultural practices of the farmer should be acceptable
- (e) dedication of the farmer to his crop
- (f) preference for medium-sized farms (10-25 hectares) where fertilizer had not been used before
- (g) first make a broad selection, and later restrict it
- (h) keep in mind that the program is one of credit, education, and research; only a good co-operator will permit achieving these objectives.²⁰

However, because a good deal of time would have been involved in locating such farmers, many participants who did not have all these characteristics had to be selected. The number of farmers²¹ co-operating by semester, extension area, and crop are shown in Table 12. Each farm was visited approximately ten times during the growing period. Fertilizer was supplied on credit by CVC and recommendations regarding seedbed preparation, seeding fertilization, weed control, insect control, disease control, irrigations, and harvesting were made. The regular visits permitted extension workers to make sure that their recommendations had been understood although in some cases not all of these recommendations were followed.

¹⁹ Unpublished outline of CVC's 1967 extension programs. Translated by the author.

²⁰ Unpublished work report of the fertilizer project, (Nov. 1967). Translated by the author.

²¹ A number of 4-H Club members also participated in essentially the same program but for the purposes of this study they have been considered part of the Boys' 4-H Club Program. Costs have been adjusted accordingly.

Table 12.--Numbers of farmers co-operating in the CVC 1967 fertilizer program by semester, crop, and extension area

	Roldanillo	Palmira	Total
1st Semester - Tomatoes	0	7	7
- Corn	5	9	14
2nd Semester - Tomatoes	4	11 ^a	15
- Corn	<u>6</u>	<u>3</u>	<u>9</u>
Total	15	30	45

^aThree farmers in this group co-operated in the previous semester.

Average total costs per day of field personnel time were 387 pesos, about 40 pesos per day lower than they would have been had they been equal to the CVC average for the type of personnel employed. Costs per day were almost the same in both extension areas. Average total costs per participating farmer were 2774 pesos in the Roldanillo area and 3257 pesos in the Palmira area. This cost differential existed because extension personnel spent more time with tomato growers than with corn growers. Average extension costs per grower for tomato and corn growers were estimated at 3832 pesos and 2395 pesos, respectively.²²

In order to ascertain the results of the fertilizer program, some participants were interviewed in detail and most of the remainder were interviewed briefly. Data on the

²²These estimates were constructed by solving the following equations:

$$4X_1 + 11X_2 = 41673 \text{ (Costs of program in Roldanillo)}$$

$$18X_1 + 12X_2 = 97711 \text{ (Costs of program in Palmira)}$$

This agreed closely with one agronomo's comment that tomato growers required about 50 per cent more time than corn growers.

participants were also obtained from CVC files. Because the CVC had maintained test plots on some farms and the program was just being completed when this study began, it was possible to piece together fairly good estimates of what had actually happened during the program. Data were collected on technical changes made due to the program together with associated increased costs and increased returns. Where all or a large part of the crop was not harvested because of bad weather, serious disease problems, or other causes yield increases due to the technical changes were usually presumed to be zero. This meant that the farmer suffered a loss of the additional expenditures for fertilizer, sprays, etc. (A total of ten corn producers and five tomato producers found themselves in this situation.)

A summary of the results of the fertilizer program for program participants is shown in Table 13. Data on individual participants are given in Tables B-5 and B-6 of Appendix B. Income increases resulting from the new technology were considerably higher on the average (both per farmer and per plaza) for tomato producers than for corn producers. While both groups experienced positive average gains, nine corn producers and six tomato producers suffered losses because the added expenses exceeded added returns.

Participating farmers were also asked to give an estimate of the length of time before they would have adopted the new techniques without extension help. In the case of

Table 13.--Summary of results of CVC's 1967 fertilizer program for participating farmers^a

	Tomato Producers	Corn Producers
Yield Increase	+160.2 boxes/plaza ^b 0 to 774 boxes/plaza	+252.2 kilograms/ plaza 0 to 958 kilos/plaza
Price per Unit	13.66 pesos/box 7 to 24 pesos/box	1.21 pesos/kilogram 1.07 to 1.36 pesos/ kilogram
Gross Income Increases	2188 pesos/plaza 0 to 12427 pesos/ plaza	306 pesos/plaza 0 to 1303 pesos/ plaza
Cost Increases	254 pesos/plaza -657 to 1304 pesos/ plaza	171 pesos/plaza -631 to +1008 pesos/ plaza
Net Income Increase	1934 pesos/plaza -1304 to 12427 pesos /plaza	135 pesos/plaza -600 to +768 pesos/ plaza
Area of Crop Grown	1.293 ^c plazas 0.23 to 4.0 plazas	3.971 plazas 0.75 to 8.0 plazas
Net Income Increases per Farm	2362 pesos -1170 to +22820 pesos	536 pesos -3480 to +4918 pesos

^aThe first figure shown represents the average or mean change.

All averages for tomatoes are weighted by boxes. All averages for corn are weighted by kilograms. Ranges given are ranges by farm.

^bA plaza is a measure of area equal to approximately 1.5 acres.

^cOnly 19 farms were used as 3 participated twice - if 22 observations had been used, the average would have been 1.221 plazas.

tomato producers this was surprisingly short - 3.16 semesters on average. However, these estimates were considered reasonable by the agronomos associated with the project as the technology, although new to the participating farmers, was not entirely new to tomato producers in the region. Participating farmers listed neighbors and other agencies as alternate information sources.

Information on the diffusion of information from participating farmers was also gathered. This will be used and explained in the calculation of program benefits in Chapter VII.

Home Economics Assistance

The home economics program was directed at rural housewives and teenage girls throughout the department. It was operated at all office locations. Extension personnel included mainly mejoradoras de hogar although agronomos and practicos spent a total of 162 and 217 days respectively working on the program. These latter classes of personnel were mainly involved in supervision and delivering the mejoradoras to work. Average total costs per day of field personnel time were 239 pesos which was just about equal to CVC's average for such a complement of personnel. Costs per day were somewhat higher than the CVC average for mejoradoras due to the involvement of the agronomos and practicos.

The nature of the program was quite similar at all office locations. Each mejoradora formed several clubs in rural neighborhoods (veredas) and the clubs were visited weekly. Some clubs were made up entirely of housewives; some were girls' 4-H Clubs; and others had both young girls and housewives as members. One mejoradora could usually service four or five clubs. A total of 45.7 clubs²³ were operated for a full year. An average of 49 days of field personnel time was required for each club although only about half of this time was actually spent at the meetings. Average club membership was 21.3 persons. Average total extension costs were 11,777 pesos per club or 551 pesos per member. Number of days per club, extension costs per day, club membership, and average costs per club and per member varied somewhat among office locations.²⁴ For example, average costs per day of field personnel time ranged from 195 pesos in Buenaventura to 273 pesos in Cali. Average costs per club member ranged from 428 pesos in Buenaventura to 706 pesos in Cali. Some of the cost differences among office locations were due to differences in other duties performed by the mejoradoras.²⁵ The remainder was probably due to

²³Some clubs were not operated for 12 months.

²⁴More details on this can be found in the tables in Appendix B.

²⁵For example, one mejoradora spent some time giving instruction in a local normal school for public school teachers. As these duties represented a small proportion of the total costs of the program and were difficult to distinguish and analyze, they have not been separated from the club work. As a result, estimated costs of the clubs may be as much as 15 per cent higher than actual costs in some locations.

different work methods, different sizes of clubs and differences in the amount of time spent with each club.

The clubs held their weekly get-together at some convenient location in the neighborhood (e.g., a member's house, a local store, a community building). Most members walked to the meetings from their houses nearby although a few came by bus, canoe (Buenaventura), or on horseback. During these weekly sessions instruction was provided in the following areas:

- Clothing - making and repairing clothes by hand and by machine (foot-operated); making use of worn-out garments; conserving and reducing wear of clothes; washing and ironing; embroidering and knitting; characteristics of different types of fabrics.
- Health - first aid; symptoms and causes of sickness and disease; methods of preventing and curing illnesses (e.g., vaccination); personal hygiene and dental care; prenatal care; keeping children in good health.
- Hygiene - construction and use of latrines and other waste disposal structures including garbage cans and cess pools; ventilation and disinfection of homes; maintenance of clean and tidy houses - especially kitchens.
- Food - nutritional value of various foods; methods of preparing local foods to conserve nutrients; nutritional needs of the human body and how to balance one's diet; preparation and use of Incaparina²⁶; new types of dishes.
- Household Improvement - fixing and painting walls and floors of houses; enlarging and improving houses; making ovens, ironing boards, plate-holders, etc., care and maintenance of pantrys and food storage.

²⁶Incaparina is the brand name of an inexpensive high protein food that has been placed on the Colombian market in recent years.

Small Industry -

making hand bags and other handicrafts; especially things of sisal, string, roots, dried plants and others.

Acción Comunal²⁷ -

care, maintenance, and support of schools, churches, and cemeteries.

Gardens - production and use of both flowers and vegetables.

Instructions were complemented by demonstrations in the members' homes and, as a consequence, many club members had an opportunity to try their hand at various new practices, particularly sewing and cooking. Sewing machines were provided by the CVC for the use of the clubs in the neighborhoods. The sewing machine usually remained in the area only as long as the club was being serviced. A few associated activities were carried out in connection with the club work (e.g., National 4-H Club Day and various exhibitions). However, these were primarily support activities for the club work and did not produce much in the way of benefits other than those realized by the members in the various areas of instruction.

The participants in the program were mainly wives and daughters of minifundistas, obreros, and local tradesmen.²⁸ The average weekly family income for the members was 162 pesos and this ranged from 40 to 500 pesos. Most had some

²⁷The literal translation of this term is "community action" but it appears to lose something in the translation so the Spanish expression is used.

²⁸Out of 40 interviewed, 28 were not farm families, although all were "rural".

education and many could read and write although a few were completely illiterate. In almost every neighborhood in which a club was operated there were many other families who did not participate in the club. In most areas the local school was the only alternative source of home economics information. Almost all of the homes lacked plumbing, electricity, and other such conveniences. Many were overcrowded and living conditions were often unsanitary. Few families were able to maintain more than a modest dwelling, sometimes without floors and occasionally with only one room and almost no furniture. Only a very few homes boasted any appliances such as televisions, refrigerators, or stoves. Almost all had a radio, however.

In an effort to get some idea of the benefits attributable to this program, 40 club members were interviewed. These individuals were selected at random with the restriction that no two members of the sample could belong to the same club. As the length of membership in the clubs varied among individuals and it was difficult to distinguish the results of any particular period, it was decided to consider all club experience - not just 1967 experience - and adjust the results to 12 months' equivalent. The average length of time in the club was 13.45 months and therefore the data presented here are somewhat of an overestimate of what 40 club members would have gained from one year's instruction. However, as 23 out of the 40 persons interviewed

indicated they had spent exactly one year in the club, no large bias should result by reducing the benefits by a factor of proportionality to a twelve month basis.

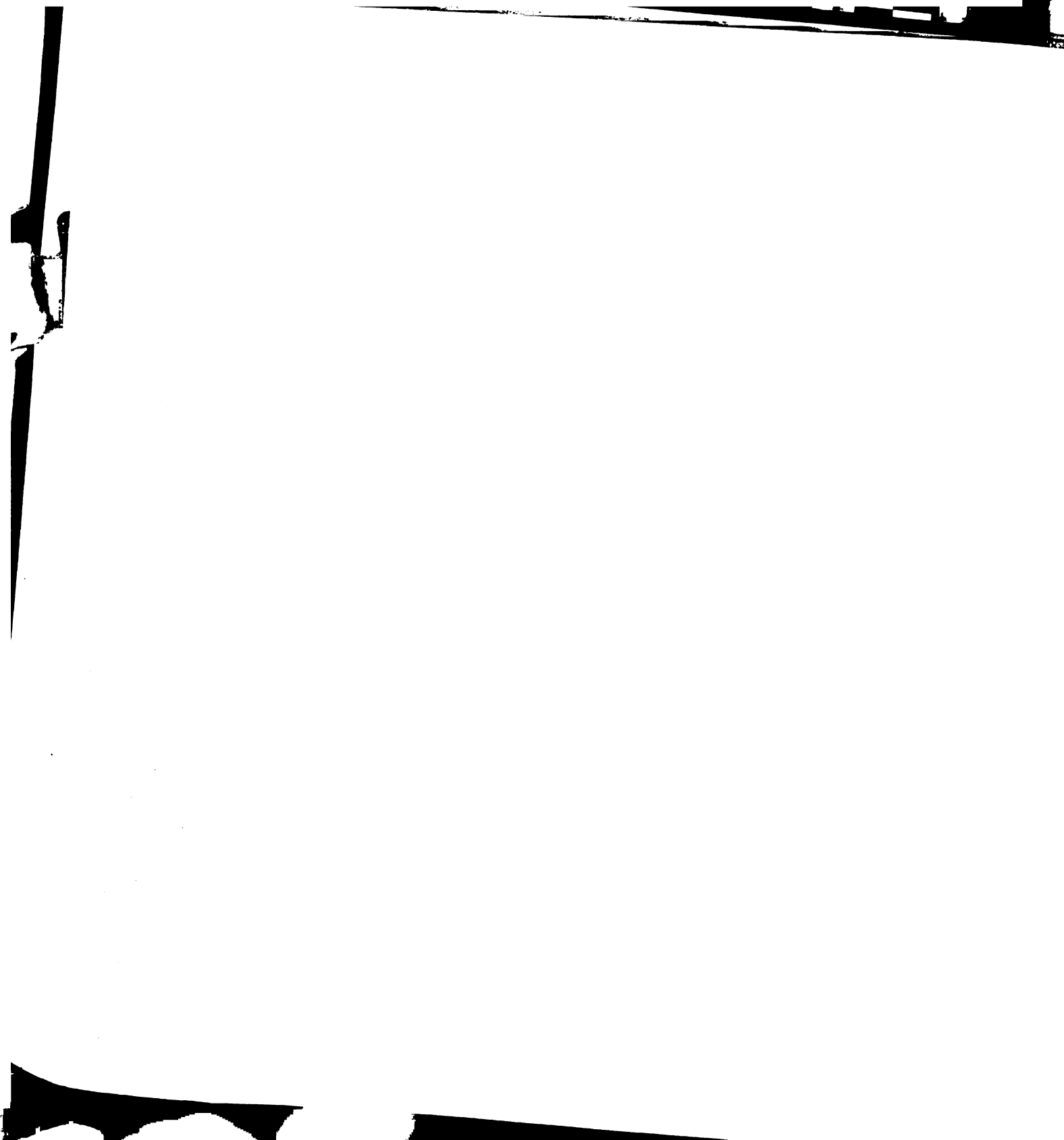
Table 14 shows the number of club members interviewed by level of instruction received, level of prior knowledge of this instruction, and the area of instruction. Some members did not receive part or all of the instruction available in certain areas because the club had operated only a short while, they had not attended some of the meetings, or the mejoradora for their club did not offer instruction in these areas. One might say that the equivalent of 10.3 per cent of the members interviewed received no instruction whatsoever, the equivalent of 19.1 per cent received only one-half the total instruction possible, while the equivalent of 70.6 per cent received complete instruction programs.²⁹ These data are of interest as the extent to which club members actually received instruction in certain areas of the program is an important determinant of the potential benefit levels. The table also provides a general idea of the extent to which this instruction was, in fact, new knowledge for club members receiving instruction. It is clear that the majority (the equivalent of 70 per cent) of the persons receiving instruction had virtually no previous knowledge of the material taught and only a very few indicated that they already knew it all (the equivalent of

²⁹ This assumes that each of the instruction areas are weighted equally as a component of total instruction.

Table 14.--Number of club members interviewed by level of instruction received,
level of prior knowledge of instruction received, and area of instruction^a

Level of Instruction Received	Virtually None	About One-Half of That Available in Program			Almost All of That Available in Program		
		Virtually None	About One-Half	Almost All	Virtually None	About One-Half	Almost All
Level of Prior Knowledge of Instruction Received	N/A						
Clothing	2	6	1	1	18	11	1
Health	8	3	4	0	13	11	1
Hygiene	3	2	4	0	12	14	5
Food	-	9	2	0	23	6	0
Household Improvement	5	7	4	0	21	2	1
Small Industry	3	5	1	0	30	1	0
<u>Acción Comunal</u>	12	4	0	1	22	1	0
Gardens	-	3	4	0	22	10	1
Average	4.125	4.875	2.50	0.25	20.125	7.0	1.125

^aThe total of each line across equals 40, the total number interviewed.



2.2 per cent). Although these measures are crude ones, it is obvious that the mejoradoras were concentrating on the introduction of new ideas and techniques to the club members. In terms of the analytical framework developed previously, most of the material taught could be viewed as either technical or managerial innovations - not just improved combinations of old inputs - and initial adoption conditions were close to zero for most of these innovations. On the other hand, where participants had previous knowledge of some of the things taught (e.g., clothing, health, hygiene, and gardens), several possibilities existed. These included:

- (a) innovations in these areas were already adopted by the group to the extent that they were useful. (The income constraint was probably important here).
- (b) the mejoradoras were facilitating movements towards economic optima.
- (c) the club members were innovators or early adopters who were increasing their knowledge in these areas and would serve as a source of information for neighbors in the future.

Possibilities (a) and (c), and (b) and (c) are not mutually-exclusive pairs.

Two measures of utilization of instruction were collected from persons in the sample.³⁰ The first measure was one of income increase due to increased production of saleable products. It should be noted that these products

³⁰ These measures were not taken where no instruction was received or where the persons interviewed indicated they had known all the material taught prior to their participation in the program.

were seldom sold - they were usually consumed in the home. However, they were valued at what they would have cost the household if they had been purchased. The value of the purchased inputs used to produce these were deducted as costs and, where the opportunity cost of labor appeared to be positive, it was also deducted.

Where income increases were not easily estimable or where the estimated income increases covered only some of the uses, a frequency of use was estimated. No exact definitions were constructed for the frequency categories and thus, they are not particularly precise. However, the distinction between "Almost Never" and "In Daily Life" appears to be intuitively-obvious and particularly revealing, especially in the areas of Home Improvement and Acción Comunal.

Table 15 shows the results of these attempts to measure level of utilization. The income estimates must be considered rather crude because they were made entirely by recall and some opportunity costs may have been overlooked. Some considerable difficulty was encountered in determining what part of 1967 income in a given area was actually due to 1967 CVC assistance. It was generally assumed that, when a club member reported knowing nothing before, the entire amount was due to new learning. However, this was not so clear where some or all of the knowledge had been acquired previously.

Table 15.--Levels of utilization of the eight areas of instruction offered to
1967 Home Economics Club members

	Number Experiencing Measurable Income Increases	Average Annual Income Increase Where Measurable (Pesos)	Frequency of Use of Knowledge Not Incorporated in Measurable Income Increases		
			Almost Never	Some- times	In Daily Life
Clothing	29	291 ^a	10	8	18
Health	0	N/A	8	17	6
Hygiene	0	N/A	16	11	5
Food	1	1700 ^b	5	15	20
Home Improvement	4	160	26	8	0
Small Industry	18	165	N/A	N/A	N/A
Acción Comunal	0	N/A	20	2	5
Gardens (Vegetable)	18	357	N/A	N/A	N/A

^aNo adjustment has been made for availability of sewing machines.

^bThe case of the woman who increased her income by 1700 pesos per year is quite unique. She used the knowledge gained in the home economics program to start a small restaurant business.

Considerable variability was noticed in the level of utilization of each category of instruction among the members. Although the 29 sample members who reported income increases in Clothing averaged a gain of 290 pesos in the year, this ranged from 30 to 970 pesos. Seven other members who received new instruction in this area reported no income increase. Most of the families could not be expected to maintain the same level of usage in the future - some might cease entirely although others might expand usage. The rate of utilization of gardens in the future was also questionable as in some cases this had been a special club project which participants might easily discontinue without the "special project" incentive.

In order to obtain some measure of club members' opinion of the relative usefulness of the eight areas of instruction, members interviewed were asked to rank their first three preferences. The results of these rankings are shown in Table 16. It is obvious that Clothing and Food were, in general, the first and second choices of the group. Gardens and Small Industry seemed to be rated about equally in third spot; Health and Hygiene were rated close together but slightly less popular than the preceding four; Home Improvement and Acción Comunal were obviously the least-preferred areas. This ranking appeared to be reasonably consistent with the levels of utilization given in Table 15.

Table 16.--Number of club members in the sample who rated the eight areas of instruction first, second, or third in order of utility for them

	First	Second	Third	Not Rated	Total ^a
Clothing	25	5	0	6	36
Health	1	8	4	18	31
Hygiene	2	3	6	21	32
Food	5	17	8	10	40
Household Improvement	0	0	3	31	34
Small Industry	4	5	7	21	37
<u>Acción Comunal</u>	0	0	1	26	27
Gardens	3	2	11	23	39
Total	40	40	40	156	276

^aTotals are less than 40 by number not receiving instruction and number indicating they already knew all that was taught.

Boy's 4-H Clubs

The Boy's 4-H Club program was directed at youths and young men throughout the area. No specific age limits were in effect and boys as young as 10 or 11 years were sometimes included in the same club with men in their early twenties. This practice was followed so that clubs of reasonable size could be formed in the various communities. The program was operated at all office locations except

Buenaventura. The extension personnel involved included mainly practicos although agronomos spent some time supervising the program and helping out in special programs while mejoradoras also co-operated in this program occasionally. Average total costs per day of field personnel time were 302 pesos which was slightly lower than the CVC average for the complement of personnel used.

The nature of the program varied somewhat among office locations depending on the interests of the Club members and the involvement of the local practico in other activities. However, each practico organized several clubs and regular meetings took place during the year. One practico could service 3 to 6 clubs depending on his other duties. A total of 16.7 clubs were operated for the whole year.³¹ An average of 89.2 days of field personnel time was required for each club although only about half of this time was actually spent with participants, the remainder being devoted to travelling, preparing programs, and administrative duties connected with the program. Average total extension costs were 26,950 pesos per club or 1,789 pesos per member. Number of days per club, extension costs per day, club membership and average costs per club and per member varied somewhat among office locations.³²

The clubs held their weekly meetings at some

³¹See Appendix B, Table B-6.

³²See Appendix B, Table B-7.

location in the local community to which all could travel conveniently. Most members walked to the meetings. During their meetings instruction was provided in the following areas:

- Seeding corn - preparation and disinfection of the soil, methods of seeding, selection of seed, control of insects and diseases, fertilization and the use of nutrients by the plant, weeding, and others.
- Vegetables - preparation and disinfection of the soil, fertilization and the use of nutrients, transplanting, irrigation, control of insects and diseases, germination test, food value of vegetables, weeding, thinning, making a hot bed, laying out a garden area, and others.
- Citrus Fruits - pruning, control of diseases and insects, thinning, fertilization and the use of nutrients by the plant, planting, weeding, harvesting for market, and others.
- Swine - feeds, feeding methods and rations, the value of feed nutrients, vaccinations, castration, control of internal and external parasites, assisting at birth of pigs, and others.
- Cattle - vaccination, feeds, feeding methods and rations, the value of feed nutrients, castration, control of parasites, care of calves, veal production, and others.
- Household Improvements - fixing and painting walls and floors of houses, enlarging and improving houses, making furniture, repairing chairs, etc.
- Hygiene - construction and use of latrines and other waste disposal structures including garbage cans and cess pools, ventilation and disinfection of houses, etc.

Instructions were complemented, where possible, by demonstrations on the members' farms. However, because of the nature of the topics discussed and the resources available to members, many had little or no opportunity to actually

use some of the instruction (e.g., members without pigs might observe at the farm of a neighbour who had pigs, but they would not have much of an opportunity to actually do anything).

Participants in the program were usually sons of local farmers, tradesmen, or obreros. Some of the families of these youths were of quite modest means; others were reasonably well-off by local standards. The average weekly income reported by club members interviewed was 134 pesos. However, in some cases this was family income and in other cases it was the member's income. In the latter instances, family income was usually much higher and the young man had already become established "on his own". Weekly family incomes reported ranged from 30 pesos to 250 pesos per week. In those few cases where club members were from families with medium to large holdings, it was questionable whether the estimates reported were actually income estimates - they seemed to correspond more closely to weekly expenses for individual or family living.

The communities in which the Boys' 4-H clubs were located were often the same ones in which the Home Economics Clubs were located. Some families would have boys in one club and girls in another. However, while members of the most affluent families in the community seldom participated in the Home Economics Clubs, there was some representation of this group in the Boys' 4-H Clubs.

In an effort to get some idea of the benefits attributable to this program, 18 club members were interviewed. These participants were selected at random with the restriction that no two members of the sample could belong to the same club. As with the Home Economics Clubs, it was decided to consider all club experience and adjust this to the equivalent of 12 months' experience in the benefit-cost calculations to be made later.

Table 17 shows the number of club members interviewed by level of instruction received, level of prior knowledge of this instruction, and the area of instruction. One might say that the equivalent of 33.3 per cent of the club members received no instruction whatsoever. The equivalent of 13.8 per cent received about half of the instruction offered, and the equivalent of 52.9 per cent received all of the instruction offered. This was partly due to the short-term nature of a few of the clubs and the fact that some members had little or no interest in some areas of instruction. The table also provides an idea as to the extent to which the instruction received was, in fact, new knowledge for those members receiving it. The conclusion is that, for the most part, the members were learning new things. The same interpretation applied to the data in Table 14 applies in this situation (see p. 218).

Three measures of utilization of the instruction received were collected from the persons in the sample. This

Table 17.--Number of Boys' 4-H Club Members interviewed by level of instruction received, level of prior knowledge of instruction received and area of instruction^a

Level of Instruction Received	Virtually None	About One-Half of That Available in Program			Almost All of That Available in Program		
		Virtually None	About One-Half	Almost All	Virtually None	About One-Half	Almost All
Level of Prior Knowledge of Instruction Received	N/A						
Seeding Corn	4	2	-	-	6	6	-
Vegetables	1	2	-	-	10	4	1
Citrus Fruits	3	2	-	-	8	3	2
Swine	4	2	1	-	9	2	-
Cattle	4	2	1	-	8	2	1
Household Improvement	11	1	1	-	4	-	1
Hygiene	5	5	1	-	5	1	1
Other	16	-	-	-	2	-	-
Average	6.0	2.0	0.5	-	6.5	2.25	.75

^aThe total of each line across equals 18, the total number of members interviewed.

data is presented in Table 18. Club members interviewed who received no instruction or indicated that they knew all that was taught have been regarded as not benefitting. The number of persons benefitting in each area have been divided into two groups - those utilizing their knowledge mainly in club activities and those already having received measurable income increases at the time the interviews were taken. In addition, the members who indicated they would likely find direct practical application for the knowledge in the future were noted. These included those who already had experienced measurable income increases and those who likely would in the future (i.e., those that were in a position to make good use of the knowledge). Of course, some of the participants interviewed were in a position where they were using (or would likely use) the knowledge they had gained in commercial ventures whereas others could (or would) probably only use it to further production for their own use. These two categories are distinguished in Table 18. As with the Home Economics Clubs, some difficulties were encountered in valuing the change in income due to instructions. Many of the income increases, especially in the area of vegetables, were measured on the basis of expenditures saved or the market value of home-used products. No allowance was usually made for additional labour costs for products produced for home-use although out-of-pocket costs were deducted.

Table 19 summarizes the rankings of the eight areas of instruction made by the members interviewed on the basis

Table 18.--Levels of utilization of theeight areas of instruction offered to Boys' 4-H Club members in 1967.

	Total Number Benefiting ^a	Number Utilizing Knowledge Mainly in Club Activities	Number Likely to Find Direct Application for Instruction in Future ^b		Number Experiencing Measurable Income Increases	Average Annual Income Increase for those Experiencing Such Increases
			Own Use	Commercially		
Seeding Corn	14	6	6	6	8	1,030
Vegetables	16	11	11	3	5	485
Citrus Fruits	13	12	3	1	1	16,000
Swine	14	13	3	2	1	5,400
Cattle	13	10	3	2	3	300
Household Improvement	6	6	-	-	-	-
Hygiene	12	12	4	-	-	-
Other	2	1	2	-	1	500

^aThis is less than the total number interviewed by the number of members not receiving instruction or already knowing all that was taught.

^b"Own Use" refers to the provision of personal needs (e.g., growing corn for home consumption. "Commercially" refers to the production of products for sale in the market.

of the utility of these areas to them. Seeding Corn, Vegetables, Cattle, and Swine showed up very well in these rankings. As the latter two categories did not show up particularly well in the utilization measures (see Table 18) this was somewhat inconsistent. Part of this appeared to be accounted for by the fact that the cattle instruction was sometimes supplemented by a credit program with very favourable terms. This enabled some members to own a cow and raise a calf for one year. However, they usually had to sell the cow to repay the loan and the calf was often sold as well because of lack of sufficient land to embark on a cattle enterprise of even a few head. Of course, this was by no means the case with all participants in this program and two club members interviewed actually had (or their

Table 19.--Number of Boys' 4-H Club members in the sample who rated the eight areas of instruction first, second, or third in order of utility for them.

	First	Second	Third	Not Rated	Total
Seeding Corn	6	5	2	1	14
Vegetables	4	4	8	0	16
Citrus Fruits	1	1	1	10	13
Swine	1	6	1	6	14
Cattle	5	2	6	-	13
Household Improvement	-	-	-	6	6
Hygiene	-	-	-	12	12
Other	1	-	-	1	2
Total	18	18	18	36	90

father had) sizeable cattle herds. The possible income increases in these cases could easily amount to several hundred or thousand pesos annually but, because of the nature of the enterprises there was no reasonable way to place a single-valued estimate on it.

Pacific Coast Programs

The programs carried out during 1967 in the Buena-ventura (Pacific Coast) area fall logically into four categories:

- (a) the water buffalo project
- (b) technical assistance to individual farmers
- (c) fomento and experimental work
- (d) home economics assistance

For the purposes of this study the home economics work in this region was included in the Home Economics Program and thus, it need not be discussed again here. The other three activities constitute the Pacific Coast Programs. The operating costs of these three activities to CVC were estimated as follows: water buffaloes, 362,646 pesos; technical assistance to individual farms, 22,666 pesos; fomento and experimental work, 68,000 pesos. Thus, about 80 per cent of the total cost of the Pacific Coast Programs was attributable to the water buffalo project which was really an applied research experiment.

The water buffaloes came to Colombia early in 1967 as part of a joint CVC - INCORA effort to test their

usefulness in the heavy rainfall areas of the country. In addition to the above maintenance costs for 1967 a capital expenditure of about \$25,000 (U.S.)³³ was made to obtain a small basic herd (about 50 head) and fly them to Colombia. Some ongoing maintenance costs were born directly by INCORA although CVC was mainly responsible for maintenance. During 1967 and 1968 the buffaloes were kept near the Calima River close to Buenaventura under careful observation. Feeding trials and other tests were carried out. If these trials prove favourable more buffaloes may be imported in the years to come and distributed among potential users in the area. It is anticipated that they may be useful in the production of milk and meat, as well as in the provision of power for agricultural tasks. However, as the Colombian environment is somewhat different than that in which the watter buffalo now flourishes, considerable uncertainty exists about this venture. The benefits from this project will not start to occur until a larger herd has been built up (or imported) and some distribution to potential users takes place. This may take between five and ten years and even then, possible benefits appear to be quite uncertain.

Technical assistance to individual farmers in the Buenaventura area was quite limited. Half a dozen small dairy farms (about 6 cows each), two small poultry farms, and

³³Private conversation with the head of CVC's Agricultural Department.

usefulness in the heavy rainfall areas of the country. In addition to the above maintenance costs for 1967 a capital expenditure of about \$25,000 (U.S.)³³ was made to obtain a small basic herd (about 50 head) and fly them to Colombia. Some ongoing maintenance costs were born directly by INCORA although CVC was mainly responsible for maintenance. During 1967 and 1968 the buffaloes were kept near the Calima River close to Buenaventura under careful observation. Feeding trials and other tests were carried out. If these trials prove favourable more buffaloes may be imported in the years to come and distributed among potential users in the area. It is anticipated that they may be useful in the production of milk and meat, as well as in the provision of power for agricultural tasks. However, as the Colombian environment is somewhat different than that in which the water buffalo now flourishes, considerable uncertainty exists about this venture. The benefits from this project will not start to occur until a larger herd has been built up (or imported) and some distribution to potential users takes place. This may take between five and ten years and even then, possible benefits appear to be quite uncertain.

Technical assistance to individual farmers in the Buenaventura area was quite limited. Half a dozen small dairy farms (about 6 cows each), two small poultry farms, and

³³Private conversation with the head of CVC's Agricultural Department.

several African palm operations were assisted. Climate and soil conditions in the area are such that dairy and poultry operations do not appear to be competitive with similar operations in the Cauca Valley. Several of these operations were visited in the course of this study and there seemed to be little chance of them developing into commercial farms. Most were owned by non-residents as a hobby. African palm is an important crop in the area and is reasonably well-suited to local conditions. However, owners of the plantations appeared to be getting most of their technical information from other sources.

Fomento and experimental work included the propagation of new varieties of fruits and other crops followed by the distribution of these to the natives. No effort was made to find out exactly what effects this was having on local agriculture because of the expense that would have been involved in tracking down recipients. Most of the local residents earned their living by working on the large African palm plantations, cutting wood, or gathering wild fruits and sugar cane. Although they might profitably use the new varieties in the future, there did not seem to be an easy way of measuring the extent of this usage.

CHAPTER VII

ANALYSIS OF CVC's 1967 EXTENSION ACTIVITIES

In this chapter an attempt is made to measure the relative success of the six major extension programs operated by CVC in 1967. The criteria used are those discussed in Chapter V. As a preliminary step the programs are compared by all of the benefit categories which were described in Chapter II. Next, PVB/PVC ratios are calculated for selected benefit categories on the basis of either actual data or stated assumptions. As it was impossible to estimate PVB/PVC ratios which incorporated benefits from all benefit classes, the general comparison by categories serves as a basis for judging the proportion of benefits included in the calculated ratios. Sensitivity analyses are carried out for all programs. A brief discussion of factors influencing the relative success of the various programs is also included.

Program Comparison by Benefit Classes

Each of the six major programs operated by the CVC was examined in an effort to discover whether or not it was producing benefits in any, some, or all of the benefit categories described in Chapter II. The results of this

scrutiny appears in Table 20. A plus sign in any square indicates that the program named in the associated column appeared to be producing some positive benefits of the type indicated in the associated row. Two plus signs appear in what is believed to be the most important benefit category for each program. A negative sign indicates that the program was producing some losses. Some programs resulted in both losses and gains in the same category. (For example, the apiculture program produced income gains for some participant bee-keepers and income losses for others.) A number of the squares in Table 20 have question marks because there was considerable doubt as to whether the program concerned was producing positive, negative, or zero benefits in that benefit category. It should be emphasized that - with the exception of the double plus sign - the table itself says nothing at all about the size of the benefits or who received them. It merely serves as a device to describe the benefit-producing possibilities of the various programs. The large number of zeros in the table should not be interpreted as saying anything about the general success or failure of programs. This merely reflects that programs in general were directed at producing specific types of benefits. And, as one might expect, changes in agricultural firms and rural households dominated the picture.

The Livestock Program

Technical changes on the farms of extension participants appeared to be the most important source of benefits

TABLE 20.---Comparison of 1967 CVC programs by benefit classes.

Classification of Benefits			Assessment of Benefits by Program					
Type of Unit	Group Influenced	Type of Change	Livestock Program	Apiculture Program	Fertilizer & Farm Planning Program	Home Economics Assistance	Boys' 4-H Clubs	Pacific Coast Programs
Changes in Rural Society	Agric- ultural Firms	Technical	++	++-	+-	Zero	+	++?
		Managerial	+	+-?	+	Zero	++	Zero?
	Non- Participants	Technical	+	Zero	++	Zero	+	Zero
		Managerial	Zero	Zero	+	Zero	Zero?	Zero
	Rural House- holds	Technical	Zero	Zero	Zero	++	Zero	Zero
		Managerial	Zero	Zero	+	+	Zero	Zero
	Non- Participants	Technical	Zero	+	Zero	+	Zero	Zero
		Managerial	Zero	Zero?	Zero	Zero?	Zero	Zero
	Community Organ- izations	Technical	Zero	+	Zero	Zero?	Zero	Zero
		Managerial	Zero?	+	+	+	Zero	Zero
Sec- ondary Outputs	Non- Participants	Technical	Zero	Zero	Zero	Zero	Zero	Zero
		Managerial	Zero	Zero	Zero	Zero	Zero	Zero
	Influence on Information Sources		Zero?	Zero	+	Zero	Zero	+
	Influence on Other Institutions		Zero?	Zero?	Zero	+	+	+
	Facilitating Natural Replacement of Managers		Zero	Zero	Zero	+	+	Zero
Assisting People to Move Out of Agriculture		Zero	Zero	Zero	+	Zero?	Zero	

^aThe diffusion phenomenon accounts for influence on non-participants.

for this program. Many participants were reported as having little contact with their colleagues and diffusion was probably slow or negligible as a result. However, if it existed, it was likely positive. Because of the technical changes which were occurring and, because of the many direct contacts between participants and extension agents, one would be led to believe that future decisions on participants' farms would be favourably influenced as well. Little carry-over influence on rural households would be expected because many of the participating farmers lived in towns and their farm business was not intimately connected with their household operations. Some carry-over to community decisions might be possible but this was not considered likely. There did not appear to be any appreciable feedback to research workers in this program although there was a possibility of favourable influence on the French Mission and the Fondo Ganadero. No other sources of benefits appeared to exist.

The Apiculture Program

Although some losses occurred on the farms of extension participants as a result of the apiculture program, these were probably outweighed by benefits. Diffusion effects attributable to the program were probably close to zero because of the lack of contact among producers and the limited possibilities of several producers operating in the same community. With expanded honey production there was the possibility that the nutritional content of diets in the

households purchasing the honey might be improved. Indeed, the extension workers included explanations of the nutritional value of honey in their promotional efforts. This would be seriously limited, however, by the fact that honey, even at twelve pesos per kilogram, was a luxury in households where diets were poor.

One of the most interesting features of this program was the attempt by the CVC to try to develop the bee-keepers' association and open up international markets. However, the possibility of selling honey to other countries (namely the U.S.A.) did not seem bright, as Mexico and Argentina are large exporters of honey to the U.S. at about \$0.10 U.S. per pound.¹ To compete with these prices Colombian producers would have to be able to sell honey in quantity at about 4.0 pesos per kilogram. Because of low labour costs in Colombia this might be a possibility in the future (say in 5 to 15 years) but, at the present time, little enthusiasm could be generated for exports at this price. Greater development of local markets seemed to be a very real possibility although this was not being pursued. Indeed, this seems to be an essential step to breaking into the export market as better local marketing would serve to build up larger-volume, more efficient producers who could more easily move towards

¹In 1967, Mexico exported 7,084,000 pounds of honey to the United States at an average price of 10.9¢ (U.S.) per pound. In 1968 total U.S. imports were 18,841,000 pounds at an average price of 10¢ per pound. (See U.S. Foreign Agricultural Trade by Commodities, Economics Research Service, U.S.D.A.) Most of the 1968 imports were produced in Mexico and Argentina.

exporting if this became economically feasible. Because of these circumstances, community action benefits were discounted heavily and technical changes on the farms of individual participants were considered as being most important benefit category.

The formation of apiculture clubs served to increase the numbers of people learning about honey production but, because many of these lacked either interest, time, or resources, or did not live in an area where more bee-keepers could start up an apiary, it did not necessarily increase actual benefits beyond what would have occurred if the extension workers had only worked with existing bee-keepers and sincerely-interested individuals. Thus, diffusion effects have been discounted heavily in this program. The possibilities for benefits from secondary "outputs" also appeared negligible.

The Fertilizer and Farm Planning Program

The fertilizer program also produced losses on some participants' farms. However, benefits from technical changes on participants' and neighbouring farms were, on the average, positive with the diffusion effect being more important. Some feedback to information sources appeared to have occurred but, as this was in no way organized, its value was considered relatively small. The frequent contact with extension personnel probably had some influence on the households of participating farmers. In some cases, wives of

participants became involved in the home economics programs because of their spouse's contact with the CVC extension personnel who were operating the fertilizer program. However, all benefit categories but technical and managerial changes on farm firms were discounted heavily. Some attempt was made to determine if managerial changes had actually taken place on participant farms by asking participants if they would be more interested in learning about new technology, co-operating with other agencies, and using fertilizer on other crops as a result of their participation in this program. However, after a number of interviews it was concluded that respondents might well be answering in an affirmative manner to either (a) protect the extension agent, or (b) avoid being in the position of saying anything derogatory about anyone. Thus, the questions were not regarded as useful tests of the hypothesis. Some indirect influence on decisions regarding community activities might result from this program. However, questioning of participants did not reveal anything concrete here and, as a result, benefits in this category were considered unlikely. No benefits were detected from secondary "outputs".

Home Economics Assistance

Even though many girls and housewives could not use some of the instruction received, technical changes in rural households were considered to be the most important benefit category for this program. Diffusion, as of the time of the

interviews, was minimal with only a few of the interviewed participants indicating they had carried any information beyond the club to which they belonged. Many indicated they had helped or instructed others in the club but benefits from this were already included in measures taken of club member's benefits. Because of the fairly intense nature of this program and the wide range of instruction given, it was considered that some carryover to future decisions would be likely to result. Thus, a "plus" appears in the Managerial section opposite "extension participants." Some of the instruction was directed at community action and perhaps some benefits would arise in this category. However, because the club members gave this a low ranking, it has been rated as rather insignificant. With the exception of aiding mothers to educate girls in already-known practices and perhaps some indirect influence by informing girls about opportunities in other areas,² no other benefits were apparent.

Boys' 4-H Clubs

Because of the relatively large response indicating that the techniques learned through the clubs were of limited direct practical application and the fact that many of the club members were relatively young with much of their

²In one case of record a 4-H Club member learned to sew in club activities and was able to get a job as a seamstress in a local town as a result. A few other similar cases were mentioned by extension personnel.

life ahead of them, managerial changes have been considered as more important than technical for this program. Diffusion as of the date of the interviews was almost zero and, because of the limited continued application of techniques learned by participants, this was not anticipated to increase. However, practical application of the techniques being taught was by no means absent and benefits in this area from both direct and diffusion effects might be substantial in relation to costs. Few other benefit categories were relevant for this program. The effects on the movement of people out of agriculture were probably negligible because of the concentrated emphasis on agricultural techniques. Perhaps some contribution may have been made in facilitating the natural replacement of managers but this would undoubtedly be negligible as the extension agents concentrated mainly on techniques new to the area.

Pacific Coast Programs

The highly uncertain nature of the benefits which might accrue from the buffalo project made it difficult to select a most important benefit category for these programs. On the assumption that this project would eventually produce benefits, it would seem likely that recipients of buffalos would be the ones who would benefit and, thus, technical changes in the farm units of extension participants are regarded as the most important benefit category. Benefits in all other categories are either non-existent or

questionable.

Calculation of PVB/PVC Ratios

As pointed out earlier, the calculation of PVB/PVC ratios requires data on both the costs and benefits attributable to the project being examined. The benefit flow attributable to changes inspired by extension work is determined by (among other things) the "shift" in the adoption distribution attributable to the extension agency. This "shift" is often difficult to isolate but, in three of CVC's major programs, sufficient data were gathered to facilitate a description of it. In one of these cases - the fertilizer program - the data was easily converted to benefit-flow form. In the other two, lack of adequate price information made this sort of transformation quite difficult. However, by making some additional assumptions PVB/PVC ratios have also been calculated for these programs. For the remaining three major programs PVB/PVC ratios have been calculated by making several sets of assumptions about their total "output". In all cases, the assumptions are formally stated and the set of assumptions believed to be most credible is indicated. It should be pointed out again that the calculated ratios incorporate only the value of benefits attributable to technical changes in agricultural firms and rural households. All other benefit categories have been omitted because of the measurement problem. This seriously limits but does not completely destroy the usefulness of

the results. In essentially every case the actual PVB/PVC ratio will be greater than or equal to the calculated PVB/PVC ratio (assuming the calculated ratio accurately represents the benefit-flow categories incorporated therein). The extent of this deviation is not believed to be large for the projects examined here. If one accepts the hypothesis that the value of managerial changes is closely correlated with the value of technical changes and notes that, in most cases, secondary extension "outputs" are rather inconsequential, the ranking of programs according to the calculated ratios would not be changed by incorporating the omitted benefit flows.

In determining the "appropriate" interest rate for calculating the PVB/PVC ratios the following factors were considered. All benefit flows for the projects examined were calculated in current (1967) pesos. Thus, the extension of such estimates into the future would represent real values and a real interest rate would be required. First mortgage rates in Colombia have ranged from 10 per cent to 20 per cent in recent years.³ Industrial bond rates have ranged from 6 per cent to 18 per cent of their original price but have been selling below par so that their effective rates are in the 12 per cent to 20 per cent range.⁴ During the period 1960 to 1966 the six most active Colombian common

³Revista del Banco de la Republica, December, 1968.

⁴Ibid.

stocks produced an average annual rate of return of between 10.26 per cent and 15.21 per cent not including capital appreciation.⁵ Capital appreciation on these stocks has been about one per cent per year. Using the national consumer price index as an indicator, inflation in Colombia has been averaging about 12 per cent per year for the past twenty years although this rate has been somewhat unsteady. By deducting the inflation rate of 12 per cent from an indicated current interest rate range of 12 per cent to 20 per cent, one arrives at a real interest rate range of zero per cent to 8 per cent. Thus, a rate of four per cent has been used with PVB/PVC ratios also calculated at the zero per cent and 8 per cent levels to test for project ranking reversals.

The Livestock Program

As indicated previously, no data was gathered on the actual benefit flow attributable to this project. PVB/PVC ratios were calculated on the basis of 50 active participants in the program. Three possibilities were considered with respect to the total number of producers influenced by this program:

- (a) Only active participants would be influenced.

⁵Alberto R. Musolem, "Dinero, Inflacion y Balanza de Pagos; La Experiencia de Colombia, 1950-1966", Mimeographed Study, Universidad del Valle, 1968, p. 24.

- (b) Twenty-five additional producers would be influenced in 1968.
- (c) Fifty additional producers would be influenced, twenty-five in 1968, twenty-five in 1969.

Four possibilities were considered for the average annual benefits per producer. The first allowed for 500 pesos per producer which amounts to about 10 pesos per head of livestock carried on participating farms. The second allowed for 2500 pesos per producer per annum or 50 pesos per head of livestock. These were considered to be minimum and maximum likely benefits respectively. The last two alternatives considered were modified versions of the first two but permitted benefits to increase at a uniform rate from zero at the time of influence to the selected yearly amount in the fifth year. However, when PVB/PVC ratios for the latter two alternatives were calculated they were found to be consistently lower by the same small proportion for a given interest rate. Thus, the results for these two alternatives are not shown here.

Shifts in the adoption distribution of 5, 10, and 15 years were examined. These were considered to be "minimum likely", "expected", and "maximum likely" shifts although they are, admittedly, rather rough estimates. However, in view of the impossibility of actually observing these values for this project and the fact that little research has been done to determine the length of similar such shifts, there was little alternative to using such "educated guesses".

The resulting PVB/PVC ratios for the various sets of assumptions are given in Table 21.⁶ The wide variability in these ratios indicates the wide range of performance which might reasonably be attributed to this program. Only a long-term detailed analysis of the participant farms could specify this performance more precisely. Thus, it would appear that a reasonable expected PVB/PVC ratio for this project lies between 0.8 and 4.0 with a low of 0.3 and a high of 10.0 being possible. The effects of variations in interest rate, size of the "shift" in the adoption distribution, number of producers affected through diffusion, and average annual benefits per producer are all clearly illustrated in Table 21.

The Apiculture Program

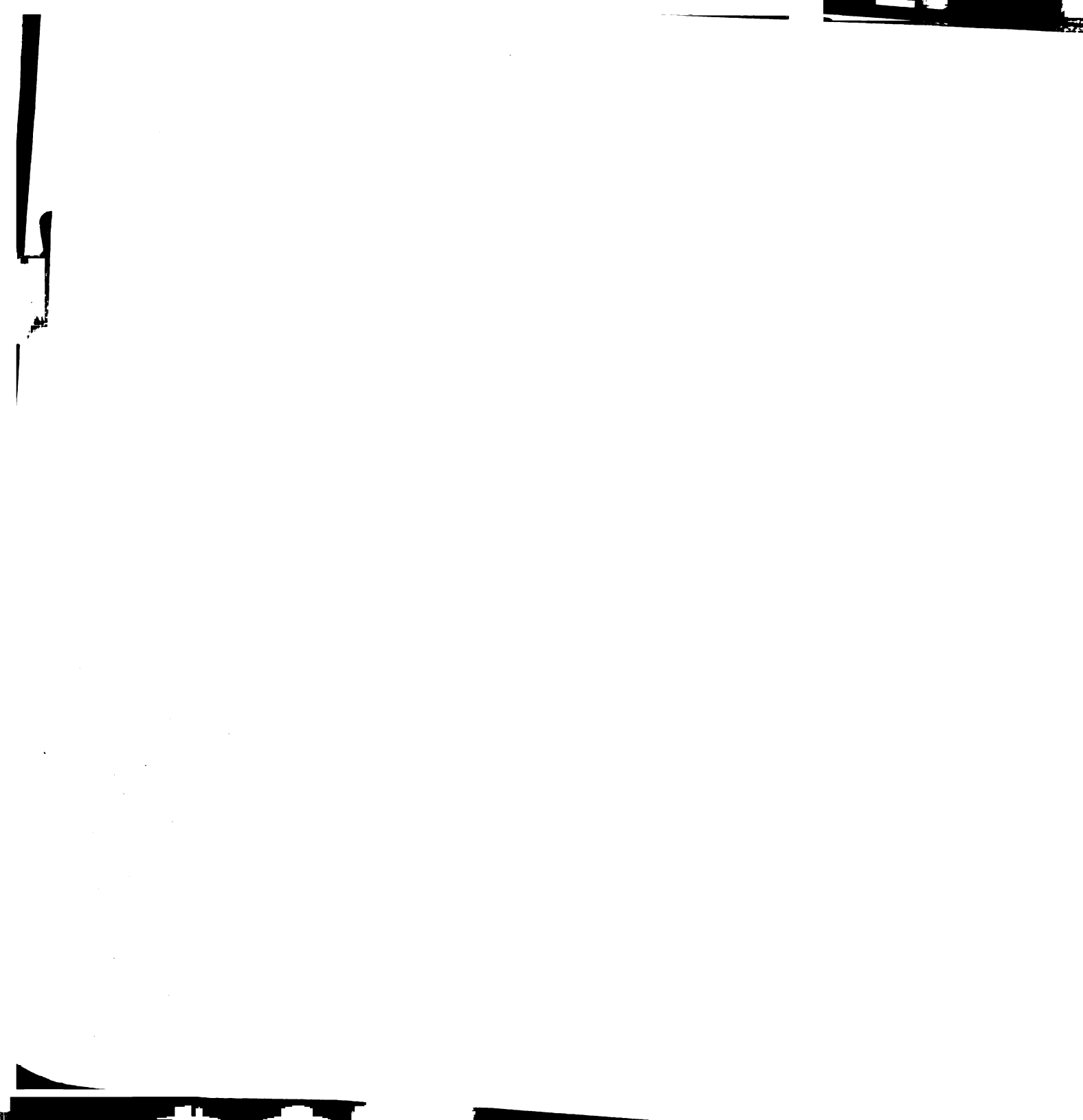
As detailed data on income changes were not available for most participants in this program, it is not possible to calculate a single PVB/PVC ratio considered to be representative of actual performance. However, such ratios have been calculated under a number of alternative assumptions in order to give some idea of the relationship between costs and pay-offs. Only technical changes in the production units of

⁶The calculations assume that benefits begin in the year following the one in which the extension expenditure was made (i.e., costs occur at time zero while benefits begin exactly one year later and the total annual benefit is received at year-end thereafter). Any benefits accruing during the year of the extension effort can be assumed to cover adjustment and learning costs on the part of program participants.

Table 21.--Calculated PVB/PVC ratios for the livestock program under selected sets of assumptions.

Number of Producers Influenced	Average "Shift" in the Adoption Distribution	Annual Benefits of 500 pesos per Producer			Annual Benefits of 2500 pesos per Producer		
		0% ^a	4% ^a	8% ^a	0% ^a	4% ^a	8% ^a
The Fifty Participants	Five years	0.33	0.30	0.27	1.66	1.48	1.33
	Ten years	0.66	0.54	0.45	3.32	2.69	2.23
	Fifteen years	1.00	0.74	0.57	4.98	3.69	2.84
Fifty participants plus Twenty-five the Following Year	Five years	0.50	0.44	0.39	2.49	2.19	1.94
	Ten years	1.00	0.80	0.65	4.98	3.99	3.26
	Fifteen years	1.49	1.09	0.83	7.47	5.47	4.16
Fifty participants +Twenty-five one year later +Twenty-five two years later	Five years	0.66	0.57	0.50	3.32	2.88	2.51
	Ten years	1.33	1.05	0.84	6.64	5.25	4.23
	Fifteen years	1.99	1.44	1.08	9.97	7.18	5.38

^aDiscount rate.



program participants have been incorporated into these calculations for, as indicated earlier (see Table 20), other benefit categories were considered to contribute little to the success of this project.

Benefit calculations were constructed on the basis of income increases per hive of 10, 50, and 100 pesos per year. Again these are "minimum likely", "expected", and "maximum likely" average increases. The estimates are based on the rather crude data obtained from the program participants interviewed. Two assumptions were made with regard to the total number of hives; one, they remain constant - two, they expand at a rate of five per cent per year. The latter assumption is perhaps more realistic as some expansion actually did occur in the 1960's. However, past experience suggests that rapid expansion of this industry is not likely unless local marketing channels improve and per capita incomes of Colombians increase rapidly. Three lengths of "shift" in the adoption distribution have been examined - 5, 10, and 20 years. As with the livestock program, these are considered to bracket the actual "shift" but there is really very little basis for concluding that they actually do.

The resulting PVB/PVC ratios shown in Table 21 indicate that there is little chance of this program performing as well as the livestock program.⁷ The "expected"

⁷As with the livestock program the benefit stream is assumed to begin in the year following the year in which the extension effort was expended.

Table 22.--Calculated PVB/PVC ratios for the apiculture program under selected assumptions.

Number of Hives	Benefits per Hive	Length of Benefit Period								
		5 years			10 years			20 years		
		0%	4%	8%	0%	4%	8%	0%	4%	8%
418 (same as present)	10 pesos/year	0.10	0.09	0.08	0.20	0.16	0.13	0.40	0.27	0.20
	50 pesos/year	0.50	0.45	0.40	1.00	0.81	0.67	2.01	1.36	0.99
	100 pesos/year	1.00	0.89	0.80	2.01	1.63	1.35	4.02	2.73	1.97
Increasing at 5% per year	10 pesos/year	0.12	0.10	0.09	0.27	0.21	0.17	0.69	0.44	0.30
	50 pesos/year	0.58	0.52	0.46	1.33	1.06	0.86	3.49	2.22	1.51
	100 pesos/year	1.17	1.03	0.92	2.65	2.12	1.73	6.97	4.45	3.03

PVB/PVC ratio appears to lie between 0.50 and 2.0 although it may turn out to be as low as 0.1 or as high as 7.0.

Indeed, there appears to be a good chance that this program is not returning benefits as large as the costs that have been incurred in carrying it out.

The Fertilizer Program

The data collected for participants in the fertilizer program were used to estimate two benefit flows - one for the work with corn producers and one for the work with tomato producers. These benefit flows include only benefits considered to be attributable to extension-induced technical changes on the farms of both participant and non-participant producers. No benefits in any other benefit category have been estimated.

Table 23 shows the estimated benefit flow for the work done with tomato producers. It has been based on a benefit period of 3.158 semesters for all producers. This was the average time between actual adoption and probable adoption (if CVC's influence had not been present) as estimated by participating farmers. Where available, actual income changes have been used. Where these were not available, an average increase of 1934 pesos per plaza - the average of the 19 participating farms over both semesters - was used. Although this included some farms which experienced losses due to bad weather, diseases, and other causes, it was considered to be a reasonable representation

Table 23.--Estimated benefit flow for CVC's 1967 fertilizer program directed at tomato producers.

Period	Classification of Beneficiaries	Number of Farmers		Number of Plazas ^a Affected	Total Value of Income Changes ^b
		Adopting	Benefiting		
1967-1	Participants	7	7	6.12	5257
	Non-Participants	4	4	5.17	4441 ^c
	Total	11	11	11.29	9698
1967-2	Participants	7	14	24.16 ^d	54408 ^e
	Non-Participants	8	12	15.52	34951 ^e
	Total	15	26	39.68	89359
1968-1	Participants	-	14	18.72	36204
	Non-Participants	8	20	25.86	50013
	Total	8	34	44.58	86217
1968-2	Participants	-	14	18.72	26892
	Non-Participants	3	23	29.74	49100
	Total	3	37	48.46	75992
1969-1	Participants	-	7	13.00	3978
	Non-Participants	-	19	24.57	30669
	Total	-	26	37.57	34647
1969-2	Participants	-	-	-	-
	Non-Participants	-	11	14.22	10671
	Total	-	11	14.22	10671
1970-1	Participants	-	-	-	-
	Non-Participants	-	3	3.88	1187
	Total	-	3	3.88	1187

^a Areas of tomatoes in non-participating farms have been calculated by assuming that they would have the same average as the 19 participating farms - 1.293 plazas.

^b Beginning in 1968, an average of 1934 pesos per plaza is used. However, to approximate an average benefit period of 3.158 semesters, benefits for farms in their fourth semester were reduced to 306 pesos per plaza.

^c Based on 859 pesos per plaza which was the average income increase per plaza for participating farms in that semester.

^d Includes non-adopting participants.

^e Income increases for farms where this information was not known were based on 2252 pesos per plaza which was the average income increase per plaza for known participating farms in that semester.

of the reality which all farms would face. All first semester participants said they would continue to use the new techniques in the future and were therefore considered to be "adopters".

Five out of the six tomato producers who participated in the second semester and did not receive any positive benefits said they would not use the new practices in the future. The sixth attributed all of his loss to the weather and said he would continue to use the new practices. He is therefore regarded as an adopter but the other five are not. None of the neighbours who learned from these five producers were considered to be "adopters". Thus, the total number of adopting participants were estimated at fourteen. All those farmers who learned about practices from this group and used them during the semester of participation and the two semesters immediately following were also considered to be adopters. Therefore, the total number of farmers influenced was 37 and, in total, almost 50 plazas of tomatoes were estimated as being affected. The total extension costs of the work with the 19 tomato producers were estimated at 26824 pesos in the first semester and 57480 pesos in the second semester.⁸

The total value of income changes shown in Table 23 is considered to be the total benefit flow attributable to technical changes as the tomato producers affected were not

⁸The costs were based on an average cost of 3832 pesos to service a producer for one semester.

considered to be a large enough group to influence market price. It should be pointed out that this benefit flow assumes no change in market prices and that the producers affected continue to grow approximately the same acreage as they are now growing. Both of these assumptions are open to question. To get some estimate of the effect on PVB/PVC ratios should these not be valid, ratios were calculated with benefit flows (beyond 1967) at 75 per cent, 100 per cent and 125 per cent of the flow appearing in Table 23. As the violent price fluctuations in tomatoes mentioned earlier tended to be seasonal, this was considered to be an adequate sensitivity test. However, if low (or high) prices were to prevail for one or two years, the benefit flow for this project could be completely eliminated (or, conversely, increased to several times its estimated size).

Because of the lack of data on diffusion, detailed benefit flow calculations were not possible for the fertilizer program with corn producers. However, as some diffusion was noted, it was decided to make some assumptions and construct such a flow. Table 24 shows the results of these assumptions. A three-year adoption "shift" and a total adoption group of 35 farmers is assumed. Based on the data collected from corn-producing participants (see Table B-6) an average income increase of 500 pesos/semester was used.⁹

⁹The average income increase for participants in their semester of participation was 535 pesos.

Table 24.--Estimated benefit flow for CVC's 1967
fertilizer program directed at corn producers.

Period	No. of Farmers		Estimated Total Value of Income Changes
	Adopting	Benefiting	
1968-1	9	9	6,087
1968-2	6	15	10,736
1969-1	5	20	10,000
1969-2	5	25	12,500
1970-1	5	30	15,000
1970-2	5	35	17,500
1971-1		30	15,000
1971-2		25	12,500
1972-1		20	10,000
1972-2		15	7,500
1973-1		10	5,000
1973-2		5	2,500

As in the tomato program this assumes that market prices and volumes for producers do not change significantly during the time period in which they are affected. However, possibilities for wide divergences from this assumption seemed very remote in this case. Again, a sensitivity analysis was conducted by calculating PVB/PVC ratios with benefit flows (beyond 1967) at 75 per cent, 100 per cent, and 125 per cent of the estimated benefit flow. Costs for work with corn producers was estimated at 33,530 pesos for the first semester and 21,555 pesos for the second.¹⁰

A summary of the calculated PVB/PVC ratios for the fertilizer and farm planning program is given in Table 25.

¹⁰The costs were based on an average cost of 2,395 pesos to service a producer for one semester.

Table 25.--Calculated PVB/PVC ratios for the tomato and corn sections of CVC's 1967 fertilizer program.

	Tomato Program	Corn Program
(a) At 75% of Projected Benefits (after 1967)		
(i) Discounted at 0%	12.50	2.10
(ii) Discounted at 4%	11.93	1.89
(iii) Discounted at 8%	11.39	1.71
(b) At 100% of Projected Benefits		
(i) Discounted at 0%	15.54	2.80
(ii) Discounted at 4%	14.81	2.52
(iii) Discounted at 8%	14.12	2.28
(c) At 125% of Projected Benefits (after 1967)		
(i) Discounted at 0%	18.59	3.50
(ii) Discounted at 4%	17.69	3.15
(iii) Discounted at 8%	16.84	2.85

It is fairly obvious that both of these programs were returning discounted benefits much in excess of their cost with the tomato program producing almost spectacular results. However, it should be pointed out that, because costs and benefits were calculated on a semester basis and benefits were regarded as occurring in the semesters in which the costs were incurred, the calculation procedure might legitimately be regarded as being slightly biased in favour of this program.¹¹

¹¹In the author's opinion this merely reflects the fact that this was a "quick-return" program relative to most others and that the assumptions of little or no return for the program year of most other programs is reasonable.

Home Economics Assistance

Any sort of benefit-cost calculation for a project such as this must necessarily be open to a good deal of criticism - even if excellent data are used. Although the data gathered in this study were collected from individual interviews with a sample of program participants, a number of possible sources of bias and measurement error exist. There is not much one can do to correct for these and thus, the data must be regarded as rather crude. Therefore, there are some strong arguments for not making benefit-cost calculations at all. Nevertheless, it has been decided that the pressing need for some sort of estimate outweighs these arguments. In other words, it is considered that this is a situation where some bad information is better than no information. Readers may, of course, choose to disagree.

In order to calculate PVB/PVC ratios an estimated benefit was constructed by assuming that:

- (a) benefits from diffusion would be zero. This was based on the relatively small amount of diffusion detected during the interviews,
- (b) average benefits per program participant could be reasonably estimated by multiplying the proportion in the sample "adopting"¹² a given type of knowledge at a given level by the average benefits per "adopter" and summing this for all benefit categories (see Table 26).

¹²In this instance the term "adopting" applies to those who were considered likely to make some use of knowledge acquired in the program. Proportions were derived directly from the information in Table 15 with some adjustments where 1967 utilization levels seemed likely to change in the future.

Table 26.--Calculation of average annual benefits for participants interviewed in the home economics assistance program.

	<u>% Adopting</u>	<u>Annual Benefits to Adopters</u>	<u>Average per Member Interviewed</u>
Clothing			
- making clothes	42.5	200 ^a	85 ^a
- other, regularly	45.0	100	45
- other, sometimes	20.0	50	10
Food			
- as business	2.5	1700	42.5
- at home, regularly	50.0	200	100
- at home, sometimes	37.5	100	37.5
Gardens			
- production	45.0	300	135
Small Industry			
- products	45.0	80	36
Health			
- regularly	15.0	100	15
- sometimes	42.5	50	21.25
Hygiene			
- regularly	12.5	100	12.5
- sometimes	27.5	50	13.75
Total			553.5

^aBenefits shown in pesos.

- (c) the "shift" in the adoption distribution could be regarded as ten years for a typical participant. A much longer benefit period might have been justified as many of the club members interviewed noted that they never would have learned the material from any other source. However, there existed the possibility that the techniques learned would become obsolete or that changes in the life pattern of the individuals concerned would render them of little value. Thus, a ten year period has been used.

These assumptions led to the conclusion that average benefits per program participant could be reasonably valued at

approximately 550 pesos as the result of 13.45 months of instruction. On a proportionate basis this would be about 500 pesos for 12 months. As there were a total of 972 participants in 1967, this would imply an annual benefit flow of 486,000 pesos.

The calculations in Table 26 require some explanation, however. On the basis of ratings given to the various areas of instruction by program participants interviewed, the benefits attributable to instruction in the area of Home Improvement and Acción Comunal have been assumed to be close to zero, and have therefore been ignored. Benefits per adopter in other categories have been assigned values so as to be approximately consistent with the following ranking:

Clothing ≥ Food ≥ Gardens ≥ Small Industry ≥ Health
 ≥ Hygiene

This ranking is based on the rankings provided by participants interviewed (see Table 16). For example, a member "adopting" techniques in the Health area would be regarded as receiving the equivalent of 100 pesos per year if she said she used these regularly.¹³ As most of the participants interviewed indicated that they had virtually no knowledge of what had been taught in the program, no attempt was made to distinguish different levels of benefits for those with

¹³No means, other than the rankings, was used to justify these figures. However, they could be justified in several ways. In the Health area, for example, if a club member learned to perform a service (e.g., diagnosis or disease prevention) that she would have had to pay a doctor or a nurse for otherwise, the opportunity cost principle could be used.

some prior knowledge from those with none. In the area of "Small Industry", future benefits were assumed to be about one-half of 1969 levels to allow for the market limitations being encountered. An adjustment downward was also made for "Gardens" in view of the indications in the surveys that some members would not continue these on such a large scale in the future. An adjustment downward was also made in the "Clothing" area to allow for the limited availability of sewing machines to some members.

The performance of this program appeared to be highly favourable when one considers that the average total costs per club member were 551 pesos, or only 10 per cent greater than the estimated average annual benefits per club member. That is, the total cost of the program was almost entirely recovered in one year. The value of the benefits amounted to the equivalent of approximately a 6 per cent increase in net family income of participants. PVB/PVC ratios for the program were calculated for benefit flow periods of 5, 10, and 15 years;¹⁴ discount rates of 0, 4, and 8 per cent; and benefit flow levels of 50, 100, and 150 per cent of the estimate of 500 pesos per participant per annum. These are shown in Table 27.

¹⁴The benefit flow period is assumed to begin in 1968. All of 1967 benefits are regarded as being required to cover the "costs" of attending club meetings, etc. It can be noted that, if 1967 benefits were not required to cover these costs, PVB/PVC ratios would be very high as net costs in 1967 would be close to zero.

Table 27.--PVB/PVC ratios for the home economics assistance program for several levels of benefits per participant, length of benefit flow, and interest rate.

Average Annual Benefits Per Participant	Discount Rate	Benefit Flow Period		
		5 years	10 years	15 years
250 pesos	0%	2.27	4.54	6.81
	4%	2.02	3.68	5.05
	8%	1.81	3.04	3.88
500 pesos	0%	4.54	9.07	13.61
	4%	4.04	7.36	10.09
	8%	3.62	6.09	7.77
750 pesos	0%	6.81	13.61	20.42
	4%	6.06	11.04	15.14
	8%	5.44	9.13	11.65

Boys' 4-H Clubs

The boys and young men who participated in this project often found themselves in a situation where they could, at that time, make only limited use of the knowledge they gained. Some reported they would likely not use it at all; others reported they might use such knowledge for producing some of their own food; and a few others were definitely going to apply this knowledge commercially. Thus, in order to estimate a benefit flow, participants have been divided into two groups corresponding to the last two levels of utilization. Benefit values for these groups have been estimated accordingly.

Essentially the same assumptions were made for this program as for the Home Economics Assistance program. The calculation of average annual benefits for program participants is shown in Table 28. Benefits per adopter were based partly on the information collected in the surveys and partly on other sources. For example, benefits per adopter in the area of seeding corn commercially were taken to be 500 pesos per annum because this was essentially the same program as the Fertilizer Program and data on the latter program appeared to be more accurate than that obtained from 4-H Club members.

In the swine and cattle categories, benefit values were based on agronomos' opinions because of the small numbers of adopters encountered in the sample. Benefit values in the "own use" categories were calculated on a smaller scale of operation. The one 4-H Club member who experienced the large income increase from citrus fruits was not considered typical but, considerable difficulty was encountered in adjusting this to a "normal" level. As can be seen in Table 28 this one participant accounted for more than half of the average annual benefits as calculated. In view of this situation, it was decided to ignore this contribution and use an estimated average annual benefit per member of 800 pesos in calculating the "expected" benefit flow.

As the "expected" average annual benefits were

Table 28.--Calculation of average annual benefits for participants in the boys' 4-H club programs.

	Adopters		Benefits per Adopter	Average Benefits per Member Interviewed
	No.	%		
Seeding Corn				
- own use	6	33.3	200	67
- commercially	6	33.3	500	167
Vegetables				
- own use	11	61.1	200	122
- commercially	3	16.7	500	84
Citrus Fruits				
- own use	3	16.7	200	33
- commercially	1	5.5	16000	880
Swine				
- own use	3	16.7	200	33
- commercially	2	11.1	1000	111
Cattle				
- own use	3	16.7	200	33
- commercially	2	11.1	1000	111
Other				
- commercially	1	5.5	500	28
Total				1669
Total (excluding citrus fruits)				789

approximately one half of the average annual costs per member of operating the program; benefits equal to program costs could be expected to be realized in two years. PVB/PVC ratios were calculated with average annual benefits at 50, 100, and 200 per cent of the expected value and for 5, 10, and 15 year periods. The results are shown in Table 29. These data indicate that, in spite of the limitations on use for many 4-H Club members, the program's performance

was likely quite good. However, the wide range of PVB/PVC ratios indicate considerable uncertainty as to the exact level of performance that could be attributed to the program.

Table 29.--PVB/PVC ratios for the boys' 4-H club program for several levels of benefits per participant, length of benefit flow, and interest rate.

Average Annual Benefits Per Participant	Discount Rate	Benefit Flow Period		
		5 years	10 years	15 years
400 pesos	0%	1.90	3.80	5.71
	4%	1.69	3.09	4.23
	8%	1.52	2.55	3.26
800 pesos	0%	3.80	7.61	11.41
	4%	3.39	6.17	8.46
	8%	3.04	5.10	6.51
1600 pesos	0%	7.61	15.22	22.82
	4%	6.77	12.34	16.92
	8%	6.08	10.21	13.02

Pacific Coast Programs

No attempt was made to calculate PVB/PVC ratios for the fomento and experimental work or the technical assistance to individual farms in the Pacific Coast area. Possible benefits due to the former activity were essentially unmeasurable; benefits due to the latter appeared to be negligible.

However, as the buffalo project accounted for such a large proportion of costs of Pacific Coast Programs, it

was decided to estimate some break-even benefit-flows for this project under selected assumptions.

The following assumptions were made:

- (a) net natural rate of increase of 20 per cent per year,
- (b) additional buffaloes would be purchased in 1971 to bring the herd up to 300 head,
- (c) maintenance costs would continue about 400,000 pesos annually until 1971 and then increase to 1,000,000 pesos because of increased herd size,¹⁵
- (d) beginning in 1971 buffaloes would be distributed to potential users at a rate of 60 per year,
- (e) the whole herd would be distributed to users in 1986.

Projected costs and basic herd distributions under this program are shown in Table 30. The total present (1967) cost of the program would be 19,850,000 pesos using a zero per cent discount rate, 13,850,320 pesos using a 4 per cent rate, or 10,217,050 pesos using an 8 per cent rate. Under such a program the average cost of each buffalo distributed (at time of distribution) would be 16,542 pesos at zero per cent; 20,214 pesos at 4 per cent; or 24,686 pesos at 8 per cent. There seemed to be little chance that buffaloes could command such a price in the area even for building basic herds. While this does not necessarily mean that this project could not "break even" it does emphasize the question "If a number of buffaloes were to be distributed in the area, at what average cost per buffalo distributed would the project be worthwhile from a social point of view?" In view of the

¹⁵These might be reduced somewhat by selling milk, meat, or working services. However, this was not being done in 1967 and there was little potential for this in the immediate area.

Table 30.--Projected costs and basic herd distributions for the buffalo project under selected assumptions.

Year	Purchases	Herd Maintained	Capital	Costs Maintenance	Total	Basic Herd Distributions
1967	40	40	400,000	400,000	800,000	
1968		48		400,000	400,000	
1969		57		400,000	400,000	
1970		70		400,000	400,000	
1971	216	300	1,850,000	1,000,000	2,850,000	
1972		300		1,000,000	1,000,000	60
.		.		.	.	.
.		.		.	.	.
.		.		.	.	.
.		.		.	.	.
1985		300		1,000,000	1,000,000	60
1986		300		1,000,000	1,000,000	360

fact that this project is not intended to produce or extend new knowledge about buffaloes - it is only intended to introduce them to Colombia - it would seem that a cost much above the normal market value of buffaloes would be too high. Given the apparent potential uses for buffaloes in Colombia, this could well prove to be much less than what they sell for in other countries.

Program Ranking

The preceding analyses do not by themselves provide all the information necessary to rank CVC's six major programs in order of performance. Income distribution effects and benefits not included in the PVB/PVC ratios also have to be considered. A summary of observations on these factors and PVB/PVC ratios is given in Table 31.

Only one change in program rankings is apparent with variations in the discount rate. On the basis of PVB/PVC ratios alone, the Livestock program would be regarded as a better performer than the Fertilizer program with Corn producers at a discount rate of zero per cent but the reverse would be true at rates of 4 per cent and 8 per cent.

Observations on income distribution effects are based on the relative financial well-being of program participants - they are not related to shifts in income from tax payers to persons benefiting from the program.

Table 31.--Summary of performance measures for CVC's extension programs.

	Discount Rate	Expected PVB/PVC Ratio	Probable Range of PVB/PVC Ratios	Income Distribution Effects	Benefits not Included in PVB/PVC Ratios
Livestock	0%	2.99	0.33 - 9.97	Unfavorable	NIL
	4%	2.40	0.30 - 7.18		
	8%	1.95	0.27 - 5.38		
Apiculture	0%	1.33	0.10 - 6.97	Neutral	Almost NIL
	4%	1.06	0.09 - 4.45		
	8%	0.86	0.08 - 3.03		
Fertilizer (Tomatoes)	0%	15.54	12.50 - 18.59	Neutral	Almost NIL
	4%	14.81	11.93 - 17.69		
	8%	14.12	11.39 - 16.84		
Fertilizer (Corn)	0%	2.80	2.10 - 3.50	Favorable	Almost NIL
	4%	2.52	1.89 - 3.15		
	8%	2.28	1.71 - 2.28		
Home Economics	0%	9.07	2.27 - 20.42	Highly Favorable	Positive
	4%	7.36	2.02 - 15.14		
	8%	6.09	1.81 - 11.65		
Boys' 4-H Clubs	0%	7.61	1.90 - 22.82	Favorable	Positive
	4%	6.17	1.69 - 16.92		
	8%	5.10	1.52 - 13.02		
Pacific Coast	Probably less than 1.0 but highly uncertain.			Highly Favorable	Probably Positive

If benefits accruing in the Livestock program were to be passed on to consumers through a shift in supply, the income distribution effect of this program would still likely be unfavorable because the poorer classes do not purchase much meat or milk. On the basis of the data contained in Table 31, it would appear that a reasonable program ranking would be as follows:

1. Fertilizer Program with Tomato Producers
2. Home Economics Assistance
3. Boys' 4-H Clubs
4. Fertilizer Program with Corn Producers
5. Livestock Program
6. Apiculture Program
7. Pacific Coast Programs

Of course, some of the above rankings could change depending upon how one weighted risk and income distribution effects against expected PVB/PVC ratios. It would be relatively easy, for example, to rank Home Economics Assistance first because of the large number of people benefiting.

Factors Affecting Differences in Program Performance

No complete explanation of the program results can be advanced here. The results themselves have not been sufficiently well-specified to attempt a complete analysis. Nevertheless, a comparison on several points may be useful. The points chosen for this purpose are:

- (a) cost differences,
- (b) unit benefit values,
- (c) diffusion effects.

Cost Differences

Program costs can be compared on the basis of (a) total extension costs per day of field personnel time, and (b) total extension costs per unit of output using a proxy measure of output where this is available.

The extension costs per day of field personnel time as shown in Table 32 reflect differences in classes of personnel employed, amount of travel required, and intensity

Table 32.--Comparison of several unit measures of total costs among 1967 CVC programs.

	Total Extension Costs per Day of Field Personnel Time (pesos)	Total Extension Costs Per Unit for Selected Proxy Measures of Output (pesos per unit)
Livestock Program	440	7330/farmer <u>or</u> 75/head of livestock
Apiculture Program	453	4980/bee-keeper <u>or</u> 498/colony
Fertilizer and Farm Planning Program	387	{ 3832/tomato producer 2395/corn producer
Home Economics Assistance	239	11777/club <u>or</u> 551/member
Boys' 4-H Clubs	302	26950/club <u>or</u> 1789/member
Pacific Coast Programs	237	N/A
Other Programs	375	N/A

of use of materials and supplies. Variations in the amount of administration and supervision among programs are not reflected as these were included in total extension costs by pro-rating them on a proportionate basis. Most of the differences in costs per day of field personnel time shown in Table 32 are attributable to differences in the classes of extension personnel employed. The only exception to this was the apiculture program where, as noted previously, about 100 pesos per day was attributable to higher than usual travel costs. As one might intuitively expect that the higher-paid, better-trained personnel would be capable of producing more in a day, there is little cause for concern in this observation by itself.

However, it should be noted that the several classes of personnel employed did not represent different levels of capability in performing the same work (i.e., the agronomos did not do what the mejoradoras did - they performed quite different functions). Indeed, it would have been difficult for one type of personnel to perform the functions of another type. Thus, unless one examines the outputs of the various classes of personnel, it cannot be assumed that their marginal value products were, in fact, different. This is rather difficult to do given the data available. However, as the programs which ranked highest in performance employed predominantly non-professional personnel, the hypothesis that professionals were overpaid

relative to non-professionals does suggest itself.

As no physical measure of output was available in any program, proxy measures were selected to permit cost comparisons. These measures must be used with extreme caution because they do not allow for some of the classes of benefits which perhaps existed in the various programs. (For example, using an estimate of extension costs/bee-keeper implicitly assumes that output varied with the number of bee-keepers serviced. This is not strictly true because of the possibility of benefits resulting from extension activities with the Bee-keeper's Association.) Nevertheless, these measures can provide some means of comparison. It is obvious, for example, that the Apiculture program has to produce benefits per participant much greater than the Livestock program if it is to be justified. As the monetary volume of business per participant is much greater in the latter case, one would intuitively question the feasibility of this. (Of course, such comparisons tell only part of the story. High costs per program participant are warranted if high levels of benefits per participant can be obtained - as in the Fertilizer program with tomato producers.) The data on costs per participant illustrate fairly well some of the rather difficult choice problems that extension agencies face. In terms of costs, two Home Economics Club members could be serviced for every Livestock farmer whose service was discontinued. Larger farm operations do not

cost a great deal more to service than small but, in the former case, monetary benefits are likely to be greater and income distribution effects are likely to be less favorable than in the latter.

Benefit Values per Unit of "Output"

A variety of factors appeared to be influencing benefit values per unit of output both within and among programs. These cannot be readily classified and must be looked at program by program.

Data from Home Economics club members were gathered in an effort to determine limiting factors for this program. A summary of these is given in Table 33. "Resources" (i.e., income and/or possessions) and "interests" were the most often-mentioned factors. Because of the heavy

Table 33.--Incidence of mention of various factors considered to limit utilization of knowledge in the home economics assistance program.

Limiting Factor Instruction	Number of Members Mentioning				
	None	Resources	Time	Interest	Under- standing
Clothing	1	29	2	2	2
Health	4	6	-	14	7
Hygiene	4	12	-	13	3
Food	2	29	-	6	3
Home Improvement	1	22	2	7	2
Small Industry	1	7	1	27	1
Acción Comunal	1	2	1	23	0
Gardens	12	12	2	8	5
Total	26	119	8	100	23

emphasis on "resources" one is led to believe that this program, even though it appeared to be well-suited to low income families, might have resulted in a little higher level of utilization if it had been directed at groups with slightly higher incomes. (The lowest-income families in the sample were usually slower to adopt recommended practices.) The heavy emphasis on "interest" indicates that the practices being extended did not offer big pay-offs to the families concerned. This is supported by data on benefit measures. Even benefits of 500 pesos per family per year could not be regarded as large in relation to family income or levels of wealth prevailing in other countries. (Many of the families interviewed seemed to realize their relative state of poverty.) Furthermore, as most of the benefits came in non-monetary form they could not be readily exchanged for preferred goods in the market place. The low incidence of "understanding" being mentioned as a limiting factor indicated that extension personnel were getting their message across.

Although similar data were not tabulated for other programs, it appeared that "resources" and "interest" would be important limiting factors in the Boys' 4-H Clubs as well. The programs directed at livestock producers, beekeepers, tomato producers and corn growers were somewhat different, however. In these cases, size of business, risk, relevance of the technology to the operation, and extension

effectiveness were all of relevance. In the apiculture program, for example, some losses were incurred because of incorrect advice. On most farms benefits would have been greater if the farmer had been in charge of a larger business. In the fertilizer program, CVC supplied fertilizer on credit but the farmer had to bear a risk he would not have had to bear if he had not used the fertilizer.

(Benefits to the fertilizer program might have been much lower if CVC had not supplied the fertilizer on credit.) In all of these programs some farmers were encountered who felt that some of the recommended practices were not relevant for their operation. However, this did not appear to be a major factor as extension workers seemed to be fairly capable of selecting the set of practices which would work on a particular farm.

Nevertheless, extension personnel did not appear to have readily available a large reservoir of technology which they could usefully promote. One got the impression that while they would not recommend practices which they felt wouldn't work, they had to put forth a good deal of effort to come up with workable sets of recommendations.

Diffusion Effects

Relatively little diffusion of knowledge from program participants to others in the community was discovered in the interviews conducted in this study. Certainly some evidence was found of this in a few programs

but, on the whole, it was rather difficult to detect and measure. Several explanations of this might be advanced. Possibly this process is rather slow in the areas and situations examined in this study and only several surveys taken a few years apart would detect it. Perhaps there is not sufficient social contact in some communities for such a process to exist except on a very small scale. Perhaps the sort of technology which was being extended was not easily communicated. In one case (i.e., the apiculture program) diffusion seemed to be almost impossible because of the nature of the business. Another reason for the lack of noticeable diffusion might have been that programs were not directed at natural innovators or leaders.

If diffusion could have been stimulated for programs such as Home Economics Assistance and Boys' 4-H Clubs, returns for these programs might have been much higher. Without diffusion effects the Fertilizer program would have received a much lower rating than it did. Perhaps more diffusion might have been stimulated for other programs if the extension service had made greater use of the mass media, especially radio. However, only experimentation and further research can lead to an answer in this area.

Cost Minimization

This section is directed at answering the question "Could the CVC have produced the same results at

lower total cost in 1967?" As there were probably an infinite number of ways of producing approximately the same results, it is necessary to approach the problem under two general sets of assumptions. The first of these assumes that personnel and extension media are fixed while office locations and transportation methods are variable. The second permits extension personnel and media to vary while considering office locations and transportation methods as fixed.

Possible Cost Savings by Changing Office Locations and/or Transportation Methods

The percentage distribution of field personnel time by type of activity and class of personnel is shown in Table 34. If "productive field personnel time" is defined to exclude those activities numbered 2, 3, 6, and 7 in this table,¹⁶ it is possible to define two possibilities which would have resulted in lower costs:

- (1) any different system of transportation and/or office location which would have reduced costs per day of "productive field personnel time" and still permitted "productive activities" to be performed as they actually were performed.
- (2) any saving in time spent "working with program participants" which did not adversely affect the level of "outputs" actually produced.

¹⁶As thus defined, "productive field personnel time" includes time spent performing both "management" and "program operation" functions. As cost calculations also include costs of "management", the conclusions reached are not wrong but in possibility (1) of the first set of assumptions they actually reflect minimizing "program operation" and "management" costs together rather than "program operation" costs alone.

Table 34.--Proportion of time spent in various activities by class of personnel for CVC's extension service.

	<u>Agronomos</u> and <u>Veterinarios</u>		<u>Mejoradoras</u> de <u>Hogar</u>		<u>Practicos</u> <u>Agricolas</u>	<u>Obreros</u>	<u>Total</u>
1. Working with Program Participants	55.7		64.5		58.4	68.0	60.1
2. Travelling	17.7		22.3		21.1	23.4	20.3
3. Delivering Others to Work	3.9		-		1.5	1.8	2.2
4. Planning Programs	8.9		5.6		9.8	1.1	7.2
5. Writing Reports	5.6		4.6		3.2	1.5	4.3
6. Fixing Cars	4.0		-		0.1	2.6	2.0
7. Lost time for Lack of Cars	2.0		2.0		1.2	-	1.5
8. Training	0.8		-		3.7	0.3	1.2
9. Other	1.4		1.0		1.0	1.3	1.2
Total	100.0		100.0		100.0	100.0	100.0

Second, it is assumed that transportation systems and office locations are fixed, so that the possibility of using different combinations of personnel and communications media which might have produced essentially the results can be considered.

Costs per day of "productive field personnel time" could have been reduced if all personnel had driven themselves and chauffeurs had not been used. Where chauffeurs were used, they increased costs per day significantly (i.e., apiculture program). However, as the extension service employed only two chauffeurs essentially full-time in 1967, the total savings here would have been only about 36,000 pesos. Some additional costs might have been incurred by providing more dependable vehicles - particularly for the mejoradoras - or by having extension personnel become more involved in taking care of vehicle problems. It might also have been necessary to replace any personnel who were not willing to drive themselves.

Thus, as the question of chauffeurs is obviously related to the transportation problem as a whole, it is perhaps better to consider it as such. There was only one vehicle available for every 2.6 extension field workers in 1967. Furthermore, these were almost all five years old or older and subject to the usual problems encountered in vehicles of that vintage. They were well-suited to the job but were often out of order for several days or weeks at a

time. Thus, some time was spent by extension personnel fixing cars, delivering others to work, and doing nothing because transportation was unavailable. There was noticeable dissatisfaction among extension personnel with the situation. Thus, the question arises "Would a better transportation system as a whole have been justified?" It appears that a regular trade-in program would have alleviated some of the problems by ensuring that not all vehicles became old simultaneously. More vehicles would have reduced unproductive time.

An additional six vehicles would have provided one for every professional field worker and one for every three mejoradoras and/or practicos.¹⁷ This would have increased total vehicle operation costs by about 158,400 pesos.¹⁸ A regular trade-in program for existing vehicles would have increased capital requirements by about 30,000 pesos per car or 450,000 pesos. This would have added an annual charge of 90,000 pesos for interest and perhaps reduced repair costs by 0.01 pesos per kilometer or 30,000 pesos. Thus, with chauffeurs eliminated, the total additional costs of this would have been higher but if some or all of the time saved could have been devoted to "productive work", costs per day

¹⁷ This system is selected for comparison because the agronomos had the largest percentage of unproductive time and they also had the highest cost per day of total time.

¹⁸ Annual depreciation: 5,000 pesos (Purchase price 60,000 pesos; salvage value 40,000 pesos). Interest - 20% of 50,000 = 10,000. Annual Operating Costs: 11,400 pesos (20,000 kilometers at 0.57 pesos per kilometer).

Total Cost per Car = 26,400 pesos.

of "productive field personnel time" might have been lower. To arrive at estimates of these costs the added costs of the suggested transport-system have been divided among classes as follows: agronomos, 85 per cent; mejoradoras, 5 per cent; practicos, 5 per cent; obreros, 5 per cent. A comparison of actual costs per day of "productive field personnel time" of the suggested transportation system is shown in Table 35 under two assumptions - (1) all time spent in activities 3, 6 and 7 would have been changed to productive time, and (2) 70 per cent of time spent in activities 3, 6, and 7 would have been changed to productive time. The latter assumption is believed to be the more reasonable.

Table 35.--Costs per day of "Productive Field Personnel Time" by class of personnel for the existing transportation system and an alternative.

	Existing System	Alternative System	
		Assumption #1	Assumption #2
<u>Agronomos and Veterinarios</u>	598	583	605
<u>Mejoradoras de Hogar</u>	292	291	293
<u>Practicos Agricolas</u>	348	342	346
<u>Obreros</u>	270	265	270

The results shown indicate that costs per day of "productive field personnel time" could have been slightly reduced if the first assumption was valid. If only 70 per

cent of unproductive time could have been converted to productive time, daily costs for agronomos would have been slightly higher. The author is inclined to believe that the slight increase in costs would have been more than compensated by better personnel morale and higher resulting productivity. However, there is some question as to whether the extension service could have adopted the suggested systems independently of the rest of CVC. This restriction and the questionable availability of capital - even at 20 per cent interest - would be important considerations in deciding whether or not to change.

Costs per day of "productive field personnel time" would also have been reduced if time spent travelling (activity #2) had been lower. Travelling accounted for 20.3 per cent of all field personnel time and, while field workers may have done some program planning while travelling, it was to a large extent "unproductive." There were three possible ways to reduce the amount of travelling time:

- (1) operate the same programs in areas closer to the office,
- (2) expand the number of office locations so that personnel would be closer to the field areas,
- (3) utilize extension methods which achieved the same result without as much travelling (e.g., radio).

The first alternative was not feasible. Areas close to the office were either already being serviced or were not agricultural. Workers in some programs (e.g., Apiculture and Livestock) had to go far afield to find extension

participants.

It appears that there may have been some gains to have been made by increasing the number of office locations. As noted earlier there was a fairly high concentration of field personnel per office - this amounted to a little over seven man-years on the average. This meant that some workers were not located in the centre of the area they serviced but outside of it. However, changed office locations would probably have required more vehicles and created difficulties in getting personnel willing to live in smaller towns. Both of these problems would have entailed increased costs. In addition, some office maintenance costs (e.g., rental, secretaries, etc.) would have been higher. Furthermore, field workers from outlying offices made frequent trips (once every week or two) to Cali for planning purposes and, if other offices had been opened, time spent making these trips would have increased. Travelling time could have been reduced by opening one or two more offices for workers in the Home Economics and Boys' 4-H Club programs. Offices were already more or less optimally-located for workers in the rest of the programs. Given these circumstances it appears that, on the whole, little or no cost reduction could have been achieved by having more offices. However, for other sets of programs this conclusion would not necessarily apply.¹⁹ Also, the larger number of offices with fewer

¹⁹ As will be seen in Chapter IX, extension workers in Antioquia spent 18.3% of their time travelling and, because of conditions, their average speed was much lower

field workers per office might very well improve the reputation of the extension service and make it easier for rural people to seek out extension workers for advice. Almost no rural people visited CVC's field offices in 1967. Thus, while there was probably no advantage to having more field offices for 1967 programs alone, it definitely appears as if more offices with fewer field workers per office could be operated for the same total cost and produce more long-run benefits.

Returning to the classification of extension activities shown in Table 34, it seems appropriate to consider if any saving could have been made in time spent "working with program participants" without reducing the "outputs" actually produced. There were some obvious possibilities here. Firstly, all work which resulted in zero or negative benefits might have been eliminated, if it could have been detected in advance. This was primarily a problem of whom to work with although in one case it appeared to involve who should do the work. The method of selecting farmers for the fertilizer program was an obvious attempt to select participants who had a high probability of adopting recommendations. As previously noted, the location

than that of CVC. Thus, for certain sets of programs, CVC's per cent of time spent travelling could probably be reduced significantly. If it were cut to 10% and total costs per day of field personnel time increased only 5% (for added office costs, cars etc.) over and above those increases under assumption #2 of the suggested transportation system, costs per day of "productive field personnel time" would be as follows: Agronomos, 579 pesos; Mejoradoras, 268 pesos; Practicos, 325 pesos; Obreros, 261 pesos.

of such participants was time-consuming. As extension workers can never know for sure who will adopt given recommendations, some proportion of their efforts will probably always result in failure. Although they try to keep this proportion low, it would probably never pay to attempt to reduce it to zero. Nevertheless, it would appear that a fairly high proportion of the efforts directed at participants in the Home Economics and Boys' 4-H Club programs produced little or no results. If extension workers had been more selective here, less time might have been required to achieve the same "output". However, given the club form of organization, the marginal cost (in terms of extension worker time) of having additional persons in the club was probably very low. Thus, no definite conclusion can be reached for these programs. In the apiculture program, the proportion of participants with no or negative benefits also appeared high and, as this program had been in operation for some time, this should, in the author's opinion, have been detected and corrected. As noted previously, a considerable part of this appeared to be attributable to the incorrect advice given by one of the extension workers. Secondly, some definite time-wasting activities were observed by the author as this study was being conducted.²⁰ Several field days were attended by this writer at which as many as seven extension workers were present (sometimes including

²⁰ It is assumed that similar activities took place in 1967.

secretaries) and most of these persons contributed nothing to the meetings. One, two, or three field workers would have been sufficient to get the job done. Field trips were made by the author with several agronomos. On three successive days the working day was considered over at two or three o'clock in the afternoon and the agronomo went home for the rest of the day. To the author's knowledge there were no added activities at other times to offset this. The elimination of such time-wasting activity could well have created more "productive work time". Of course, in any large organization some of this is bound to occur and it is difficult to say that the extent of this in the CVC was unusually high.

Possible Cost Savings by Changing Extension Personnel and/or Extension Media

As noted earlier, it appeared as if there might have been some savings to be made by using extension media which did not involve as much travelling. The choice of media was severely limited by environmental conditions but most extension participants had a radio and many had access to newspapers.²¹ More extensive use of meetings and field days might also have been appropriate. However, most extension personnel had little or no experience in the use of these methods of communication and their clients were not accustomed to receiving technical information in this manner. There

²¹Quite often one member of a family would read, or families would pick up news from neighbours who had access to a paper.

could be little doubt that, if other methods were adopted by the CVC, they would have to be used to complement existing methods - not to completely substitute for these. Given the limited budget of the CVC, it would also be necessary for those extension workers who were using existing methods to learn and apply the new ones. The costs of training and making existing personnel "jacks-of-all-trades" might more than wipe out any savings in transportation.

It would seem, however, that the use of other media, particularly the radio, might be more appropriately evaluated on the basis of changed results and not on costs savings alone. As has been already indicated, there was a noticeable lack of diffusion from extension participants to their neighbours in most of CVC's programs. This did not appear to be due entirely to the lack of relevance or utility in the technology being extended. Instead, it appeared as though the neighbours of participants had no incentive or basis for inquiring and participants themselves were reluctant to adopt the role of teacher without such inquiries. If this hypothesis is correct, the use of radio could have a noticeable effect on program results by stimulating non-participants to quiz their participating neighbours about CVC's work. The person-to-person contact would still likely be required to get new technology adopted by innovators, but, once a few had adopted, the diffusion rate might be more rapid. It would seem that a controlled experiment to evaluate the effectiveness of radio in producing

such results would be warranted.

Most variations in extension personnel or extension methods are difficult to achieve without influencing program results. Thus, it is difficult to analyze these in strictly a cost-minimizing context. Nevertheless, it was noted earlier that the productivity of professionals did not appear to exceed that of non-professionals by the difference in salaries. This raises the question as to whether CVC could have reduced costs in some programs by using lower-qualified personnel. This certainly appeared to be a possibility, particularly as far as field work was concerned. Perhaps the apparent low productivity of professional personnel resulted from their heavy involvement in administrative tasks, the dearth of useful available research material for them to interpret for farmers and their colleagues, their lack of practical background, their relative inexperience - (some were recent graduates) - or their high turnover rate. In any event, it certainly appeared that, in 1967, CVC could have produced the same results at lower cost by having fewer professionals and more non-professionals.

It is questionable, however, as to whether this conclusion would hold in the future. Certainly the influences mentioned above may change. Other possible influences may also change. This could mean that professional personnel would become more productive. However, at the

present time there would appear to be little reason to assume, as some studies have done,²² that the hiring of professionals will automatically improve extension effectiveness.

²²This assumption is implicit in the study on "Higher Agricultural Education in Colombia" and the study by DiFranco and Clifford on five Colombian extension agencies.

CHAPTER VIII

EXTENSION ACTIVITIES OF THE DEPARTMENT OF AGRICULTURE OF ANTIOQUIA

Characteristics of the Department

Antioquia is one of the largest departments in Colombia both in terms of population and area. It is located in the north-western part of the country but is largely surrounded by other provinces and only borders the Carribean for a short distance. In 1964 its population numbered 2,477,299, of which 46.6 per cent lived in areas outside of the county seats.¹ Medellin, Colombia's second largest city, is the province's capital and only industrial center. The 1964 population of Medellin itself totalled 772,887 and, like other Colombian cities, it has grown steadily since then. The Medellin Valley (or "metropolitan" Medellin) now contains almost half the province's population. A number of towns and villages scattered throughout the province account for the rest of the "urban" population but these are heavily agricultural

¹The smallest unit of government in Colombia is the municipio which is roughly equivalent to the country in the U.S. or Canada. The town in which local government offices are located is called a cabecera. It is usually the only village or town of any size in the municipio and is referred to here in English as a "county seat".

in their make-up. The largest of these has a population of only 17,700.

Antioquia is recognized by Colombians and foreigners alike as being a source of progressive ideas and industry. A disproportionately large number of Colombian firms are owned and operated by Antioqueños. Many Colombian companies have their main plants and offices in Medellin. Antioqueños are proud of this reputation and do not hesitate to accentuate it. On many government desks in Medellin one finds the motto "We Antioqueños can do more."² There are various theories as to why the natives of Antioquia have developed such a progressive spirit³ but for the purposes of this study it is only necessary to note that it exists.

Although the main economic activity of Antioquia is farming and ranching, the province is, for the most part, quite unsuitable for intensive agriculture. It is largely hilly and mountainous with some level land along the Atlantic Coast near the port of Turbo and in the Magdalena Valley (see Figure 9). Nevertheless, areas of rice, beans, corn, pasture, coffee, and sugar exceeded those of Valle del Cauca in 1965 (see Table 36). Large proportions of these crops (except for pasture) appear to have been produced on very

²There are several versions of this saying in Spanish. The most common is "Los Antioqueños podemos hacer mas".

³See, for example, Everett E. Hagen, On The Theory of Social Change: How Economic Growth Begins, (Homewood, Illinois: The Dorsey Press, Inc., 1962.

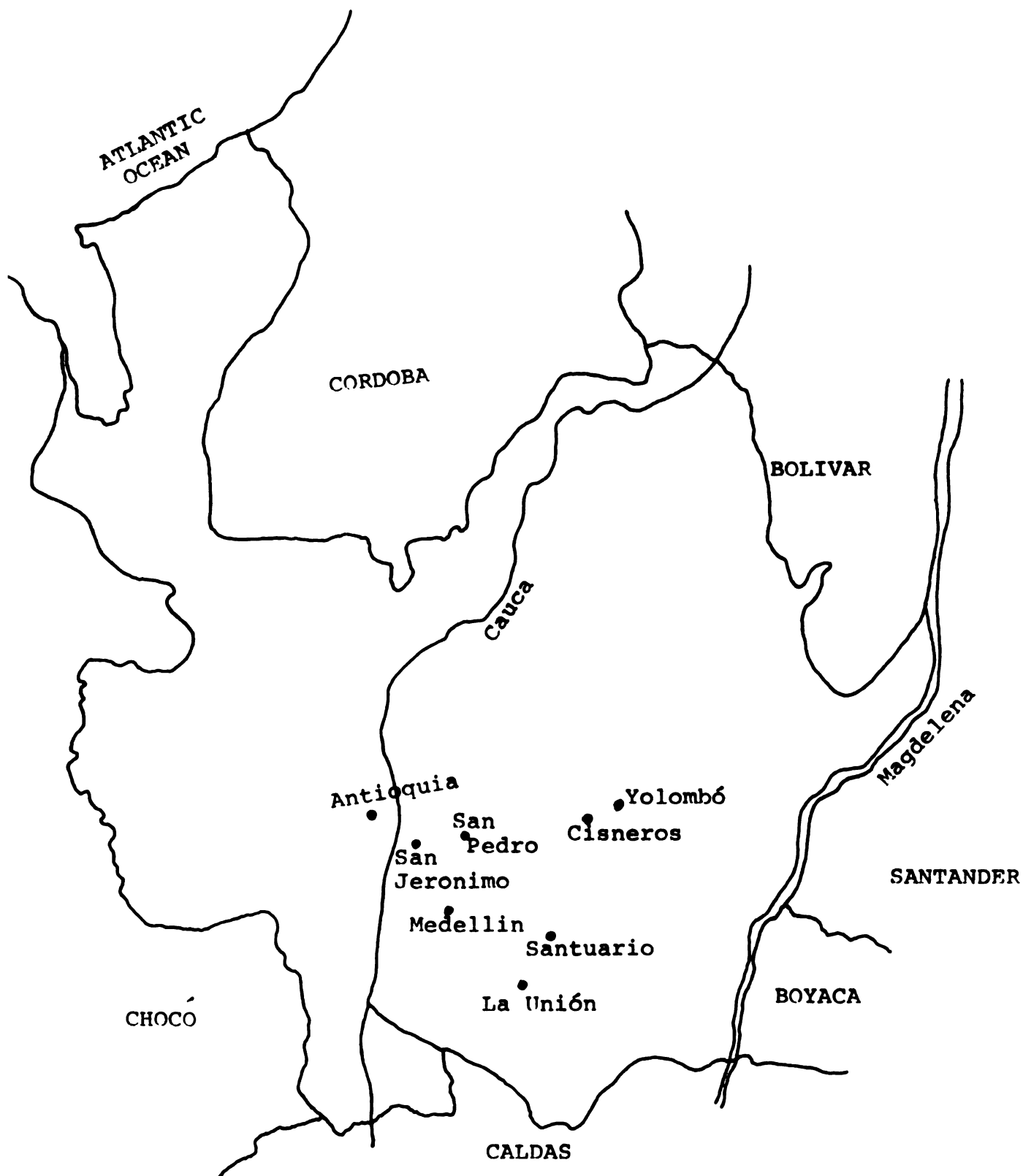


Figure 9.--Map of Antioquia showing office locations of the extension service of the Department of Agriculture.

Table 36.--Estimated land use pattern for land in farm units in the Department of Antioquia in 1965.^a

	Hectares	%
Temporary Crops		
- Rice	26,100	0.9
- Beans	17,200	0.6
- Corn	65,600	2.4
- Potatoes	4,200	0.2
- Tobacco	200	-
- Cassava	10,200	0.4
- Others and Fallow	154,200	5.6
Permanent Crops		
- Bananas	6,600	0.2
- Cacao	2,500	0.1
- Coffee	142,800	5.2
- Sugar	98,400	3.6
- Plantain	19,200	0.7
Permanent Pasture	1,201,400	43.5
Mountains and Forests	897,600	32.5
Others	113,400	4.1
Total	2,759,600	100.0

^aAdapted from Dane's 1965 Encuesta Agropecuaria.

small farms by mostly human and, occasionally, animal power. This is a semi-subsistence type of agriculture in which very little food is purchased by the farmers from outside the community but they are nevertheless part of the market economy in that they sell some products to obtain cash for purchases of clothes and a few industrially-produced items. Most of the farm families in the area are quite poor, owning less than five hectares of land and earning less than \$200.

(U.S.) per year. A number of large cattle ranches are located in the province and these account for perhaps one-third of the land divided into farm units. Many of the owners of these ranches are not rural residents.

Table 36 gives a general description of the pattern of agricultural production in Antioquia. The importance of cattle, coffee, corn, plantain, cassava, sugar, beans and rice is evident. The wide variation in altitude produces similar climatic variations to those noted in Valle del Cauca. Thus, a wide variety of products can be produced in the region. However, because of transportation costs and production advantages in other regions, the output of many items is used to supply only local needs and the Medellin market. In fact, Medellin always imports some food products, such as corn, from other areas. As in most parts of Colombia, coffee is the main agricultural export. Some bananas produced in the Turbo area are also exported.

As might be expected, agricultural technology differs in many respects from that found in the flat valley floor area of Valle del Cauca. For example, the differences in the production and use of sugar cane are quite marked. In Valle a large amount of sugar cane is grown for the ingenios⁴ whose owners operate large holdings solely for

⁴An ingenio is a sugar processing plant but the term is sometimes used to describe both the factory and the plantation.

the production of refined white sugar. In Antioquia virtually all the sugar cane is used to produce panela - a partly-refined cake of brown sugar. The terrain in this region is not well-suited to the establishment of the large fields of cane required to support a sugar refinery. Thus, it is not economical to completely refine the product and the two sugar industries differ considerably. (A large amount of sugar cane is used for panela in Valle as well but, in general, even the panela operations are larger in that region).

Antioquia's rugged terrain is a serious deterrent to the provision of some of the components of rural infrastructure that are now considered an important process of agricultural growth.⁵ Transportation is particularly difficult. In 1967 only about one in eight farm parcels in Eastern Antioquia was located on a road.⁶ Rail and air transport are of little direct relevance to rural areas although they are quite important to the industrial economy of Medellin. Some water traffic exists on the Cauca and the Magdalena Rivers but only a small proportion of agricultural output reaches market this way. Thus, most traffic in and out of rural areas is by road with some stages often being

⁵See Chapter 4 of Agricultural Development and Economic Growth, edited by H.M. Southworth and Bruce F. Johnston.

⁶Felstehausen, H., "Local Government and Rural Service Barriers to Economic Development in Colombia", (A Report of the Land Tenure Center, Edificio CIRA, Bogotá, Colombia, 1968), p. 25.

completed by horse, mule, or on foot. Most rural areas have poor educational facilities. About three in one hundred children finish five years of schooling. Medical facilities are much poorer in rural areas than in Medellin. Eastern Antioquia has only one doctor for every 8,000 people. Many rural towns and villages have some form of public utilities to provide electricity, water, sewage, garbage collection, and animal slaughter service. Telephone and postal services also exist. However, the quality and quantity of these services are such that many rural residents receive little or no benefits from them. Nevertheless, it is generally acknowledged that the government of Antioquia is an active and progressive one. Felstehausen suggests that "there are also indications that local government and public services in Antioquia are among the best in the country."⁷

Felstehausen's study describes the distribution of provincial and municipal revenue and expenditures in eastern Antioquia in 1966. The heavy dependence of public projects on taxes from tobacco, beer, liquor, and lotteries is quite evident. It is Felstehausen's contention that "many public factors are scarce in Colombia and cannot be easily obtained."⁸ He suggests that revenue could be raised for such services by means of a land tax if landowners,

⁷Felstehausen, op. cit., p. 6.

⁸Ibid., p. 2.

who control the provincial government, were willing to tax themselves. He maintains that existing "bureaucratic interests and concepts" together with "ancient administration methods"⁹ serve as barriers to the provision of necessary elements of rural infrastructure. Felstehausen's study also shows the heavy reliance of local public services upon departmental and national funds. As rural people have little control over any of the public decision-makers in these areas, the system can perpetuate itself even if they (rural people) are willing to change the amount or the "mix" of public expenditure. However, it should not be assumed that, because funds for many public services must be appropriated by provincial and national governments, the rural areas are being subsidized by urban ones. On the basis of departmental budgets alone this may appear to be true, but, when one considers the "double-exchange-rate" tax on coffee exports, the reverse appears to be true.

Activities of the Department of Agriculture

The Department of Agriculture usually accounts for two to three per cent of the total budget of Antioquia. This amounted to about 7.5 pesos (\$0.45 U.S.) per rural resident in 1964. While this appears to be relatively small by North American standards, it probably represents between one-third and one-quarter of one per cent of the total

⁹Ibid., p. 66.

income of rural residents in the province. It is also sufficient to support the largest and most active provincial agricultural program in Colombia. One of the key features of this program is the extension service.

The extension division of the Department of Agriculture is divided into three sections: Rural Extension, Communication, and Agricultural Assistance. The Rural Extension section operates about eight field offices and is administered by personnel located in the Department of Agriculture offices in Medellin. The Communications section does no field work. It is in charge of editing, printing, and, in some cases, writing publications which are directed at farm people and distributed mainly by the field officers of the Rural Extension Section. It also prepares a variety of reports for use only within the Department of Agriculture or for publicity purposes. The Agricultural Assistance section aids farmers directly in three areas - panela ovens, animal power, and tree fruits. These programs are to some extent educational but appear to consist mostly of providing services (e.g., constructing panela ovens, repairing machinery in panela mills, training oxen, and giving away fruit tree seedlings).

Other divisions of the Department of Agriculture include Livestock, Co-operatives, Research, Natural Resources, and Fondo de Fomento. Programs of the Livestock division involve mainly research and regulatory functions. However, some extension is also carried out by the various sections

of the Livestock division. The Co-operatives division offers accounting and managerial assistance to various established co-operatives in the province. It also assists farm groups wanting to establish co-operatives. The Research division conducts studies of economic interest. Measuring costs of production and collecting data on prices and output of agricultural products are popular. The Natural Resources division is in charge of managing public forests, promoting reforestation, and conducting forestry research. The Fondo de Fomento division has been used to build storehouses in various parts of the department and to provide revolving credit facilities for the Rural Extension section. Virtually no funds are devoted to crop research in spite of the vital importance of crop production to the province's agricultural economy. However, a considerable amount of research has been done on coffee by the Coffee Federation and I.C.A. is engaged in research on other crops in the region.

In order to reduce this study to manageable size, it was decided to examine only a sample of the activities of the Rural Extension section of the Extension Division during 1967. Since the late 1950's this division is charged with the responsibility of servicing several (usually two or three) districts composed of 100 to 200 families each. These districts do not necessarily adjoin each other geographically. They are usually

communities of farmers with small farms surrounded by rough uninhabited areas, large cattle ranches, or other fairly distinct rural communities. The boundaries of the districts are defined by the extension personnel. Work in any district may be terminated if it is considered that extension resources could be used to better advantage elsewhere. Similarly, field offices may be closed or opened, or the responsibility for any district may be transferred from one field office to another. When it is decided to offer extension services in a given area the personnel who will work there interview all the families in the district. A wide variety of questions¹⁰ are asked and the answers are compiled and interpreted by extension personnel and the Research Division of the Department of Agriculture. The results of these studies serve as a basis for program planning in the various districts. Reports are written to summarize the findings and specify the work programs for each district. Usually the work plans are formulated on a five year basis. They are however, subject to change, should it be discovered that programs are not working as expected.

In 1967 eight field offices were in operation and these offices offered extension services in twenty-one districts. The activities of two of these field offices are discussed in detail in this study. These two sectors

¹⁰ Several of the district reports indicated that about 175 questions were included in the questionnaire.

were not selected randomly but were chosen with a view to keeping research costs low. The author has not visited the other field areas but, he has been assured by competent persons who are familiar with Antioquia that extension activities and the rural environment in those areas are quite similar to those in the sectors studied. Thus, although it cannot be concluded that the results presented here are representative of the work being done by the Department of Agriculture throughout the whole of Antioquia, there seems to be little reason to suppose that they are not.

The field offices chosen were located in San Jeronimo and Santa Fe de Antioquia. In 1967, the San Jeronimo office serviced the districts of Urquité and El Brasil while the Santa Fe de Antioquia office serviced the districts of Tinajitas, Buenos Aires, Pinguro and El Espinal. Cost estimates were made of all 1967 extension activities in each of these districts. (As mentioned in Chapter I, this was somewhat different from the approach used for CVC where it was possible to estimate costs by program. However, because of data limitations and the methods of work organization, it was impossible to analyze the two agencies on the same basis.) Estimates of benefits were constructed for three districts in the Santa Fe de Antioquia sector and one district in the San Jeronimo sector. These estimates were constructed so as to represent as closely as possible

the results of all extension work in the area by the Department of Agriculture in 1967.

Costs of 1967 Extension Programs

In 1967 the Extension division of the Department of Agriculture of Antioquia operated the Rural Extension section, the Communications section, and the Agricultural Assistance section for a total estimated cost of 5,953,017 Colombian pesos.¹¹ These costs included, in addition to the direct program costs incurred by the Extension division, allowances for (1) a proportionate¹² share of the Administration of the Department of Agriculture, (2) transfers to extension employees from other parts of the Government of Antioquia, and (3) services rendered by the Research division of the Department of Agriculture. The proportionate share of Administration costs may be a poor estimate of the costs actually incurred by the Secretary in administering 1967 extension programs. However, it seemed the most reasonable method to use under the circumstances.

The transfers from other parts of the Government were obviously part of the costs of 1967 extension efforts because they were made up almost entirely of fringe benefits

¹¹The breakdown of these costs is shown in Appendix Table C-1.

¹²The proportion used was that of Extension Service direct program expenses over total direct program (non-administrative) expenses of the Department of Agriculture.

for extension employees for that year.¹³ The estimate of costs of services rendered by the Research division of the Department of Agriculture is based on conversations with personnel of that division regarding approximate allocations of their time.

Salaries, wages and employee fringe benefits represented about 85 per cent of the total cost of operation. This was only slightly higher than CVC as about 81 per cent of the latter organization's expenditures fell in this category. Although definitions of other expense categories were not specific, it appeared that transportation accounted for a somewhat lower proportion of the total costs than in the CVC's extension service. The possibility existed that some transportation costs (i.e., gasoline, maintenance, depreciation on vehicles, etc.) were actually paid by other parts of the government but no one in the Medellin extension office or in the accounting offices visited thought this was the case. Chauffeur's salaries and fringe benefits were probably considered "personnel" rather than "transportation" costs by the accounting system and this makes comparison with the CVC difficult. A large part of the cost of operating the Communications section was incurred in providing materials for the Rural Extension section. Thus, in order to arrive at an estimate of the total costs of providing the services in the eight field areas, 80 per cent

¹³ See Appendix Table C-2.

of the costs of operating the Communications section was considered to be directly attributable to the operation of the eight sectors. This brought the total costs of the services provided by these sectors to 4,354,930 pesos or 544,366 pesos per office.

The complement of personnel operating out of these offices varied somewhat from office to office and throughout the year. However, on the average, the field personnel working out of each office included 1.2 agronomos or veterinarios, 1.8 mejoradoras de hogar, 3.0 practicos and 3.8 obreros.¹⁴ Some secretarial help was also employed at each office. Average costs per working day of the various classes of field personnel was estimated¹⁵ and these are shown in Table 37. "Other costs" are noticeably lower than for the CVC's extension service although "salaries and fringe benefits" are just about the same. The difference in "other costs" may be due in part to some administrative costs being omitted in the case of Antioquia and/or administration being over-charged in the case of CVC. The author is of the opinion that the rest of the difference resulted from the slightly different administrative services

¹⁴These averages are calculated from the data on distribution of field personnel time by office location given in Table C-4. An average of 300 working days per year was used for obreros and 230 working days per year for other personnel.

¹⁵Calculations are shown in Table C-4. "Other costs" were estimated by assuming them to be constant for all classes of personnel.

Table 37.--Average costs per day of field personnel time by class of personnel for the rural extension section of the Department of Agriculture of Antioquia in 1967.

Class of Personnel	Salaries and Fringe Benefits (pesos)	Other Costs (pesos)	Total Costs (pesos)
<u>Agronomos and Veterinarios</u>	312.5	95.5	408.0
<u>Mejoradoras de Hogar</u>	107.0	95.5	202.5
<u>Practicos Agricolas</u>	107.0	95.5	202.5
<u>Obreros</u>	54.0	95.5	149.5

that were provided and the spreading of some fixed costs over a larger number of working days. As with the CVC, it was impossible to accurately distinguish fixed and variable costs. Probably less than 20 per cent of total costs could be considered fixed. There was no reason to believe that a larger organization would not result in slightly lower costs per day of field personnel time.

The estimates of average total costs per day of field personnel time were used to estimate the costs of 1967 programs in the six districts of San Jeronimo and Santa Fe de Antioquia (see Appendix Table C-5). These costs, along with average costs per family, are shown in Table 38. As a family is not a well-defined unit of measure of what extension output might be, several types of families are shown. "Resident families" include all families residing

Table 38.--Total extension costs, number of families, and average extension costs per family for 1967 extension programs by type of family for the six districts serviced by the sectors of San Jeronimo and Santa Fe de Antioquia.

District	Total Extension Costs	Resident Families		Farm Families		Participating ^a Families	
		Number	Cost/ Family	Number	Cost/ Family	Number	Cost/ Family
El Brasil	195,155	153	1276	147	1328	121	1613
Urquitá	256,785	70	3668	65	3951	38	6578
Tinajitas	157,074	101	1555	75	2094	59	2662
Pinguro	181,045	99	1829	86	2105	44	4115
Buenos Aires	119,568	124	964	107	1117	68	1758
El Espinal	184,761	112	1650	85	2174	69	2678
Total	1,094,388	659	1661	565	1937	399	2743

^aMost of these families participated in 1967.

in the district but these families do not necessarily farm or own land. (Some land in the district is owned and farmed by non-residents.) "Farm families" include all resident families with land. Participating families include those families who participated in extension programs at some time since the inception of these programs in the district. (Almost all of these families participated in 1967.) Participating families are all essentially resident farm families. As can be seen, costs per participating family varied considerably from district to district. This variation may be either above or below the actual variation because of the method of calculating costs. Most of it appears to be due to the variation in percentage participation among farm families as costs per farm family are fairly stable.

The Method of Estimating Program Benefits

Approximately one-third¹⁶ of the participating families in each of the districts of Tinajitas, Buenos Aires, Pinguro and Urquité were interviewed in an attempt to estimate the benefits attributable to 1967 extension programs in these respective areas. A list of extension programs offered in the districts and the names of families participating in each program were supplied by the extension service. As extension records were not available on an annual basis, a few of the families named by the local offices did not participate

¹⁶Samples were selected at random.

during 1967 but had received assistance at other times. Questionnaires were completed only for families who had participated in 1967 programs.

Two families out of the 58 interviewed did not participate in 1967 because they did not feel they had benefited from the extension services programs in previous years. Two more indicated they had received no assistance although the extension service indicated they had. Out of the 58 interviewed nine participated in 1967 who had not participated previously. Of these, four did not know about the extension service previously and five knew about it, but either did not believe that it could help them or professed they had no time to participate. These data are presented by district in Table 39.

During the interviewing it was found that a number of families did not recall having received any assistance in some of the areas in which they were named as participants by the local extension office. Discussions with extension workers revealed that families were sometimes recorded as participating in programs when they actually only attended a few meetings at which the topic was discussed. Therefore, where families could not recall the assistance after repeated questioning it was assumed that the assistance given was too superficial to be of any direct practical usefulness to them.

In most cases considerable difficulty was encountered

Table 39.--Summary of extension participation among sample families in the four districts.

	Tinajitas	Buenos Aires	Pinguro	Urquité	Total
Number not interviewed	1	2	2	2	7
Number not participating in 1967 or before	0	1	0	1	2
Number participating before 1967 but not in 1967	1	1	0	0	2
Number participating in 1967 but not before	2	6	0	1	9
Number participating in 1967 and before	16	8	13	8	45
Total number in Sample	20	18	15	12	65

in determining what actually happened in 1967. Many projects had been started in 1965 or 1966 and were continuing at the time the interviews were made. Thus, while it was evident that certain practices had been learned from the extension service, it was sometimes difficult to say whether they were being used because of 1967 efforts or because of extension activities in 1965, 1966, or 1968. It was therefore decided to estimate the results of all extension efforts from the time the extension service began working in each of the districts until the end of 1967.¹⁷

Estimates of income increases attributable to changes in production activities made as a result of extension programs were constructed for each family interviewed. In general, these estimates were made on the basis of the results achieved in 1967 and/or 1968. Gains and losses which appeared to be of a short-term nature were ignored.¹⁸ Additional amounts of inputs were valued at their cost in the local markets whether they were donated by the extension

¹⁷The problem of distinguishing results attributable to a specific year's programs could have been avoided initially by attempting to examine the total extension effort in each district. However, an attempt to avoid this approach was made because the costs of programs in the various districts in previous years were not known. As will be seen later, only rough estimates of these could be made.

¹⁸For example, one family tried raising rabbits in 1967. They received 240 pesos in revenue from this source with no cash expenses and very little extra labour. However, the rabbits destroyed their garden and were not kept around the next year. Neither the income from the rabbits nor the losses of the vegetables were considered in income estimates which appear in this study.

service or purchased by the farmer. Additional amounts of owned inputs were valued at opportunity costs. Products were valued at market prices to the farmer or, in those cases where they were consumed on the farm and the families would have otherwise had to purchase them, they were valued at what the families would have had to pay for them. Some wide discrepancies were noticed between the acquisition cost and salvage value of some products. All of these efforts were directed at constructing an estimate of those increased incomes which resulted from previous extension programs and which would continue to be realized by the participating families if the extension services were withdrawn from the community.

The fact that families participating in extension programs received a variety of gifts from the extension service is a rather significant one and creates an unusual valuation problem. If these gifts had been less extensive they could have been regarded as educational materials and part of the cost of educational programs. However, they were quite widespread and of considerable cost to the extension service. They included such a wide range of items as garden seeds, fruit tree seedlings, rabbits for breeding, free use of sewing machines, assistance in preparing and maintaining gardens, construction of rabbit hutches and pig pens, and repair or remodeling of houses. Indeed, virtually all of the efforts of the obreros employed by the extension service were directed towards these ends.

Typically, the participating family would supply some materials and the extension service would send a man to do some or all of the work involved in the construction project. In many cases, it appeared as if the participating family would benefit by having a better house, a new rabbit hutch, or some other item, but would not really learn very much from the extension expenditure. Thus, the "product" to be valued was essentially the resultant physical facility - not the improved capability of rural people.

These practices made it difficult to distinguish why people were co-operating with the extension service and whether or not they were actually learning something useful. One housewife commented that the practico came and cared for the garden but didn't teach the family anything. (The family harvested and consumed the vegetables but did not seed a garden the following year.) One family received a gift of five bottles of honey from the extension service. They sold four and one was broken accidentally. It was difficult to see how any lasting benefits could arise from such activities and thus, in such cases, it was assumed that the participating family had co-operated for the purpose of receiving these gifts and that they gained nothing beyond the gifts themselves. Accordingly, benefits could not exceed the cost of the gifts.

In the cases where some physical facilities were constructed for a family, there were obviously lasting benefits. In some cases these were accompanied by increased

human capacities although it was not clear that the physical facilities were a prerequisite for the increased capabilities. For example, was it necessary for the extension service to construct rabbit-hutches in order to get families started raising rabbits? In other cases (e.g., housing improvements) no increased capabilities among participating families seemed possible. Thus, in many of these cases as well, benefits would not likely exceed the cost of the gifts. Indeed, they might be less because the cost of construction by the extension service appeared to be greater than in the local markets. (Some interesting side effects also resulted. For example, a few local tradesmen complained they were being forced out of work.)

Attempts were made at the time of the interviews to get some idea of possible diffusion effects and the probable "shift" in adoption attributable to the extension service's activities. As in Valle del Cauca, considerable difficulty was encountered in obtaining such information and the analysis (see Chapter IX) relies heavily on assumptions in this regard.

The District of Tinajitas¹⁹

Tinajitas is located about 35 kilometers from the Santa Fe de Antioquia office on the Medellin - Turbo road.

¹⁹ Much of the background information in this section was drawn from the "Socio-Economic Study of the District of Tinajitas" constructed by the Extension Service of the Department of Agriculture of Antioquia, July, 1967.

It can be reached by car from Medellin in about five hours. Its characteristics are described in some detail here to provide the reader with an example of the environment in which the extension service works.

Physical Resources

The principal asset of the community of Tinajitas is the land. Like many parts of Antioquia it ranges from hilly to mountainous and is badly eroded. Approximately 50 per cent of the land in the district is cultivated. The remaining area is devoted to pasture and trees, or is merely rugged, unusable terrain. In addition to the topographical problems, much of the land is low in nitrogen, phosphorous, or potash and some of it is gravelly as well. The altitude of 2300 meters is responsible for the average temperature of 17°C which varies little throughout the year. Like Valle del Cauca there are two fairly distinct rainy seasons each year. The distribution of land among the 161 families in the district is shown in Table 40. Although almost all families depend on agriculture for their livelihood, almost one-third of the families control no land at all and one-half of them control less than two hectares per family. Some of the operators of the smaller farms work for larger land owners to augment their income. Almost all farms are controlled by ownership as opposed to rental arrangements. Most farmers live on and manage their own farms. The owners

of larger holdings employ some of the men who have no land. Other landless families gain their living from store keeping, transporting goods, or performing other such functions.

Table 40.--Distribution of land among the families of Tinajitas.

Farm Size (Hectares)	Number of Families	% of Families	% of Area
0	28	27.7	0
0 - 2	51	50.5	20.0
2 - 5	9	9.9	10.9
5 - 20	10	9.9	37.8
20 - 40	3	3.0	31.3
Total	101	100.0	100.0

Houses of very poor quality constitute the only buildings of significance in the area. Land improvements in the form of clearing and breaking form the balance of the investment in real estate.

At the time the extension service conducted its socio-economic investigation there were 190 cows, 1,511 chickens, 90 pigs, 50 horses, and 9 mules in the district. These were of poor quality and local origin. They were distributed among the families in a similar fashion to the land. Machinery is almost non-existent although hand tools of various types are found in all homes. These include machetes, hoes, and similar items.

Approximately 20 per cent of the population are

males between the ages of 15 and 60. This group might be regarded as the community's work force, although almost everyone is employed at least part time at one task or another. The extension service estimated that a typical family might earn 1,916 pesos²⁰ a year in addition to the products it consumed from its own farm. Approximately one-half of this comes from crop sales and one-half from wages earned on other farms. Day wages ranged from 4.50 to 7.50 pesos in 1965.

Public resources in the area are low. Electricity is available to a few houses. Telephone and other public utilities are unknown. The closest doctor is several hours away. There is a public school in the district but facilities in the school are poor and only three grades are offered. A police inspection point is maintained in the district. The Medellin - Turbo road is kept in reasonable condition but there are no roads for cars in the district itself. Transportation must be by mule or foot.

Existing Technology

The principal crops grown in Tinajitas are coffee, sugar cane, sisal, corn, beans, and onions. Vegetables, cassava, corn, and beans are grown mainly for consumption on the farms in the area. Coffee and fruits are grown for sale in Santa Fe de Antioquia. Coffee accounts for about

²⁰1965 pesos.

30 per cent of the land area in crops; corn accounts for about 20 per cent. Yields for all crops appear to be below Colombian averages. The primary source of power is the farmer himself. The same hand methods of cultivation have been used in the area for many years. Use of insecticides, fungicides, and chemical fertilizers is virtually unknown. Corn in the area typically requires ten months from planting to maturity. No earlier maturing varieties are available for these conditions. Almost one-half of the farmers burn off the vegetation before planting. Few efforts are made to control erosion. Livestock is generally of poor quality. Production of milk and eggs is low because of poorly balanced rations and inferior quality animals. Little is done to keep animals in good health other than feed them pasture and corn.

Similar levels of technology exist in the households. Only 32 per cent of the households had latrines at the time the extension service made its study. Kitchens are often no more than a fireplace made by placing several rocks on the floor. Floors are usually of earth; walls are mostly mud and boards; roofs are largely tile made locally from clay. In general the houses are not conducive to disease control. The ultimate product of these poor living conditions and consequent disease problems is a short life expectancy. Only 10 per cent of the population were over 50 years of age at the time of the extension service's survey.

Communication Channels

Most of the people in Tinajitas have some contact with outside areas through their periodic trips to the nearest town for marketing or through relatives living outside of the community. Many of the young people leave the district to search for better opportunities in other areas - mainly Medellin. Data on changes in the population of the district by itself are not available but the municipios of Buriticá and Giraldo in which it is located²¹ experienced average annual population changes of -1.2 per cent and +0.86 per cent during the period 1951 to 1964.²² Thus, it would appear that population is perhaps steady or declining in the district due to the outflow of persons noted by the extension service. At the time the socio-economic study was made, 50 per cent of the families read a weekly paper (El Campesino) and 44 per cent listened to the radio regularly. Radio Sutatenza and the Voice of America were the most popular stations.

Several other government agencies have carried out various projects in the area. These include the Coffee Federation, the Caja Agraria, the Ministry of Education, the Ministry of Health, and others. However, the contact of

²¹The district lies partly in one municipality and partly in the other.

²²Departamento Administrativo de Planeación, Gobierno de Antioquia, Anuario Estadística de Antioquia, 1966, (Medellin, Colombia: An Annual report of the province of Antioquia, 1967.)

local people with these agencies is relatively small as the projects were not extensive. The Department of Agriculture of Antioquia has tended to follow a policy of not working in areas where services similar to their own are available from other agencies. One of the reasons that Tinajitas and other districts were chosen by the Department was that the Coffee Federation did not regard them as strong coffee-growing areas and hence was not actively servicing them.

The people of the area live in close contact with one another - population density is 232 persons per square kilometer - but social activities appear to be few. Family size is large (6.4 persons average) and sometimes one finds several families living in one house. However, people have a reputation for minding their own affairs and communication channels within the district seem to be rather slow as a result.

Agricultural Extension Activities

The extension service of the Department of Agriculture has been working in Tinajitas since 1965. The socio-economic study of the area was begun in that year and, while the study was being completed, a number of projects were started on various farms in the area. On the basis of the socio-economic study extension priorities for the area were determined using a point (or index) system (see Table 41). Possible programs were assigned a score of zero to five

Table 41.--Method used for determining extension program priorities in the district of Tinajitas.

Extension Program	Is it a need of the majority?	It is an urgent answer to keep others content?	Technical knowledge exists to ensure success	Credit, transport and storage facilities exist to ensure complete fulfillment	Can be left to later without hurting the area?	Is within the plan of development of the country?	Are the farmers in a favorable position to make use of it?	Total
(1) Cottage industry	5	5	5	5	5	2	3	30
(2) Health & Hygiene	4	5	5	5	5	5	2	29
(3) Housing	3	4	4	5	5	5	2	28
(4) Nutrition	5	5	3	4	5	3	3	28
(5) Sisal	3	5	5	5	5	0	5	28
(6) Vegetables	3	5	5	5	5	0	5	28
(7) Fruits	5	5	5	5	5	2	1	28
(8) Beans	1	4	5	3	2	1	2	18
(9) Corn	2	4	5	4	0	0	2	17
(10) Pasture	2	0	3	5	3	0	4	17
(11) Coffee	5	0	5	0	0	0	3	13
(12) Sugar Cane	4	0	5	0	0	0	2	11

depending on the extent to which they met various criteria. The points assigned to each program for the various criteria were summed to arrive at a total score for each program. These total scores were then used to rank the possible programs. Programs 1 to 6 were selected as being most appropriate for the area. Horticulture was incorporated in the nutrition programs because of the complementary relationship between fresh vegetables and better nutrition. These programs were begun early in 1966.

To estimate the benefits attributable to the 1967 extension programs in Tinajitas the author selected a sample of 20 participating families. One of these families could not be contacted in three attempts. One other did not participate in 1967 although they had participated previously. Thus, eighteen families were interviewed regarding the results of their participation in 1967.

The extension programs appear to have been modified somewhat since the socio-economic study was made and extension priorities were established. In 1967 a number of extension activities not included in the six high priority programs were carried out. Furthermore, several of these six programs seemed to be receiving little or no attention.

The results of the 1967 extension programs directed at production activities for the sample of participating families are summarized in Table 42. It can be noted that there are significant differences between the numbers of families given assistance and the numbers actually benefiting

Table 42.--Summary of results of 1967 extension programs directed at the production activities of eighteen Tinajitas families.

Production Activity	Number of Families Given Assistance ^a	Number of Families Recalling Assistance ^a	Number of Families Recalling Assistance ^a	Number of Families Adopting Practices	Average Annual Income Change for Families Who Adopted (pesos)
Fruits	2	1	1	None	N/A
Vegetables	12	1	11	9	259
Sisal	9	3	6	5	?(1994 plants) ^b
Rabbits	7	2	5	4	147
Swine	2	1	1	None	N/A
Poultry	2	1	1	None	N/A
Bees	4	1	3	1	72
Cattle	3	0	3	None	N/A
Handicrafts	11	2	9	4	27
Clothing	11	1	10	8	78
Seed bed construction	7)				
Transplanting	7)				
Disease control	8)				
Compost	3)				
Pile					

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the assistance was not recalled it was not possible to determine when it was received, if at all.

^bIncome increases not directly observable at the time surveys made.

^cThe last four production activities were usually associated with work in vegetable gardens. Any income increases associated with these are reflected in other areas. They were, however, recorded as separate types of assistance by extension personnel.

through adoptions. In most cases income estimates could be regarded as reasonable projections for future years as well as for 1967 or 1968, the years on which the observations were based. Vegetable gardens were undoubtedly the most successful program. Rabbits, bees, clothing, and handicrafts were the only others with any significant degree of success.

In those cases where instruction was recalled but no changes or adoptions resulted, families often commented that they lacked time to apply the new techniques or they couldn't afford the expense involved. This latter comment was not surprising in view of the fact that 44 per cent of the families interviewed had incomes less than 400 pesos per month, 44 per cent between 400 and 700 pesos and only 12 per cent earned more than 700 pesos monthly. The former comment was understandable as most people spent long hours tilling their own soil by hand or working for others in order to earn their living. (Average size of farm for families interviewed was 4.3 hectares, but most farms were less than 4 hectares in size.) Among those families adopting new technology there were a variety of favorable comments as to how the extension service had improved production in the area.

No income changes could be observed for sisal which was just beginning to produce at the time the surveys were made. On the five farms where sisal had been planted, an

average of 1994 plants per farm were in production.²³

Several farmers interviewed pointed out that sisal was not entirely new to the area but that the new variety and new methods of handling it were much better than the old ones.

Of the eighteen families interviewed, six reported using credit from a bank or government agency. However, only one of these used credit in order to adopt new technology. Usually credit was used to carry families from one harvest to the next.

The results of 1967 extension programs directed at consumption activities are summarized in Table 43 for the eighteen families interviewed. Measures of the utility of this assistance could not be made and it was only possible to ask the families whether or not they benefited from the assistance. With few exceptions, the answer to this question was "yes". However, as can be seen in Table 43, almost all who answered "yes" received some form of material aid as part of the assistance. Thus, no conclusion can be drawn with regard to whether or not useful knowledge was gained. In view of the fact that, in most cases, the assistance took the form of material aid only, one is tempted to conclude that increased knowledge was not a significant result. In addition to the consumption activities listed in Table 43,

²³This was an excellent example of the gifts being distributed by the extension service. All of the seedlings had been given to the participating families and a machine to assist in extracting the final product was also being supplied.

Table 43.--Results of extension programs directed at consumption activities in the district of Tinajitas in 1967 for eighteen sample families.

Type of Extension Program	Number of Families Given Assistance ^a	Number of Families Not Recalling Assistance ^a	Families Recalling Assistance			
			Receiving Material Aid	Not Receiving Material Aid	Regarding Assistance as Useful	Not Regarding Assistance as Useful
Latrines	5	1	3	1	3	1
Housing	8	2	6		6	
Medical	7	3	3		3	
Water Line	10	2	7	1	7	1
Water Tanks	5	3	2		2	
Sewers	7	1	6		6	
Recreation	2	1		1	1	

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the assistance was not recalled, it was not possible to tell when it was received, if at all.

the extension service indicated it was offering assistance in the areas of nutrition, first aid, improving literacy, and clean-up programs. However, so few families received assistance in these areas that none appeared in the sample.²⁴

In the areas of latrines, housing, water lines, water tanks, and sewers, the assistance provided by the extension service usually involved providing an obrero to construct the facilities. Where projects were public in the sense that they served more than one family the extension service usually purchased some of the materials as well. Of course, the participating families usually contributed some labor.

Families were questioned as to when they would have learned the new methods if the extension service had not been working in the area. Some did not understand these questions but most who did answered "never". Two suggested they might have learned a little by means of radio.

Of the eighteen families interviewed, seven reported teaching some of their newly-acquired knowledge to neighbours who usually had already adopted some techniques or were likely to adopt some in the coming year. Only one of the persons who extended knowledge to neighbours reported teaching more than one other person.

In addition to technical changes in the areas of production and consumption, some other extension outputs were also observed in Tinajitas. Two 4-H clubs were operated -

²⁴ Some nutritional advice was given as part of the vegetable garden program.

one for males and one for females. The boys' club involved 12 teenage youths while five housewives and 17 girls attended the other club. Many of the changes listed in Tables 42 and 43 resulted from club work, as, not infrequently, it was a 4-H club member that was the extension participant in a family. However, other benefits may have resulted from club work as well. Some managerial changes undoubtedly occurred as the young people worked together at club activities. The club members probably also picked up some knowledge about other regions from extension workers. This could be useful if they decided to leave the community.

The most significant contribution of the extension service to changes in community activities came through the Acción Comunal programs. Fourteen of the eighteen families interviewed reported being involved in these programs which included improvements to the school, road repair and improvement, sewer construction, and water line construction. (Some of these items were already listed in Table 43.) All families involved said they benefited from these programs. The extension service and the Coffee Federation assisted in getting things organized but, what appeared to be more important to the local families, both these institutions provided obreros to work on the jobs and money to buy the necessary materials. Because of the nature of these programs it was not possible to measure the extension service's

contribution or evaluate the probable benefits. However, local families were quite enthused about the extension service's activities in these areas.

Other Districts Studied

The districts of Buenos Aires, Pinguro, and Urquité were in many respects similar to Tinajitas although significant differences in soils, climate, and people were noted among them. Detailed descriptions of these three districts can be found in their respective socio-economic studies prepared by the Department of Agriculture. Only the observed results of 1967 extension programs are summarized here.

Buenos Aires

The district of Buenos Aires is located about two and one-half hour's drive from the nearest extension office in Santa Fe de Antioquia. Travel within the district is also tedious and time-consuming. The practico and mejoradora assigned to the district in 1967 found it more convenient to reside with local farm families than to commute. The Department of Agriculture of Antioquia has operated extension programs in this area since 1965 and extension workers are reasonably well-known by the inhabitants. Programs were planned for the district in the manner similar to that used in Tinajitas. However, these programs were modified considerably by experiences in 1965 and 1966.

Although Buenos Aires is similar in many respects to the other districts studied it is definitely the best coffee-growing district of the four. Of the 1680 hectares in the district, 469 were devoted to coffee when the extension services conducted their socio-economic study in 1964.²⁵ Because of the relatively favorable conditions for coffee production in the area, the Coffee Federation has been involved in much of the technical assistance extended to coffee producers. Thus, it was difficult to attribute all of the benefits from changes in coffee production to the Department's extension service.

Technology, land distribution, communications channels, and physical resources, and social structure are quite similar to those of Tinajitas. For example, 60 per cent of the population is illiterate; 99 per cent of the farmers didn't use chemical fertilizer when the extension service began its work in the area; soils are steep, acid, and eroded; children find they must leave school at an early age (10 to 12 years) to earn their living; and the area was, until the early 1960's, very much involved in the political

²⁵To give some further indication of the importance of coffee to the district's economy, it can be noted that a typical family's income (as estimated by extension personnel) would be as follows:

50 <u>arrobas</u> of coffee	2500 pesos
60 <u>arrobas</u> of sugar cane	270 pesos
Wages from day-labor	<u>480 pesos</u>
Total	3250 pesos

Extension workers pointed out to the author that coffee was so important to the area that, at harvest time, everyone became involved in harvest activities and no other activities would be carried out.

violence which disrupted many parts of rural Colombia.²⁶

The results of 1967 extension activities directed at the production areas of the 14 sample families²⁷ of Buenos Aires are shown in Table 44. A marked difference between the numbers of families receiving assistance and the numbers actually benefiting was noted. Many families did not recall receiving the assistance which extension workers indicated had been given to them. Others recalled the assistance but reported that they either did not make use of the assistance of 1967 or 1968, or if they had tried it then, they would not find it useful in the future. Some short-term gains and losses were experienced but these were ignored in tabulating the data appearing in Table 44.²⁸ The reasons given for not using practices in the future included lack of money to purchase inputs and lack of interest or time to pursue the practices. In all cases where a family adopted techniques in a given area and planned to continue to use

²⁶The extension service's social-economic study of the district states that "El campesino es demasiado entregado a la pasión político, la cual lo ha llevado al caos económico y social en que vive actualament." While the author does not agree with the unilateral direction of the cause-effect relationship implied by this statement, there can be little doubt that there has been an important connection between economic conditions and political violence in Colombia.

²⁷Four of the eighteen families chosen could not be interviewed.

²⁸One example of this was the case where the Extension Service constructed a hen house for a farmer which he used for one year and sold at a profit (for him) because he decided to devote his time to what he considered to be other more profitable endeavours.

Table 44.--Results of 1967 extension programs directed at the production activities of the 14 families interviewed in Buenos Aires.

Production Area	Number of Families Given Assistance ^a	Number of Families Not Recalling Assistance ^a	Number of Families Recalling Assistance	Number of Families Experiencing Income Increases	Average Annual Income Increase (pesos)
Coffee	9	6	3	2	1600
Fruits	2	2	2	1	251
Vegetables	8	1	7	4	505
Rabbits	8	0	8	3	210
Poultry	4	3	1	0	N/A
Swine	1	1	0	N/A	N/A
Handicrafts	1	0	1	1	10
Clothing	5	3	2	1	294
Compost Pile	2)				
Seedbed	)				
Construction	8) Data not collected on recollection, adoption, and				
Transplanting	7) income changes directly. ^b				
Disease	)				
Control	2)				
Vaccinating					
Cattle	3 (effect on income not known but presumably positive)				

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the assistance was not recalled, it was not possible to determine when it was received, if at all.

^bThese four production activities were associated with vegetable gardens, coffee, and fruits. Any income increases resulting from these are reflected in those categories.

these in the future the family was questioned about the amount of time involved in the activity. This often was significant but no families reported leaving paying jobs or regular work on their own farm to perform the new activities.²⁹ They were essentially employing what had previously been unproductive time in order to start a new enterprise or expand or improve an old one. Coffee and vegetable gardens were the most successful programs with some successes also being noted with rabbits.

Most of the programs associated with production activities appeared to be directed at making farm families more self-sufficient whereas the results indicated that, when a farmer chose to adopt technology in a given area of production, he was usually interested in making a commercial enterprise out of it. It was also interesting to note that the extension service's socio-economic study suggested fruit crops as being products with which some useful extension work could be done whereas, when the author visited the area, some fruits, particularly oranges, were in such abundant supply as to be worthless in local markets. Of course, good markets did exist for oranges at other times and, perhaps even in other areas of the department at the same time. Thus, unless extension workers could have

²⁹ One example of this was the family who took an active interest in vegetable gardening. Their net return per annum was 350 pesos but the farmer's wife had to devote 30 days of work to the garden. Thus, her daily return was about 12 pesos - a fairly competitive wage.

somehow found new marketing methods or techniques for changing the harvest period, their work would have been in vain. The usual production-oriented advice was simply irrelevant for fruit crops on most farms.

Income levels, farm size, and use of credit were similar to those noted amongst the sample of families interviewed in Tinajitas. Sixty-four per cent of the families interviewed had estimated monthly incomes of less than 400 pesos. The average farm size for those families interviewed was 6.5 hectares but only two families had more land than average. Five families had used credit from banks or government agencies. Of course, most families used local credit sources to keep them going between harvests.

The results of 1967 extension work directed at the consumption activities of Buenos Aires sample families are shown in Table 45. As in the case of Tinajitas, in a sizeable number of instances (55 per cent) assistance mentioned by extension personnel could not be recalled by the farm family. However, most (86 per cent) who recalled the assistance regarded it as useful. With the exceptions of the areas of nutrition, recreation, first aid, and medical assistance, all who regarded the assistance as useful had received material aid, usually for construction purposes. Again, this appeared to be a situation in which the families were so poor as to be unable to apply recommended practices in most areas of assistance. The extension service realized

Table 45.--Results of extension programs directed at consumption activities of the fourteen sample families interviewed in Buenos Aires.

Consumption Area	Number of Families Given Assistance ^a	Number of Families Not Recalling Assistance	Families Recalling Assistance			
			Receiving Material Aid	Not Receiving Material Aid	Regarding Assistance as Useful	Not Regarding Assistance as Useful
Latrines	9	5	2	2	2	2
Housing	12	4	7	1	7	1
Nutrition	4	0	0	4	4	0
Medical	13	9	0	4	4	0
Water Supply	7	3	4	0	4	0
Water Tanks	6	2	4	0	4	0
Recreation	3	0	0	3	3	0
First Aid	1	0	0	1	1	0
Literacy	1	1	N/A	N/A	N/A	N/A
Clean-up	8	5	0	3	1	2

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the assistance was not recalled, it was not possible to tell when it was received, if at all.

this and concluded that the only way they could get people to adopt was to bear a large share of the costs. It is hypothesized that many of those families who said they did not recall assistance may have received instruction either individually or at 4-H Club meetings but, because they had not been able to afford to adopt the new practices, they chose to "forget" about it when interviewed.

Those Buenos Aires families who adopted new practices did not hesitate to inform their neighbours of their activities. Eight of the thirteen families interviewed reported passing on knowledge to their neighbours and a total of ten neighbours received some such assistance. Most participants interviewed had no idea when they might have learned about the new ideas if the extension service had not been working in their area. As many pointed out, there was just no other opportunity for them to learn anything new except, perhaps, the radio.

As was the case in Tinajitas, several extension outputs were noted which did not involve technical changes in the production or consumption activities of individual family farm units. A girls' 4-H club with 17 members and a boys' 4-H club with 12 members were active throughout the year. Expanded knowledge of nutrition, health, hygiene, clothing, etc. was the main short-run result of this activity. Future technical changes in production and consumption activities might well be inspired or speeded up by means of this knowledge. As in Tinajitas, Acción Comunal was active

with ten of the fourteen families interviewed indicating they benefited from road, school, or water supply improvements made through this organization. One of the extension service's principal functions here was to assist the local people in petitioning the Coffee Federation for grants to make these improvements. Of course, the extension service would supply some labor and materials as well. In a typical project costs would be shared as follows: Coffee Federation, 50 per cent; Department of Agriculture, 25 per cent; local residents, 25 per cent.

Pinguro

The district of Pinguro is located in the municipality of Giraldo close to the border of Buriticá and only about twenty kilometers from Tinajitas. The extension service of the Department of Agriculture had been working in the area since 1963 at which time they started several projects, including a school. They conducted their socio-economic study of the district in that year and, with this as a basis, began a group of more intensive and organized programs in 1964. Because of this long record of service and because the practico and mejoradora sometimes live in the district, the extension service is quite well-known in the area.

The socio-economic study of the district carried out by the extension service identified a few problems peculiar to the area but, for the most part, the situation

is similar to that in other districts. Incomes are low, housing is poor, life expectancy is short, some children cannot attend school because of lack of facilities, farms are small (2 to 3 hectares), soil is steep and eroded, and so on. The extension service made the following recommendations for work in the district:³⁰

1. Family

- (a) try to improve social structure by aiding in construction of houses so that young families would not be dominated by their parents with whom they often must live at present.
- (b) attempt to modify existing dwellings so as to prevent the promiscuity observed in the district.
- (c) promote animal production (e.g., bees, poultry, swine, cattle) to offset the protein deficit which most of the inhabitants of the area currently experience.
- (d) develop campaigns to improve the unsanitary conditions which prevail in most houses.
- (e) attempt to develop small industry or handicrafts in order to increase family incomes.

2. Agriculture

- (a) try to transform old, traditional coffee plots into higher-yielding ones along the lines recommended by the Coffee Federation (e.g., new varieties, fertilizer, disease control).
- (b) develop conservation-oriented programs to encourage farmers to control erosion in the area.
- (c) concentrate on improvement of vegetable gardens especially as these can be an important source of better nutrition for most families.

³⁰These comments are a precis of those contained in the Department of Agriculture's socio-economic study.

- (d) by means of a community action program, attempt to control the arriera ant which currently prevents some crops from being grown in the area.
- (e) although livestock cannot be a basic industry, it is important to try to get each family to own their own cow to provide milk for them. This would require pasture improvement in the district.
- (f) poultry and honey enterprises could be developed to supplement incomes as a local market exists in Santa Fe de Antioquia. Both of these could be developed with technical assistance.

3. Economic

- (a) as credit will be required for some programs to succeed, attempts should be made to utilize credit supplied by the Caja Agraria or the rotating fund of the extension service itself.
- (b) by means of Acción Comunal, the roads in the district can be improved to facilitate marketing locally-produced products.
- (c) as poultry producers develop they should become affiliated with the Co-op in Santa Fe de Antioquia to facilitate marketing their products.

4. Community

- (a) to maintain the social welfare of the community a sports program should be developed.
- (b) by means of Acción Comunal, school facilities should be expanded.

As in other districts, extension programs were Carried out by means of visits to individual families, 4-H Clubs, and Acción Comunal meetings. These were supplemented by monetary assistance for community projects and material assistance to individual families. An extreme example of

the type of assistance rendered to individual families was the case in which an obrero employed by the extension service worked for one family for 82 days. During this time he constructed a latrine, remodelled the house, built a water tank on top of the house, and made a pig pen. The family supplied materials using money borrowed from the extension service. The farmer estimated the value of the service rendered by the Department of Agriculture at 25 pesos per day or 2,050 pesos in total. The entire family was quite pleased with the assistance they had been given.

The results of 1967 extension programs directed at the production activities of the thirteen families interviewed in Pinguro are shown in Table 46. Vegetable gardens and clothing appeared to be the most successful programs with some successes being noted in handicrafts, coffee, and bees. As in other districts, the income increases shown represent the results of technical changes only and do not reflect the results of managerial changes in these areas. However, given the likely prospects for progress in the area it is doubtful if managerial changes directly related to agricultural production will have much opportunity to pay off in the future.

The single poultry producer in the sample who is listed as possibly experiencing an income increase due to technical assistance is an example of the uncertainty associated with adopting new technology and the difficulty in estimating related income changes in advance. This

Table 46.--Results of 1967 extension programs directed at the production activities of the thirteen Pinguro families interviewed.

Production Area	Number of Families Given Assistance ^a	Number of Families Not Recalling Assistance ^a	Number of Families Recalling Assistance	Number of Families Experiencing Income Increases	Average Annual Income Increase (pesos)
Coffee	4	1	3	2	125
Fruits	3	2	1	0	N/A
Vegetables	11	1	10	7	280
Rabbits	3	2	1	0	N/A
Swine	2	0	2	1	200
Poultry	3	2	1	1?	?
Bees	2	1	1	1	400
Handicrafts	4		4	4	76
Clothing	4		4	4	122
Seed Bed					
Construction	7)				
Disease Control	3) Data not collected on recollection, adoption,				
Compost Pile	3) and income changes directly. ^b				
Transplanting	6)				
Vaccinating					
Cattle	4 (effect on income not known but presumably positive)				

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the indicated assistance was not recalled, it was not possible to determine when it was received, if at all.

^bThese production techniques were associated with vegetable gardens, coffee, and fruits. Any income increases resulting from these are reflected in those categories.

family had borrowed 4,500 pesos from the extension service's rotating fund in order to get the poultry enterprise going. However, their hens contracted disease, production dropped, and a number of birds died. At the time of the survey the family had not obtained sufficient revenue to repay the loan. It appeared as if they might break even and, if they did, they might try again next year. They might well be disinclined to try again on borrowed money even if they did manage to break even in 1967-1968 but their decision had not yet been made when they were interviewed.

The results of 1967 extension programs directed at the consumption activities of the thirteen Pinguro families interviewed are shown in Table 47. Again, some families did not recall receiving the assistance extension personnel reported giving them. A close association between the usefulness of the assistance and whether or not it was accompanied by material aid was also noted. In general, programs directed at consumption activities in Pinguro exhibited similar results to those in Tinajitas and Buenos Aires although the proportion of cases where families recalled assistance was higher (close to 70 per cent).

Income levels, use of credit, and general conditions in Pinguro corresponded very closely to those noted by the extension service's socio-economic study several years earlier. Three families reported using credit from the Caja Agraria; three others reported using the Department's rotating credit fund. Most families interviewed had monthly

Table 47.---Results of 1967 extension programs directed at the consumption activities of the thirteen Pinguro families interviewed.

Consumption Area	Number of Families Receiving Assistance	Number of Families Not Recalling Assistance	Families Recalling Assistance			
			Receiving Material Aid	Not Receiving Material Aid	Regarding Assistance as Useful	Not Regarding Assistance as Useful
Latrines	4	2	2	0	2	0
Housing	7	2	1	4	2	3
Nutrition	4	0	1	3	3	1
Medical	6	1	4	1	4	1
Water Supply	3	2	1	0	1	0
Water Tanks	3	1	2	0	2	0
Recreation	2	0	0	2	0	2
First Aid	1	1	N/A	N/A	N/A	N/A
Clean-up	2	1	0	1	1	0

incomes of less than 700 pesos.

As in other areas some evidence of diffusion was noted. Three families reported teaching neighbours some of the new technology they themselves had learned from the extension service. They all indicated that their neighbours had been quite interested and would likely adopt some, if not all, of the new methods.

The families interviewed in Pinguro were in general unable to say when they might have learned about the new methods if the extension service had not been operating there. One suggested five years, another two years, but most said "never" or declined to answer. In contrast to Buenos Aires where some assistance might have been forthcoming from the Coffee Federation, there was little likelihood of Pinguro residents learning about new technology from any other agency.

Extension outputs other than technical changes in production and consumption units were noted in Pinguro. Two 4-H clubs with 18 boys and 40 girls as members respectively were operated. Community projects were carried forward by means of Acción Comunal. These involved road and school improvements as well as water line construction. As in other areas the Coffee Federation, the families of the community, and the Department of Agriculture shared the costs. However, most of these projects were completed prior to 1967 and consequently their costs were also incurred in prior years.

Urquité

The district of Urquité is located on the main road from Medellin to the port of Turbo. It is only about a one-half hour's drive from the local extension office in San Jeronimo. However, the practico who works in the district chooses to live there rather than commute. Extension work in Urquité began in 1965 when the extension service's socio-economic study was being completed. However, field advisory work was carried out mainly in 1966 and 1967.

Like Buenos Aires, Urquité has somewhat more favorable conditions for coffee production than Tinajitas or Pingura. Twenty-nine per cent of the land in Urquité is devoted to coffee production with plantain and pasture accounting for another 40 per cent. Sugar cane, beans, vegetables, and waste land account for most of the remainder. In most respects the district is similar to the other three already discussed. However, as it is not so remotely located from Medellin, the inhabitants have more opportunities for off-farm employment.

The results of 1967 extension programs directed at the production activities of the nine Urquité families interviewed are shown in Table 48. This data would be similar to those collected for other districts if it had not been for one sample family where results were somewhat spectacular.

In all districts studied it was obvious that some families were able to make a good deal more use of the

Table 48.--Results of 1967 extension programs directed at the production activities of the nine Urquita families interviewed.

Production Area	Number of Families Given Assistance ^a	Number of Families Not Recalling Assistance	Number of Families Recalling Assistance	Number of Families Experiencing Income Increases	Average Annual Income Increase (pesos)
Fruits	3	0	3	1	640
Vegetables	9	0	9	6	555
Coffee	1	0	1	1	8250
Other Crops	1	0	1	1	326
Swine	4	2	2	1	460
Rabbits	1	0	1	0	N/A
Poultry	5	1	4	1	8328
Handicrafts	1	0	1	1	617
Clothing	2	0	2	1	210
Compost Pile	4)				
Transplanting Seedbed	4) Data not collected on recollection, adoption,) and income changes directly. ^b				
Construction	5)				
Disease Control	3)				
Vaccinating Cattle	2(effect on income not known but presumably positive)				

^aFamilies included in these two columns may have received the indicated assistance in years other than 1967. When the indicated assistance was not recalled, it was not possible to determine when it was received, if at all.

^bThese production techniques were associated with vegetable gardens, coffee, and fruits. Any income increases resulting from these are reflected in those categories.

extension service's assistance than others. While the families which benefited more were usually those with larger farms - but not ranches as these were not serviced - and higher incomes, this was not a hard and fast rule.

Variations in benefits among farms, even those of about the same size, were usually large but not spectacular, with one exception. One family received assistance in many areas and were able to increase their annual income by almost 20,000 pesos as a result. In view of the fact that only a few other families experienced income increases of 1,000 pesos or more, this case deserves explanation.

Firstly, this family was already one of the more well-to-do in the community and owned 39 hectares of land. Secondly, the family was quite large (17 members). Thirdly, the practico who worked in the area resided with the family.

This combination of factors created a situation where the family was eager and able to change their operation so as to fully employ most family members. As they were relatively well-off, they could afford to make the expenditures recommended by the practico. The estimates of net income increases for this family are probably too high as no opportunity cost for added labour was charged. However, no such charge was made as it was difficult to tell what family members would have been doing if they had not become more fully-employed on the farm. It should be pointed out that, in all districts where a practico resided, the family with whom he lived usually benefited to a much greater degree

than other families in the district. Families who "boarded" the practico (or mejoradora) usually received at least a proportionate share of the material assistance provided by the extension service.

It is also significant to note that, in Urquité, only the one outstanding family experienced income increases from programs other than vegetable gardens. While the sample is a relatively small one and, thus, this situation could have arisen by chance alone, there is the suggestion that perhaps assistance, as well as benefits, was more concentrated in this district than in others. In each of the other three districts more than 50 per cent of the sample families experiencing income increases experienced these in more than one area of production.

The results of 1967 extension activities directed at the consumption activities of sample families in Urquité are shown in Table 49. These results are similar to those noted in other districts.

Income levels, credit use, and general conditions in the district were similar to those described as the socio-economic study of Urquité and already noted in other districts. Two of the sample families reported using credit from government agencies. One of these was using it to try out new production methods in 1968 but, in general, credit use was restricted to enabling families to service from harvest to harvest. Average farm size for eight farms surveyed was 1.5 hectares - the other sample farm encompassed

Table 49.--Results of 1967 extension activities directed at the consumption activities of the nine sample families in Urquité.

Consumption Area	Number of Families Given Assistance	Number of Families Not Recalling Assistance	Families Recalling Assistance			
			Receiving Material Aid	Not Receiving Material Aid	Regarding Assistance As Useful	Not Regarding Assistance As Useful
Latrines	7	7	3	4	5	2
Housing	5	1	2	2	3	1
Nutrition	5	1	0	4	4	0
Medical	5	2	0	3	2	1
Water Lines	3	1	2	0	2	0
Water Tanks	1	0	1	0	1	0
First Aid	5	2	1	3	2	2
Clean-up	1	1	N/A	N/A	N/A	N/A

39 hectares.

Four of the nine sample farms reported teaching some of the new methods they had learned to their neighbours. Six neighbours received instruction in this way and several adopted some new methods. Most of the families surveyed had no idea when they might have learned about the new technology if the Department of Agriculture had not been working in the district.

As in other districts, extension outputs other than technical changes in production and consumption units were noted. 4-H club membership totalled 13 boys and 25 girls in 1967. As in other districts a number of the results in production and consumption activities were attributable to 4-H activity but other benefits would likely be forthcoming from these programs as well. The Acción Comunal program was active in the district in 1967 and eight of the nine families interviewed reported participating and benefiting from this. Road improvements, water lines, and school expansion were the main projects. The extension service contributed some funds, organizational assistance, and labour, to these projects.

CHAPTER IX

ANALYSIS OF EXTENSION ACTIVITIES IN ANTIOQUIA

Because cost and benefit data were collected by district rather than by program, the nature of the analysis of extension activities in Antioquia differs somewhat from that conducted for the CVC. No comparison of programs in different districts by benefit categories has been made. The first part of the chapter is devoted to the calculation of PVB/PVC ratios although it turns out that these do not reveal significant differences in extension effectiveness among districts. The remainder of the chapter is devoted to the discussion of possible factors affecting effectiveness among and within programs and districts, and possibilities for cost reduction.

Calculation of PVB/PVC Ratios

Serious problems were encountered in measuring benefit flows attributable to technical changes in consumption activities and community organizations. This has a particularly limiting effect on the analysis because of the heavy involvement of the Department's extension service in community activities. Problems were also found in measuring benefit flows for managerial changes and secondary

extension outputs, but, as in the case of the CVC, benefits in these categories appeared to be small or non-existent and thus, their obscurity does not present a serious drawback to the analysis. More difficulty was encountered in estimating "shifts" in adoption distributions attributable to extension activities than was found in Valle and some rather strong assumptions were necessary in order to permit calculations to be made.

The benefit flows attributable to technical changes in agricultural production units are based on a twenty year uniform adoption distribution.¹ It is assumed that the extension activities of the Department of Agriculture had a contracting effect on the earlier part of the distribution. However, even though this study originally attempted to isolate changes which occurred as a result of 1967 extension efforts, the changes observed appeared to have occurred, to a large extent, over a two to four year period depending on the district. This period is assumed to be a contraction of the first half of the theoretical adoption distribution and leads to the use of the total number of families participating in 1967 as being "adopters" by 1968. This same assumption is made for all types of technology adopted as

¹This is an intuitive estimate based on the facts that the districts are relatively small and that the adopters are probably relatively slow to change their ways because of the high risks and their limited general knowledge base. The uniform distribution was used as an approximation to the normal to facilitate calculations. It was considered that other assumptions outweighed this substantially in their effects on the final results.

there was little empirical basis for distinguishing among them, even though, in reality, the adoption rates for different types of technology might be quite different. However, the method of calculation does not assume that all participating families adopted all types of technology or, in fact, that all families adopted some technology.

Where it appeared that the results measured in the surveys were attributable to several years' extension efforts, it was necessary to estimate extension costs for years prior to 1967. These estimates were based on average extension costs for resident families serviced by the offices of San Jeronimo and Santa Fe de Antioquia in 1967. Only extension costs for years in which extension field work appeared to have been done were included. One may argue that the costs of the socio-economic studies of the districts should have also been included. However, they have been omitted for two reasons. Firstly, part of the total cost of operating the extension service in 1967, from which the costs for the districts were derived, represented tabulation of data for socio-economic study and therefore, some allowance has already been made for this. Secondly, the total usefulness of the socio-economic study could not be considered exhausted in 1966 and 1967 extension programs. It would surely be of some utility in planning future programs in the districts studied or similar parts of the region. It would therefore, be inappropriate to charge the total cost of such a

study against the results observed in the survey.

There was no good way of arriving at an estimate of the families in a given district which would eventually adopt technology of a given type. Presumably this is related to profitability, some characteristics of the new technology, and some characteristics of the potential adopters.² However, as this relationship is not well-known, it could not be approximated here. Thus, it was decided to make the somewhat arbitrary assumption that benefits at the levels observed in each district would eventually spread to all resident families in that district and, that sufficient diffusion of technology would occur among families to increase this by 50 per cent by 1980. This seemed reasonable to the author but, as has already been noted, it is highly arbitrary. It would require, for example, that, if 20 per cent of the sample families were using a given technology on a given average scale at the time of the interviews, then either 30 per cent of all families would be using it by 1980, or there would be sufficient increase in average scale of use among those adopting to offset any lesser incidence of use.

Although there is little basis for this other than intuition and the fact that the number of adopters in any given early part of a normal or uniform distribution bears a constant relation to the total number of adopters, the

²See the discussion of an extension system model in Chapter III.

results appear to be consistent with other observations. For example, changes in vegetable gardens, which were widely adopted in all districts, can be maintained by almost any family that has a very small amount of suitable land. The production techniques are not complicated and most products are easily incorporated into existing diets.³ Furthermore, most people already had some sort of garden even though products were few and yields were low. Bees and rabbits, which were not widely adopted prior to 1968, are not likely to become widespread because they require more careful attention and, once the products are realized, there is a good deal of incentive to sell them for cash to buy other foods (e.g., rice, panela). As local markets are limited for both honey and rabbits, and technical conditions limit the extent of honey production in a given area, the total potential for economic production appears to be less than for vegetables. Furthermore, with both these products there are risks which are not associated with vegetable gardens. For example, Peace Corps volunteers succeeded in establishing widespread rabbit production in some parts of Colombia in recent years only to have the total population of some regions wiped out by disease. Thus, at the present time it appears unrealistic to expect rabbit-growing to be a successful enterprise on more than a few farms in each

³Some exceptions to this were noted in the interviews. A few families remarked that they didn't like carrots and other vegetables which were new to the area.

district. As seven families in the samples of the four districts had adopted rabbits for an average annual income increase of 150 pesos per family, the assumption underlying the benefit flow calculations implies that, by 1980, the total benefit flow from rabbits will be 7,650 pesos. This could be obtained by 51 families experiencing the same average income increase as that observed in the sample or by a somewhat lesser number with a higher average increase. This does not seem unreasonable,⁴ although as will be seen later, the data collected does not permit much in the way of distinguishing significant differences among districts or areas of production.

Severe limitations on the usefulness of managerial changes are likely going to be encountered in all districts. These limitations will include limited amounts of resources, low quality of resources, market disadvantages because of transportation costs, and other production disadvantages related to the lack of infrastructure. In the author's opinion, worthwhile managerial changes certainly occurred as the result of extension efforts. Their worth probably depends on much the same factors which determine returns to existing production activities in the various districts and may very well vary directly with such returns. However, because of measurement problems it has been necessary to exclude them from the benefit flows calculated here.

⁴As 54 of 209 participating families were interviewed, an unbiased estimate of the number of families already having adopted rabbit-raising by 1968 is 27.

Benefit flows attributable to most of the technical changes in consumption units were considered to be close to zero when valued at market prices. This conclusion was reached because virtually none of the techniques extended to the families in the area were directed at getting more out of existing incomes. This does not mean to say that the consumption assistance did not help people in the area. However, its market value was perhaps equal to or less than the cost of providing it. Thus, it was decided to deduct an estimate of the costs incurred in providing such assistance from extension costs for each district. As the obrereros were the main cost in furnishing this aid, the costs of maintaining them in the various districts was used as an estimate of the cost of this assistance.

Benefit flows attributable to technical changes in community organizations were not estimated because no information was available on precisely what the extension service did to further these activities - other than provide labor and materials. Because of the joint involvement of the Coffee Federation, the Department of Agriculture, and members of the community it was virtually impossible to say how much the final product depended on extension's contribution. If it had been possible to calculate PVB/PVC ratios for these activities alone, the results would have been quite interesting as it certainly appeared as though they were quite successful. However, without the

contributions of resources from both the Department and the Coffee Federation, few or no projects would have been completed.

Benefits from influencing technology developers, information sources, or institutional activities outside of the area were considered to be zero. Extension personnel in Antioquia undoubtedly did have an opportunity to interact with personnel of agencies such as the Coffee Federation, INCORA, the Caja Agraria, other divisions of the Department of Agriculture, I.C.A., municipal governments, and a few non-agricultural departments of the government of Antioquia. There were possibilities for interaction among field personnel from the field sectors and personnel of the Communications and Agricultural Assistance sections of the Extension Service. This latter possibility could perhaps have resulted in improvements in the work of the three sections. Inter-action with the Coffee Federation, I.C.A., and other divisions of the Department of Agriculture may have perhaps resulted in some useful changes in the research activities being conducted by these organizations. No organized attempt was made in this study to measure the extent of such interaction or determine the nature of the ensuing changes. Casual observations indicated that such influence may have been slight or negligible. Extension workers had no control over research decisions and no organized procedure existed for recommending useful research

projects to research workers (even within the Department of Agriculture). Thus, while communication between entities undoubtedly occurred, it did not appear to be having any significant impact on research decision-making.⁵ Benefit flows resulting from this type of secondary activity were therefore considered to be zero, although perhaps erroneously.⁶

In the districts examined there were virtually no extension resources devoted to training young people or new producers in technical or managerial practices already in widespread use in the area. Thus, the benefit flow for this "output" was assumed to be zero in all cases. This lack of activity was probably an appropriate action for the extension service because all districts examined appeared to exhibit high out-migration rates due to relative economic conditions.

Benefits from assisting in the direction of people out of agriculture might very well exist. Some of the 4-H club activities in the districts probably did contribute something along this line although there were no specific programs for achieving this purpose. On the contrary, the general policy of the extension agency appeared to be one of keeping people in the rural areas in order to avoid increased

⁵One exception to this was the participation of the Research Division in tabulating data for the Socio-Economic studies of the extension districts.

⁶It intuitively seems that a negative benefit flow in this area would be unlikely. However, such a possibility cannot be ruled out a priori.

pressure on the public facilities in Medellin where people would almost surely go if they left their home districts. Nevertheless, the weekly contacts with extension agents probably produced certain managerial changes in rural young people which may have encouraged them to leave their areas and at the same time may have made them more capable of doing so. For example, casual conversations at 4-H club meetings may have acquainted some young people with job possibilities in urban areas and the sorts of lives extension workers and/or their friends in urban areas enjoyed. It would require a much more intensive study than this one to measure any of these effects and, as extension programs were not directed at producing them, they have been considered to be a rather inconsequential part of the benefit flow attributable to the extension activities studied. Again this may be an erroneous conclusion. The possibility of error is illustrated by a family visited during the course of this study. This family was heavily dependent on the weekly contributions of several younger members who worked in Medellin. If the extension service had played some part in aiding or influencing these young people, then perhaps both the young people in Medellin and their parents in the district were better off as a result.

For the above reasons no allowance was made for secondary extension outputs in the benefit flow calculations. It would seem that the calculated flows are likely to be underestimates of total benefit flows as a result.

The District of Tinajitas

As this study progressed it became increasingly apparent that the results observed in Tinajitas were probably attributable to extension work carried out in both 1966 and 1967. As mentioned in Chapter VIII, some of the extension projects encountered in Tinajitas had begun as early as 1965 and this sort of assistance was still being rendered in 1967 and 1968. Only two of the eighteen families interviewed in Tinajitas were new extension participants in 1967. While it was possible to distinguish some assistance which had been completed in 1965 and/or 1966 and discard it as not being pertinent to the inquiry, it was not possible to do this with most of the assistance observed. As the socio-economic study of Tinajitas took place in 1965 and relatively few projects were begun in that year, the families interviewed who had difficulty recalling exactly when assistance was rendered and/or who had definitely received assistance over a period longer than one year, almost surely did not receive such assistance prior to 1966.

However, because of the uncertainty regarding the actual costs of producing the results measured in this study it was decided to use three cost estimates. The "lower limit" was considered to be the cost of 1967 extension work alone, not including the obreros - approximately 111,000 pesos. The "upper limit" was considered to be the estimated costs of 1966 and 1967 programs excluding obreros -

approximately 246,000 pesos.⁷ The simple average of these two figures (178,500 pesos) was regarded as the "expected value". The use of the three figures permits testing the sensitivity of the ratios based on the "expected value".

The average annual income increase due to extension activities directed at production activities in Tinajitas was 329 pesos. On the basis of diffusion, which was obviously present to some extent in the district, this was assumed to increase to 500 pesos per family in approximately ten years. This permitted construction of a benefit stream for changes occurring as a result of extension's influence (see Appendix Table C-7). A hypothetical alternative distribution without extension influence was assumed to begin in 1980 and to be complete by 1999. This could arise, for example, if a few families learned some of the new techniques by radio and these were gradually picked up by their neighbours. This would be a much delayed and slower process than the extension-influenced distribution. There is some justification for assuming a longer - perhaps infinite - distribution "shift" in this case but, because of the widespread use of radio in the area and the mention of it in survey responses, this alternative has been used. The calculation of the benefit flow attributable to extension work is shown in Appendix Table C-7 along with the present (1967) values

⁷ Because these costs were incurred in different years, an interest charge of 4 per cent was levied against 1966 costs and is included in the total.

of these benefits discounted at 0, 4 and 8 per cent.

These estimates of benefits and costs were used to calculate the PVB/PVC ratios shown in Table 50. In addition, Table 50 shows PVB/PVC ratios calculated for benefit flows of 18,000 pesos and 50,000 pesos per annum for 31 years. The former is regarded as a "lower limit" and represents 100 families (all resident families) benefiting by 500 pesos per year. This permits testing the sensitivity of the basic PVB/PVC ratios to some of the assumptions underlying the benefit flow calculations. An expected PVB/PVC ratio of 3.43 with possible extremes of 13.96 and 0.83 are noted.

The District of Buenos Aires

Although the socio-economic study of Buenos Aires was carried out in 1964, most of the extension programs did not really get going until 1965. While this study originally attempted to isolate the results of work done in 1967, it appears that what actually was observed was the results of work carried out in the period 1965 to 1967. There were several reasons for this. Firstly, much of the work directed at consumption activities was carried out by obreros, but, according to information supplied by extension personnel, no obreros worked in Buenos Aires in 1967 (see Appendix Table C-6). Secondly, in many production activities, assistance had been continued for more than one year. Thirdly, the

Table 50.--PVB/PVC ratios for extension work in Tinajitas for several different assumptions regarding costs and benefits.

Extension Costs (pesos)	Benefits to Extension Programs (pesos/annum)	Discount Rate		
		0%	4%	8%
111,000	18,000	5.03	2.85	1.84
	as in Appendix Table C-7	9.43	5.52	3.54
	50,000	13.96	7.92	5.11
178,500	18,000	3.13	1.77	1.14
	as in Appendix Table C-7	5.87	3.43	2.20
	50,000	8.68	4.93	3.18
246,000	18,000	2.27	1.29	0.83
	as in Appendix Table C-7	4.25	2.49	1.60
	50,000	6.30	3.57	2.31

extension offices had provided a list of all assistance rendered to families in the sample and, as many families could not specify exactly when the assistance had been received, it would have been inappropriate to regard all changes as attributable to work done in 1967. However, it seems likely that a considerable portion of the work in Buenos Aires must have been carried out in 1967 as six out of the fourteen families interviewed had not participated at all prior to 1967.

Estimates of the annual costs of 1965 and 1966 extension programs in Buenos Aires were constructed. These incorporated a deduction of 25 per cent⁸ from costs for each of these years to compensate for the costs of producing physical facilities such as latrines, house improvements, etc. whose benefits were regarded as equal to or less than costs.

Again, because of the uncertainty surrounding the actual costs of producing the results measured by this study, three different estimates have been used in calculating PVB/PVC ratios. The "lower limit" (120,000 pesos) consists of an estimate of 1967 extension costs alone. The "upper limit" includes also 1965 and 1966 extension costs (excluding obreros) and amounts to 450,000 pesos. (This includes an allowance for interest charges at 4 per cent). The simple average of these two figures is used as the

⁸This represents the proportion of costs attributable to obreros in the four districts studied.

"expected value" of costs for the work in the district.

The calculations of the projected benefit flow for extension work in Buenos Aires is shown in Appendix Table C-8. This is based on benefits beginning at 465 pesos per family, which was the average for the fourteen families interviewed in Buenos Aires, and increasing to 700 pesos. It assumes that by 1982 benefits will be received by 124 families - the total number resident in Buenos Aires in 1965. This was five years earlier than in other districts, mainly because of the probable interest and influence of the Coffee Federation in the district. The alternate distribution was assumed to reach a benefit level of 465 pesos per family, approximately half-way through its existence (i.e., by 1983). On the basis of the surveys, there was little doubt that some diffusion was occurring in Buenos Aires. However, the above assumptions do not necessarily accurately reflect the extent of this diffusion or the likely "shift" in the adoption distribution caused by extension effort.

Because of the uncertainty associated with the above assumptions, PVB/PVC ratios were calculated by "lower" and "upper" limits of benefit flows as well for the "expected" level. The "lower" limit was based on 68 families benefiting at the rate of 465 pesos per year. The "upper" limit was based on 125 families benefiting at the rate of 700 pesos per year. Both were assumed to extend for 27 years, the same duration as the "expected" value stream.

The various PVB/PVC ratios calculated for extension programs in Buenos Aires are shown in Table 51. An "expected"

Table 51.--PVB/PVC ratios for extension work in Buenos Aires for several different assumptions regarding costs and benefits.

Extension Costs (pesos)	Benefits to Extension Programs (pesos per annum)	Discount Rate		
		0%	4%	8%
120,000	31,500	7.09	4.29	2.87
	as in Appendix Table C-8	9.86	6.16	4.15
	87,500	19.69	11.91	7.97
285,000	31,500	2.98	1.80	1.21
	as in Appendix Table C-8	4.15	2.59	1.75
	87,500	8.29	5.01	3.36
450,000	31,500	1.89	1.14	0.77
	as in Appendix Table C-8	2.63	1.64	1.11
	87,500	5.25	3.18	2.13

PVB/PVC ratio of 2.59 is noted along with possible extremes of 19.69 and 0.77. These data illustrate the uncertainty underlying the estimates of benefits and costs but, when one considers the benefits not included in estimated benefit flows, it seems evident that extension programs in Buenos Aires were very likely returning substantially more than their cost.

The District of Pinguro

Most extension programs in Pinguro began in 1964, the year after the socio-economic study of the area was completed. Only the school and a few other community projects were carried out in 1963. As in the other districts it became apparent that the information from the surveys was probably describing the results of extension programs throughout the entire period of extension activity - not just 1967 alone. In fact, all thirteen of the families interviewed indicated that they had participated prior to 1967.

Accordingly, estimates of costs for the years 1964 to 1966 were constructed using the same method as was used for Buenos Aires. The resultant total estimated cost for all years was 493,000 pesos. The cost for 1967 extension programs alone, excluding obreros was approximately 90,000 pesos. (Obreros accounted for 91,000 pesos in costs to give total estimated costs of 181,000 pesos in 1967). The simple

average of these two figures was used as an "expected value" of extension costs.

The calculation of the projected benefit flow for extension programs in Pinguro is shown in Appendix Table C-9. This is based on benefits per family of 280 pesos in 1968 rising to 420 pesos by 1982. Average annual benefits for the thirteen families interviewed in Pinguro were 277 pesos. As with Tinajitas, the probable alternative distribution was assumed to begin in 1980 at a somewhat lower benefit level. Both distributions were assumed to include 99 families, the total number of resident families in the district.

The various PVB/PVC ratios calculated for extension programs in Pinguro are shown in Table 52. The "lower limit" benefit flow of 12,500 pesos is based on 45 participating families benefiting by 277 pesos per annum. The "upper limit" of 42,000 pesos is based on 100 resident families benefiting by 420 pesos per annum. As in other districts these ratios will be in error mainly due to the fact that benefits from changes in community organizations and costs of the socio-economic study of the district have been omitted. The results are similar to those noted in Tinajitas and Buenos Aires. The "expected" PVB/PVC ratio is 1.48 with extremes of 14.47 and 0.29 being noted.

Table 52.--PVB/PVC ratios for extension work in Pinguro for several different assumptions regarding costs and benefits.

Extension Costs (pesos)	Benefits to Extension Programs (pesos per annum)	Discount Rate		
		0%	4%	8%
90,000	12,500	4.31	2.44	1.58
	as in Appendix Table C-9	8.39	4.79	3.00
	42,000	14.47	8.21	5.30
291,500	12,500	1.33	0.75	0.49
	as in Appendix Table C-9	2.59	1.48	0.93
	42,000	4.47	2.53	1.64
493,000	12,500	0.79	0.45	0.29
	as in Appendix Table C-9	1.53	0.87	0.55
	42,000	2.64	1.50	0.97

The District of Urquité

The results of extension work observed in Urquité appeared to be attributable to both 1966 and 1967 extension programs. Very little advisory work had been carried out in 1965 as the field work for the socio-economic study was being completed that year. Thus, 1966 extension costs were estimated using the same method as had been used in other districts and an "upper limit" of costs of 298,000 pesos was arrived at. The lower limit of 205,000 pesos represented 1967 costs (excluding obreros) and the average of these was used as an "expected value" of costs.

Benefit flow calculations presented a problem because of the extremely skewed distribution of benefits in the sample of families interviewed in the district. It was considered rather inappropriate to use the average of 2,463 when one family accounted for 90 per cent of the total benefits in the sample. On the other hand, to omit the family entirely and use the average of 283 pesos observed for the remaining eight families surveyed would also have been inappropriate. It was decided to use the average benefits per family surveyed in the four districts (excluding the one family with spectacular results in Urquité) as an estimate of the average benefits per participating family in this district in 1968. Thus, it was assumed that benefits would rise from 325 pesos per family in 1968 to 500 pesos per family in 1980. Calculation of a projected benefit flow on this basis is shown in Appendix Table C-10. The probable

alternative distribution was assumed to begin in 1980 and be complete by 1993.

Calculated PVB/PVC ratios for Urquité are shown in Table 53. The "lower limit" of the benefit flow is based on 37 participating families benefiting by 325 pesos each while the upper limit is based on 70 resident families benefiting by 500 pesos each. The results are not as variable as those noted in other districts. The "expected" PVB/PVC ratio is 1.39 with possible extremes of 4.27 and 0.43 being noted.

All Districts

Because of the interest it might have for persons interested in returns to extension in general, PVB/PVC ratios have been calculated for extension work in the four districts as a group. The results are shown in Table 54. Both the costs and benefit flows for individual districts were summed to arrive at total costs and total benefit flows. Thus, the result represents a weighted average of the four districts.

A slightly lower variability is noted in the overall PVB/PVC ratios with extremes of 11.58 and 0.55. The expected PVB/PVC ratio is 2.12 which indicates that in general, extension programs in Antioquia were likely returning more than their monetary cost. However, this does not say that they were better or worse investments than alternative government programs which might have been carried out. Nor

Table 53.--PVB/PVC ratios for extension work in Urquité under several assumptions regarding costs and benefits.

Extension Costs (pesos)	Benefits to Extension Programs (pesos per annum)	Discount Rate		
		0%	4%	8%
205,000	12,000 as in Appendix Table C-10	1.46 2.72 4.27	0.91 1.70 2.67	0.62 1.14 1.82
251,500	12,000 as in Appendix Table C-10	1.19 2.21 3.48	0.75 1.39 2.17	0.51 0.93 1.49
298,000	12,000 as in Appendix Table C-10	1.01 1.87 2.94	0.63 1.17 1.83	0.43 0.79 1.25

Table 54.--PVB/PVC ratios for extension programs in the four districts studied.

Extension Costs (pesos)	Benefit Flow from Extension Work	Discount Rate		
		0%	4%	8%
526,000	"lower limit"	3.98	2.35	1.56
	"expected value"	6.73	4.05	2.65
	"upper limit"	11.58	6.83	4.51
1,006,500	"lower limit"	2.08	1.23	0.81
	"expected value"	3.52	2.12	1.39
	"upper limit"	6.05	3.57	2.36
1,487,000	"lower limit"	1.41	0.83	0.55
	"expected value"	2.38	1.43	0.94
	"upper limit"	4.10	2.42	1.60

does it say that tax revenues should have been increased (or decreased) to expand (or cut back) such programs. As no welfare loss due to taxation has been included in the costs, it may be that these programs are returning less than their social costs despite such apparently favorable results.

Program Performance Ranking by District

A summary of the factors relevant to ranking the effectiveness of extension work in the four districts is shown in Table 55. No changes in rankings are noted with variations in the discount rate although it is evident that Pinguro and Urquité programs have equivalent "expected" PVB/PVC ratios at 8 per cent but differ at lower rates. At rates higher than 8 per cent, Urquité programs would exhibit a higher "expected" PVB/PVC ratio than those in Pinguro.

All districts exhibit considerable possible variance in PVB/PVC ratios and, as would be expected, this variability is not symmetric about the expected value. Thus, it is difficult to compare districts directly on this basis. Such a comparison is not entirely unnecessary as the districts of Pinguro and Buenos Aires, although they exhibit lower "expected" PVB/PVC ratios than Tinajitas, exhibit higher possible or "upper limit" ratios. Buenos Aires, for example, has an almost identical PVB/PVC ratio to Tinajitas at the "lower limit" and a substantially higher ratio at the "upper limit". Thus, depending on one's utility for large gains, it would be possible to rank Buenos Aires above Tinajitas.

Table 55.--Summary of performance measures for the Department's extension programs.

District	Discount Rate	Expected PVB/PVC Ratio	Probable Range of PVB/PVC Ratio	Income Distribution Effects	Not Included in PVB/PVC Ratios	
					Benefits	Costs
Tinajitas	0%	5.87	2.27 - 13.96	Highly Favorable	Community Organization Changes	Socio-Economic Study
	4%	3.43	1.29 - 7.92			
	8%	2.20	0.83 - 5.11			
Buenos Aires	0%	4.15	1.89 - 19.69	Highly Favorable	"	"
	4%	2.59	1.14 - 11.91			
	8%	1.75	0.77 - 7.97			
Pinguro	0%	2.59	0.79 - 14.47	Highly Favorable	"	"
	4%	1.48	0.45 - 8.21			
	8%	0.93	0.29 - 5.30			
Urquité	0%	2.21	1.01 - 4.27	Highly Favorable	"	"
	4%	1.39	0.63 - 2.67			
	8%	0.93	0.43 - 1.82			

Income distribution effects were essentially the same for all districts.⁹ These are described as "highly favorable" to emphasize the fact that, for the most part, extension participants were members of the low-income class. However, there did not appear to be any basis for saying work in any one district influenced income distributions more favorably than work in any other.

Benefits and costs not included in PVB/PVC ratios were all of the same nature for each of the four districts. Whether or not their levels varied among districts is not possible to say here. However, in view of the fact that the activities involved were very similar it seems safe to assume that these benefit and cost levels were about the same.

On the basis of this limited information it would seem that the four districts might be ranked as follows with regard to extension effectiveness.

1. Tinajitas
2. Buenos Aires
3. Pinguro
4. Urquité

However, because of the large degree of uncertainty associated with the expected PVB/PVC ratios, it is not possible to say that this ranking is a very significant one.

⁹This disregards the single outstanding family in Urquité although they undoubtedly had a much above average income for the district.

Factors Affecting Differences in Program Performance

Differences in program performance are again discussed under the headings of (a) cost differences, (b) unit benefit values, and (c) diffusion effects. However, because the program comparison is by districts, these prove much less interesting than in Valle del Cauca and thus, a further category of "type of program" is introduced to permit examining differences noted among different production and consumption activities.

Cost Differences

Extension costs per participating family and per resident family are shown in Table 56. In view of the fact that some considerable uncertainty existed regarding costs, it is difficult to draw definite conclusions from these data. However, there appears to be an inverse relationship among costs per family - both resident and participating - and "expected" PVB/PVC ratios. The causes of these apparent cost differences are not known as similar extension methods appeared to be used in all areas. It appears that, even though Tinajitas and Buenos Aires were the most remote of the four districts, costs for servicing families in these two districts were lower than in the other two. As Urquité was serviced by the San Jeronimo office perhaps differences in operating practices among offices may account for part of the

Table 56.--Costs per participating family and per resident family of extension programs examined in this study.

	Costs per Participating Family			Costs per Resident Family		
	Upper Limit	Expected Value	Lower Limit	Upper Limit	Expected Value	Lower Limit
Tinajitas	4169	3025	1864	2436	1769	1089
Buenos Aires	6618	4191	1765	3629	2298	968
Pinguro	11205	6625	2045	4980	2944	909
Urquité	7842	6618	5395	4257	3593	2928
All Districts	7115	4816	2518	3774	2555	1335

differences in costs. It would seem that the difference is sufficiently large to warrant concern as costs in Urquité appear to be approximately double those in Tinajitas and no corresponding difference in benefits was apparent.

Unit Benefit Values

As the family was chosen as the unit upon which to base benefit calculations, data relating to benefits per family have been summarized and the resultant statistics are shown in Table 57. It is obvious from the high standard errors that the differences between districts are not significant statistically at the usual confidence levels. However, as the averages were used in arriving at the PVB/PVC ratios calculated earlier, differences between the averages undoubtedly influenced the numerical results.¹⁰ Nevertheless, it would be inappropriate to conclude from the sample data that substantial differences in benefits per participating family exist among districts.

The unusual nature of the distribution of benefits among participating families interviewed merits comment. As noted in Table 57, eleven of the fifty-four families interviewed reported no measureable¹¹ benefits at all, whereas six families reported benefits of more than 1,000 pesos per

¹⁰This was partially reflected in the wide variations in PVB/PVC ratios exhibited earlier.

¹¹"Measureable" means capable of being reduced to monetary terms.

Table 57.--Benefits per family interviewed for the districts studied.

	Average Benefits per Family (pesos)	Range of Benefits per Family (pesos)	Standard Error (pesos)	No. of Families with no Benefits
Tinajitas	329	0 - 1,750	419	4
Buenos Aires (a)	465	0 - 4,201	1,130	7
Buenos Aires (b)	177	0 - 1,292	363	7
Pinguro	277	0 - 1,428	400	4
Urquité (a)	2,463	0 - 19,888	Not calculated	3
Urquité (b)	283	0 - 1,300	449	3
All Districts (a)	689	0 - 19,888		11
All Districts (b)	327	0 - 4,201		11

Note: Entries denoted (a) include the family with the highest benefits in the district. Entries denoted (b) exclude this family.

year - about three times the average. The average annual benefit for families receiving benefits - excluding the one rather unusual case in Urquité - was 412 pesos or 26 per cent higher than the average with those not benefiting at all included. The significance of this sort of distribution is by no means clear. It may be that extension personnel were attempting to work with late adopters who would not likely adopt until they saw results on their neighbours farms. It may be that recommended practices were just not applicable on some farms.

Diffusion Effects

There was no evidence to indicate differences in diffusion among districts. However, the decision to use the total number of resident families as the total population which would ultimately benefit obviously affected the PVB/PVC ratios somewhat. This decision rested on the fact that the principal sources of benefits required little or no land. As some of the minor benefit sources do require some land, the use of resident families may cause an overestimate of the benefit flow.

Obviously, the techniques in certain areas will have a much more limited potential for diffusion than others. This applies to both numbers of families involved and scale of operation. Changes in coffee production methods, for example, could possibly diffuse to all farm families in a

district such as Buenos Aires. However, the scale of operation on farms adopting after 1967 might be quite different than those adopting before. This was certainly the case in Urquité where one family had the largest coffee area in the district and, as noted earlier, adopted some changes and benefited substantially. It is considered that the benefit flow estimates used reflect this situation adequately but only time will tell whether or not this is the case.

There was the possibility that some of the new technology would not diffuse but, perhaps, would even be rejected by farmers considered in this study to be adopters. Several instances of rejection were noted in the surveys. These cases show up in the data as families recalling assistance but not experiencing income increases. For example, several families reported they would not plant vegetable gardens the coming year if the extension service did not supply the seeds. A few vegetables (e.g., carrots) were not very popular among some families because of the differences between them and the vegetables which were already standard fare in the region.

Type of Program

Table 58 provides a summary of the results of extension programs directed at the production activities of the 54 families interviewed. These data indicate that a few programs could be regarded as widely successful whereas

Table 58.--Summary of benefits by program among 54 sample families in four districts.

Type of Program	Total Number of Families Receiving Assistance in 1967	Number of Families not Recalling the Assistance Received	Number of Families with Recalling Assistance	Number of Families with Apparent Direct Benefits	Average Annual Benefits per Family for Families with Benefits (pesos)
Coffee	14	7	7	5	2,340
Fruits	10	5	5	2	446
Vegetables	40	3	37	26	371
Sisal	9	3	6	5	499
Other Crops	1	1	0	1	326
Rabbits	19	4	15	7	174
Swine	9	4	5	2	330
Poultry	14	7	7	1+1?	8,328+?
Bees	6	2	4	2	236
Handicrafts	17	2	15	10	104
Clothing	22	4	18	14	115
Vaccinating Cattle	12				

many were quite limited in extent of success. Vegetable gardens and clothing fell into the former category whereas such items as swine, poultry, bees, and fruits belong to the latter. Handicrafts were relatively widely-adopted but this was one case in which future prospects looked poor because of limited markets. Coffee, although it was the principal source of cash income for many families surveyed, did not appear to be a crop where changes were being widely-adopted. Most of the farmers with small acreages were reluctant to take the short-term losses necessary to change varieties even though longer-term gains seemed sizeable. However, they might well do this when they witnessed the benefits on their neighbours' farms. As the four districts surveyed are not highly-adapted to coffee, it may be that benefits due to better technology in these districts are not as large as they might be in other regions.

The differences in degree of success among types of program is not readily explained. It cannot be assumed that extension effort was constant among all program types. Extension personnel were emphasizing certain things in some districts (e.g., sisal in Tinajitas) and not in others. It does not appear that the number of families adopting in the area is very closely related to profitability as measured by average benefits per family adopting. However, because of the small numbers involved, it would be inadvisable to place very much weight on this statement. Vegetable gardens and clothing appear to have been successful because:

- (a) they were already essential parts of the families' lives,
- (b) changes could be made with little cash outlay on the parts of the families involved. (This appeared to limit the level of benefits in the clothing area.)
- (c) techniques were easy to learn and their benefits could be readily seen.

Risk and limited resources (i.e., working capital) were likely instrumental in limiting the success of other programs such as poultry, swine, bees, etc.

Adoption in programs directed at consumption activities appeared to hinge directly on whether or not material aid was supplied to the families. Accordingly, one can reasonably infer that income was the limiting factor here and that, if incomes in the region were higher, some of this technology would be adopted without provision of material aid. Of course, even if incomes were higher, adoption would not likely occur without some sort of educational program to point out the advantages of the new ideas.

The extension service's success in the area of community organizations seems largely attributable to provision of obrerros and funds for community projects. As thirty out of the fifty-four families interviewed reported benefiting from these programs it seems reasonable to regard them as successful in some sense. Of course, as the families concerned did not bear the full costs, PVB/PVC ratios for these programs might well have been small (i.e., less than one) despite this reaction.

Cost Minimization

Cost minimization considerations may be analysed by examining expenses in two categories: "salaries and fringe benefits of field personnel" and "other costs". These categories accounted for approximately 52 per cent and 48 per cent respectively of the total costs of operating the extension service in 1967. The former category includes salaries of extension workers in the field, wages of obreros, and all primas, bonuses, pension allowances and similar fringe benefits for these employees. The latter category includes costs of office maintenance, transportation, materials and supplies, administration, the services provided to the field workers by the communications and research divisions of the Secretary of Agriculture and all other goods and services purchased in 1967.

Both cost categories include expenditures for "management" activities because both administrative and field personnel were involved in making decisions regarding the nature of programs offered. Both categories also include expenditures for "program operation". It was not possible to obtain specific cost estimates of these two classes of activities.¹² However, it appeared that a

¹²Some of those "management" costs incurred prior to 1967 (e.g., the socio-economic studies) should have been charged to 1967 programs because they were costs of choosing 1967 programs. On the other hand, part of the 1967 "management" costs were probably incurred in planning programs which would continue in 1968 and perhaps 1969. Thus, even if a cost division between "management" and "program

significant proportion of total costs were devoted to "management". In the two regions studied, 14.2 per cent of total field personnel time was devoted to "office work" and 40.8 per cent was devoted to activities other than farm visits, meetings, demonstrations, tours, office work, and travel. Although the exact nature of the "other activities" is unclear it appeared that a considerable proportion was devoted to administrative duties, organizing community activities, and planning sessions while training sessions may have accounted for the remainder. Perhaps 20 to 50 per cent of "other costs" were attributable to "management" activities. A large part of administrative salaries, maintenance of administrative offices, and costs of collecting and processing data on field operations were clearly "management" expenses. However, transportation, materials and supplies, field office maintenance, and services of the research and communications sections were essentially all "program operations" costs. Thus, perhaps 20 to 40 per cent of total 1967 costs were "management" costs.

There is little evidence to suggest that the extension service was not minimizing costs for the "management" activities which were performed during 1967. The reports which had to be completed by field personnel naturally took a good deal of time. Similarly, field programs could operation had been made for 1967 expenses, the resultant "management" costs would not necessarily have been representative of the "management" costs of 1967 programs. Of course, even greater difficulty would have been encountered in measuring the costs of the programs actually analyzed as these extended over several years.

not be carried out and modified without field personnel spending some time analyzing what was happening in the various programs. The collection and processing of data and the carrying out of the various administrative functions that were part of the existing management system also were time-consuming. There probably were cheaper (less time-consuming) ways for reports to be completed, existing programs to be observed, new programs to be analyzed, decisions to be reached, and decisions to be carried out. However, an analysis of these problems would have been quite costly and the possible gains relatively small. Thus, it will be assumed here that the extension service was, in a practical sense, minimizing the costs of the "management" activities it carried out during the year.¹³

A similar conclusion can be drawn about the "program operation" activities conducted during the year. Table 59 shows the percentage distribution of field personnel time by the type of activity and class of personnel for the Santa Fe de Antioquia and San Jeronimo offices. On the average, 18.1 per cent of personnel time was spent visiting farms. Mejoradoras de hogar spent less time in this activity than other workers because much of their work was done with groups rather than individual families and could be carried out in a

¹³This should not be interpreted as meaning that no improvements could be made in the management of the extension service. In the author's opinion the extension service could have operated a much better management system for the same cost. Thus, while what was done was probably done at least cost, a somewhat different system could have produced better results.

Table 59.--Percentage distribution of field personnel time by type of activity and class of personnel for the sectors of Santa Fe de Antioquia and San Jeronimo in 1967.^a

	Santa Fe de Antioquia			San Jeronimo			Both Sectors
	<u>Agronomos and Veterinarios</u>	<u>Mejoradoras de Hogar</u>	<u>Practicos Agrícolas</u>	<u>Agronomos and Veterinarios</u>	<u>Mejoradoras de Hogar</u>	<u>Practicos Agrícolas</u>	<u>All Classes</u>
Farm Visits	26.7	8.2	27.9	16.6	8.1	16.7	18.1
Meetings	2.0	4.9	2.0	2.4	12.1	3.0	4.3
Demonstrations	0.6	13.9	2.4	0.7	2.5	1.2	3.7
Tours	0.3	0.4	0.2	-	-	-	0.2
Office Work	24.6	7.4	5.6	25.3	32.2	11.0	14.2
Travel	15.2	16.7	18.9	20.1	13.2	24.1	18.7
Other Activities	30.6	48.5	43.0	34.9	31.9	44.0	40.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

^aCalculated from summaries of monthly reports filed by the two field offices.

central location. Practicos and agronomos might have used this approach to a larger extent. The author was surprised to find that the monthly reports indicated that the agronomos spent about the same proportion of their time on the farms as the practicos because they were not nearly as well known in the districts surveyed. Travel accounted for 18.7 per cent of field personnel time on the average with practicos in San Jeronimo being the highest of the six groups with 24.1 per cent. Summaries of data submitted by the Santa Fe de Antioquia and San Jeronimo offices indicate that on the average, field personnel in these offices were able to cover only 12.8 and 18.3 kilometers per hour respectively. This is a reflection of the road conditions in the area. Some of the practicos lived in the districts and walked to the farms. Within some of the districts, cars could not be used and travel was exclusively by foot or horseback. Thus, while travel time used up a significant portion of the working hours there did not appear to be much that could be done about it.

CHAPTER X

POSSIBILITIES FOR IMPROVING EXTENSION EFFECTIVENESS IN COLOMBIA

This chapter will focus on the two categories of extension activities delineated in Chapter III - program operation and extension agency management. The purpose of the chapter is to suggest, on the basis of both conceptual and empirical considerations, guidelines for improving extension effectiveness or efficiency within the existing budget allotments. As indicated at the outset of the study, no consideration has been given to whether or not budget allotments should be raised or lowered.

Extension Programs

On the basis of the observations made in this study, there is no reason to believe that any one of the "outputs" of extension work defined in Chapter II should be entirely ignored by Colombian extension agencies. There appears to be potential for effective extension work in promoting technical changes in farm firms, rural households, and community organizations, and in promoting managerial changes in rural society in general. There also appears to be potential for effective extension work in performing the four

secondary extension functions outlined in Chapter II. In addition, there may be potential for effective extension work in the marketing of agricultural products - an area not investigated in this study because of the little current activity in it.

However, in various parts of the country it will probably be appropriate for extension workers to focus on one or more particular "outputs" and exclude one or more others from consideration. This conclusion obtains because of the relative potential pay-offs for producing different "outputs" in different regions, the costs of maintaining extension personnel capable of focusing on all "outputs" in all parts of the country, and the differing effects on income distribution of programs directed at producing different "outputs" under different environmental conditions. An attempt will be made to clarify this rather general conclusion in the following discussion.

Agricultural Production

This study indicates that extension programs directed at inducing changes in farm firms in Colombia can have a very high pay-off¹ in relation to the costs of carrying them out if (a) the technology being promoted has a high pay-off

¹As agricultural extension and agricultural research are, to a large extent, complementary, the pay-offs noted in this study need to be interpreted with care. It must be remembered that no research costs have been included in the calculations and that the returns measured must, in the long run, cover these as well.

for potential adopting farmers and (b) extension programs can achieve a substantial shift in the adoption distribution among farms.² Determinants of both of these conditions lie, to a considerable extent, outside of the jurisdiction of extension workers. Extension personnel can only select from available ideas those which they believe will achieve the first of these conditions and promote them using ways and means which they believe will achieve the second in the existing environment. It is not possible for a study such as this to recommend specific programs which would increase extension effectiveness in dealing with farm firms in Colombia. However, it is possible to suggest some general guidelines. These will be discussed with reference to the two general conditions mentioned above and income distribution and extension cost considerations. However, it must be noted that there is considerable interaction among these two conditions, income distribution considerations and extension costs. Benefit flow levels resulting from very high pay-off technology adopted on a few farms may be essentially the same as those resulting from low pay-off technology adopted on many farms. Furthermore, income distribution effects and extension costs might be equivalent or significantly different in two such situations.

The following general points apply to an analysis of the potential pay-off of agricultural technology for adopting

²This conclusion may have to be modified for income distribution considerations as discussed in Chapter V.

farmers in Colombia:

- (i) The potential pay-off to individual farmers will usually vary directly with the size of the operation (measured in units of output). This would imply that, other things being equal, extension workers should promote techniques applicable to larger farms. However, diffusion possibilities, income distribution considerations, or extension costs, may not "be equal" and hence negate this conclusion.
- (ii) Techniques of relevance on larger farms may be totally irrelevant on small or medium-sized farms and vice versa. This applies both because of risk considerations and the different environmental conditions surrounding the farming operations of different sized units. Mechanization is an obvious example of a set of techniques of relevance to large farms but largely irrelevant to small farms. However, there are others. Narrow profit margins per unit of output may make the total pay-off for a large producer quite significant but may not be significant enough to offset the risk for a small holder. This could apply to new varieties, fertilizers, insecticides and similar techniques. Of course, some techniques (e.g., new varieties) might apply to both large and small units.
- (iii) The potential pay-offs of particular types of technology on individual farms will usually be much greater if the technology can be used on a number of products (with perhaps different treatment levels). As many Colombian farmers grow several crops, techniques such as fertilization, insect control, disease control, and so on, fall into this category. As diffusion possibilities are likely to be greater as well, while extension costs may be only slightly higher and income distribution effects are likely to be invariant, extension programs directed at promoting multiple-use technology (such as fertilization) are likely to be more effective than those directed at promoting single-use technology (such as control of insects unique to particular crops).
- (iv) In many cases, there may be pay-offs from foreign agricultural technology on individual farm firms in Colombia. However, because of price differences, limited input availability, and different input/output relationships, the profitability of such technology may be vastly different than that in the country from which the technology originates. This does not necessarily mean the pay-off is lower - it

may be higher.³ However, it does imply that field trials may be necessary to assess profitability and risk under local conditions.

- (v) The merits of technology to the farmer should not be judged on the basis of expected profitability alone, especially on small operations. Some combination of profit (allowing for opportunity costs) and risk considerations seems appropriate for making such assessments, especially where the new technology creates a possibility of monetary loss which had not existed before. The use of purchased inputs such as fertilizers, sprays, feed supplements, and so on, fall into this category as, in many cases, traditional Colombian farmers produce crops or livestock with no purchased inputs and hence, in the case of crop failure or death of livestock, lose only their labor.
- (vi) The provision of credit for farmers with small holdings may eliminate one of the barriers to adoption on individual farms but it may not achieve the desired results if farmers are making "minimax" decisions (see (v) above). For very low income farms it may be necessary to offer rural entrepreneurs a virtually risk-free proposition to encourage adoption. Thus, it might be useful to try some programs where the credit need be repaid only if the technology produces the claimed results.
- (vii) It should not be assumed a priori by extension workers that, for every community in Colombia, there exist available techniques with high pay-offs for farmers in the area. Because of the limitations to foreign agricultural technology (see (iv) above) and the limited resources which have been devoted to agricultural research in Colombia in the past, there may be many areas in which few pay-offs are possible. (Indeed, because of the uniqueness of conditions in some areas and the stringent character of the local environment, research designed to discover technology suitable to these areas may be out of the question.) In some parts of Colombia there may be no possibilities for doing effective extension work directed at promoting changes in agricultural production.
- (viii) The adjustment to economic optima for new or existing technology offers a possibility for effective extension work, particularly if product and input price changes

³Indeed, it may mean that some techniques which are known but regarded as uneconomic in advanced societies, have a very high pay-off in developing countries.

are frequent, or the levels of uncontrollable factors vary frequently. While diffusion potential for this sort of change is often limited, it can sometimes be achieved at low cost and hence, it may be quite competitive with other extension work. Such low-cost extension work would likely involve publications and/or use of the mass media to reach a large number of farmers. Even though diffusion is small or non-existent, such work can be justifiable from a social point of view if the cost of carrying it out is low in relation to benefits per farmer and, if private sources are not meeting this need.

- (ix) The potential pay-off of agricultural technology to individual producers is heavily dictated by the opportunities created by their environment. In Colombia, the environment dictates that many individuals will never have any land, or, if they do, this will be a very small parcel. It also dictates that they will not likely be involved in livestock production or some other types of commercial agriculture. Thus, there seems little point in extending some types of technical agricultural knowledge to such rural people as there will not likely ever be any opportunity for them to use this knowledge. In both the CVC and the Department of Agriculture of Antioquia a number of cases were noted where instruction of this sort was given (e.g., individuals who were taught to care for cattle had little prospect of ever doing so). Many rural residents will have some forms of current endeavour which can be exploited more fully, but if not, then perhaps extension resources can be utilized more wisely in other areas than in extending techniques which will not likely ever be used.
- (x) The introduction of new crops or types of livestock to a given area may involve cost structures significantly different from existing ones. They may require inputs which are not currently available and they may place entrepreneurs in risk situations which are quite different from any of those which they have ever faced before. Therefore, field trials will likely be necessary to assess the merits of such technology to individual communities.
- (xi) The use of field trials and demonstrations (see (iv) and (x) above) by the two agencies examined in this study was quite limited. A related extension method involved supplying a number of local families with seeds, seedlings, or other similar supplies. The families in question regarded these "gifts" as the full extent of extension assistance. It is this

writer's hypothesis that a few trials of such technology on farms of interested persons coupled with complete demonstration and instruction in related cultural practices and complete follow-through to measure results and demonstrate them to the rest of the community would have been more appropriate. The levels of profitability of some of the techniques being promoted by "gift" of seeds, etc. were not even well established in the minds of extension workers, let alone among the recipients.

- (xii) The availability and price of inputs together with the marketing cost and availability of product markets are a significant cause of the difference in relevance of technology to large and small farms mentioned in (ii) above. Fertilizer is reasonably-priced and widely-used in the floor of Valle del Cauca where large farms predominate. However, it is very expensive to the minifundista in many parts of Antioquia - especially when he must spend several days carrying it home by horse or on his back. Similarly, minifundistas in remote areas find that their⁴ products command relatively low prices at the farm. While much can be done to improve marketing conditions in Colombia⁵ and extension agencies may⁶ even contribute significantly to such improvements, physical conditions dictate that some of such differentials can never be eliminated. On the other hand, it may be⁷ appropriate in some areas as Felstehausen suggests, for extension agencies to promote roads and other public services so that such differentials can be reduced. Unless such reductions occur, producers in such areas will always be at a relative disadvantage in the market place.

⁴For example, in visits to different areas of Antioquia in the course of this study, this writer noted oranges being left to rot even though these were being sold regularly to consumers in Medellin and Cali. The reason for this was that prices were currently so low as to not even cover the transportation costs to such markets.

⁵Harold Riley, et. al. "Market Co-ordination in the Development of Cauca Valley Region - Colombia", Research Report No. 5, Latin American Studies Center, Michigan State University.

⁶Ibid., pp. 364-365.

⁷Felstehausen, op. cit.

The following general points apply to an analysis of the effect of extension work on the adoption distributions of technology on farm firms in Colombia.

- (i) This study uncovered no evidence to contradict, and some evidence to support, the general concept of adoption advanced by Rogers. Thus, it would probably be useful for Colombian extension personnel to view their clients as innovators, early adopters, late adopters, and laggards. The possibilities of shifting any adoption distribution are likely to be far greater by working with⁸ innovators and early adopters than with other groups. However, because of the variability in size of farm and environmental conditions in Colombia, it would seem appropriate to identify regional and sub-regional groups of farmers and work with innovators in each of these groups. Sub-regional groups might be usefully identified on the basis of products produced and income level of size of operation.
- (ii) Some technology may have a very limited potential for diffusion because there are only a small number of producers of the product(s) affected. Specialty crops (e.g., tomatoes in Valle) or products whose total output value is low (e.g., honey) are cases in point. Effectiveness of extension programs in such cases will be limited unless benefits per producer are high, extension costs per producer are low, or income distribution is much more favourably influenced than by competing programs.
- (iii) Some technology may have a very limited potential for diffusion because, even though there are a large number of producers of particular products which it affects, the number of these producers to which it is relevant is small in relation to the total population. This observation appears to be particularly significant in Colombia because of the wide variation in size of farm and environmental conditions throughout

⁸For example, in Antioquia it was noted that extension workers were endeavouring to work directly with a large proportion of the families in the communities studied. Some of these families were much more receptive than others. The less receptive families could well have been waiting to see how techniques worked on neighboring farms before adopting them themselves. Attempting to get them to adopt at the same time as their more innovative neighbors was not necessarily the best use of extension resources.

the country. For example, new corn varieties relevant to the floor of Valle del Cauca are not relevant to corn producers in the mountainous parts of the same state even though they may be only a mile or two from the valley.

- (iv) Some technology may have a reasonably good potential for diffusion but may have a low pay-off for extension effort because it is being promoted through non-extension information sources. Thus, the potential for extension workers to shift adoption distributions is relatively small. In Colombia, producer associations for sugar, rice, cotton, barley, beef cattle, and other products are substituting for extension in these areas. In addition, input suppliers and/or the purchasers of some products also supply technical assistance thereby making the potential for extension workers to shift adoption distributions smaller than they would otherwise be. Of course, such situations should not be ignored entirely as extension can often "speed up" adoptions which are already occurring. (This seemed to be the case in the tomato program of the CVC).
- (v) Most of the non-extension information sources found in Colombia appear to compete with, rather than complement, extension work. However, in many areas such competitive information sources are absent or few, and extension workers find that, unless changes are promoted by extension agencies, the local population will be a long time finding out about them. In such cases the time "shift" in adoption attributable to extension will be substantial and may well compensate for high extension costs or low pay-offs to individual units. Such cases usually result in favorable income distribution effects as well.
- (vi) In the two agencies examined in this study there seemed to be relatively little extension effort directed at facilitating the diffusion process. It is this writer's hypothesis that it would be useful for extension workers to attempt to utilize innovators for focal points in local communities. Field trials, demonstrations, and meetings could be held on the farms of such individuals and, if it became known that these people were willing to share their experiences and knowledge with their neighbors, the total time for the adoption of useful ideas on farms in the area would likely be shortened. Another means of doing this would be through "awareness" programs utilizing the mass media. If people could be made aware that a few farmers in nearby communities were trying out

new ideas, the possibilities of diffusion from a few extension participants might expand considerably.

The following general points apply to an analysis of the effect of extension work on the income distributions of Colombians as a result of changes in technology in farm firms.

- (i) The belief that work with high income farmers aggravates income distributions⁹ is not necessarily a valid one. In those cases where such farmers are producing products which are widely-consumed by low income people, shifts in supply can serve to pass these gains on to consumers and hence improve income distribution. In Colombia, products such as rice, beans, potatoes, corn, cassava, and plantain are cases in point. Conversely, if shifts in supply do not occur or, if the products concerned are consumed mainly by high income families, income distributions are likely to be aggravated. Products such as cattle, swine, poultry, milk, eggs, coffee, and perhaps sugar might well fall into this latter category although this situation is by no means clear cut as all income classes consume some of these products.
- (ii) Technological innovations which are sufficiently widespread as to cause shifts in supply and hence lower (or prevent an increase in) prices, may well have an adverse effect on some farmers. Technical changes in the production of products such as corn, coffee, and plantain which are produced on both large and small holdings in Colombia have a very great potential for cutting the incomes of low-income producers. Coffee for example, appears to be by far the best source of cash income for families in those parts of Antioquia studied. Should the Coffee Federation's technical advisory program, which is aimed at the better coffee-growing areas be instrumental in shifting the supply curve¹⁰ and lowering the price of coffee, the net effect in districts such as those examined in Antioquia would of necessity be lower incomes. In this case the benefits would be passed on to coffee consumers who, to a large extent, are high income families either in Colombia or elsewhere.

⁹This belief was encountered among some extension personnel by the author.

¹⁰This possibility is complicated by the fact that the price of coffee for export is not determined in a "free" international market.

- (iii) In view of the fact that many rural residents of Colombia are employees of large and medium-sized farming operations, they can be adversely affected by agricultural extension programs directed at replacing hired labor with mechanized operations. Rice, corn, and sugar are cases in point. While it may be advantageous for owners of large farms engaged in the production of these crops to mechanize, there are some significant disadvantages for the workers who as a result, find themselves without jobs. These disadvantages are evident in increased pressures on cities by rural-urban migration patterns.
- (iv) Extension work directed at low income producers will not necessarily produce benefits for these farmers any sooner than if they had been ignored and extension efforts had been directed at high income producers. Observations made during the course of this study tend to support the notion that higher-income farmers are more likely to be innovators than their poorer neighbors.¹¹ Thus, the poorer farmers, who tend to be late adopters and laggards may wait to see what the innovators do before they act, even though extension workers focus their attention on them. However, this conclusion would perhaps not apply nearly as strongly among similar groups of farms and regions as it would within these groups and regions. As noted earlier, it might well be appropriate for extension workers to classify producers into several groups on the basis of size and location and work with innovators in each group.
- (v) There appear to be some types of technology which are likely to have a positive effect on income distribution in Colombia whether they shift supply curves or not. Improved techniques of relevance to crops which are widely consumed and produced by low-income classes are cases in point. Of these new techniques, yield-increasing varieties and improved cultural practices not involving purchased inputs are likely to be the most promising for adoption on low income farms. Unfortunately, extension workers are severely limited in what they can do in this area because few such varieties are available and little research in the area of improved cultural practices is being done. Of course, limitations in effective demand for such commodities obviously exist so it is not possible to push this idea very far without taking such limitations into consideration.

¹¹ An exception to this may be the group of traditionally-oriented farmers who own larger blocks of land primarily for cattle production.

- (vii) Because of the social character of Colombia, it seems evident that extension programs directed at helping rural society may be more appropriately directed at making food cheaper for the consumer than at making greater profits for the producer, if situations arise where these two ends are, in fact, in conflict. This obtains because all members of rural society are food consumers while only a fraction of them are profit recipients.

The following points apply to an analysis of the extension costs of promoting agricultural technology in Colombia.

- (i) Because of differences in environmental conditions between Colombia and developed countries such as the United States, there are significant differences in extension costs which must be allowed for in selecting extension programs. Salaries are much lower in Colombia but transportation and the costs of supporting services are generally higher. Thus, it is appropriate for Colombian extension agencies to attempt to use a different mix of these resources than is found in North America or Europe.¹² However, as these classes of resources tend to be complementary, care needs to be taken to ensure that efforts to reduce costs by changing the "mix" do not seriously weaken extension programs.
- (ii) Because of differences in environmental conditions within Colombia, there are significant differences in extension costs among regions. Lack of services, especially roads, in some rural areas makes extension costs per rural resident serviced so high as to reduce extension effectiveness considerably. The use of semi-professionals (i.e., practicos) who are willing to live in such areas and use public transportation is one means of keeping costs low. However, extension workers such as these need continuing competent technical support from qualified, practically-oriented, professionals if they are to be productive on a continuing basis.
- (iii) In the two agencies examined in this study, several possibilities were noted for reducing costs and/or

¹² This appears to be in direct conflict with the implication of the Commission on Higher Agricultural Education (see footnote 7, Chapter I) that extension agencies should not be spending most of their budget on salaries.

improving extension service at no added cost. These include elimination of the use of chauffers unless this serves to make one vehicle serve several extension workers to a much greater extent than it would otherwise, establishing a regular replacement program for vehicles, and reducing the amount of non-productive travelling (e.g., secretaries attending farm meetings). (Conversely, some cases were noted where attempts at cost-economy severely limited extension programs.) However, the potential for increasing extension effectiveness by focusing on costs is relatively small and it is doubtful whether either of the two agencies examined in this study were any more wasteful of public funds than government agencies in other parts of the world.

Home Economics

Extension programs directed at rural Colombian households seem to be capable of achieving a high pay-off in relation to costs even though diffusion is not substantial¹³ because many rural Colombian communities contain a sizeable group of households with a number of common interests, each of which offers some possibility for worthwhile change. Furthermore, these common interests can be serviced by relatively low cost personnel. The net result appears to be that, under these conditions, costs per household serviced can be much lower than the present value of future benefits per household. Home economics programs can then become

¹³There are two circumstances which appear to explain the apparent lack of diffusion of home economics practices examined in this study. Firstly, home economics programs were directed at a substantial proportion of the total number of families in the communities in question. Thus, only a few families were not informed of the practices directly. Secondly, the families who were not informed directly would likely be "late adopters" or "laggards" in any event and thus, one would not expect diffusion to them to take place quickly.

quite competitive with programs directed at agricultural production units and, in some cases, offer a much greater possibility for useful extension work. Another significant factor is that such programs almost invariably have a positive effect on income distribution because most rural households belong to low, or low to medium, income families and the gains made from these programs do not usually get transferred to other groups by any direct mechanism (like shifts in the supply curves of agricultural products for example). It is also significant to note that although benefit-cost ratios may be high, there is little possibility of beneficiaries paying the cost because the benefits are usually received "in-kind" and are not readily converted into money in the market place. Another point of interest is that home economics programs, of the sort examined in this study, need not be restricted to farmers nor even to rural residents. They appear to be applicable to a large group of Colombian families whose incomes are low (but not less than about 100 pesos per week).

The following points appear to apply to an analysis of benefits per household served by home economics programs.

- (i) While the benefits of home economics programs may be difficult to evaluate, the application of the opportunity cost principle for such skills as the diagnosis and/or treatment of simple illnesses, and the making and/or repairing of clothes can produce rather spectacular results. These results should not be ignored - they reflect the fact that people have learned to do for themselves what would be (for them) prohibitively expensive otherwise. Thus, such measurements reflect net additions to these people's level of living.

- (ii) Similarly, where it is possible to change the nutritional composition of the human diet and thereby improve the health of the individuals involved, the benefits are obviously significant. It is possible to place a value on this by having the beneficiaries relate this benefit to some other goods or services which can be traded in the market place. However, one of the difficulties with this approach is that the beneficiaries may not fully appreciate the biological effects of improved diets.
- (iii) The restricting effect of low incomes is felt in most home economics programs. The changes promoted often require corresponding changes in the family expenditure pattern. This effect appears to be such that relatively little success can be achieved with families of income levels lower than 100 pesos per week. (Perhaps these are the late adopters and laggards who would adopt "when they can afford it" or when they see how things work out for their neighbors.)
- (iv) Although income level is a very restricting factor for Colombian home economics programs, extension workers do not appear to be focusing as strongly as they might on the problem of "getting more out of existing incomes", particularly in the area of nutrition. A number of the extension participants interviewed mentioned that they knew (from home economics programs) that they should eat more meat and drink more milk in order to get a balanced diet, but they couldn't afford these foods. Perhaps more work needs to be done in the area of calculating diets (using available foods) which are acceptable to people and which come as close as possible to nutritional "requirements" on existing food expenditures. Few possibilities for improving diets on existing incomes were known to the extension workers encountered in this study. Furthermore, while some knowledge of nutritional "requirements" was evident, extension personnel seemed to have little idea what would happen if such "requirements" were not met in full.
- (v) The benefits to be derived from vegetable gardens can be readily estimated by using market prices for the products and seeds and opportunity costs for the land and labor involved.¹⁴ In many cases, the results can be quite satisfactory although, for some

¹⁴ This applies only to the extent that the products can substitute for purchased foods and/or usefully improve the diet of the family. Production in excess of economic levels of home consumption must be marketed and there may be no market for it.

families, poor land, lack of land, or distaste for the products produced make this sort of venture impractical. Nevertheless, many rural families appear to know little about growing vegetables for home use. Therefore, there appears to be considerable potential for usefully expanding vegetable gardens in Colombia. However, if this expansion is to occur, it would appear that extension workers themselves have to know more about the appropriate cultural practices to follow and many families have to acquire access to a small plot of good land. The families of many rural laborers do not currently appear to have access to enough good land for a garden.

- (vi) The benefits from programs directed at up-grading the abilities of rural families to make and repair clothes can be estimated by using market prices for raw materials and finished products and opportunity costs for labor.¹⁵ The results, although limited in some cases by the restricted availability of sewing machines, can be quite satisfactory. Most of the rural families interviewed in this study rated this type of program quite highly. While on the surface this sort of activity might appear to be severely limited by family income, it appeared as though the instruction offered often allowed families to make better use of their existing clothing expenditures and, for this reason, was very popular. Extension participants appeared to be willing to utilize such skills even when their diets were apparently poorly balanced,¹⁶ a fact which was somewhat disconcerting to a few extension personnel who believed nutrition was more important than clothing.
- (vii) The benefits from programs directed at up-grading the abilities of rural families to make home improvements are not readily estimated but the results, in many cases, appear to be unsatisfactory. If one uses market prices for finished products and raw materials, and charges labor at opportunity cost, then, for some of the programs examined in this study, the benefits appear to be negligible.¹⁷

¹⁵ Again, this applies only to the extent of satisfying the needs of the family - it should not be assumed that families can or will market the goods in question.

¹⁶ The people involved appeared to be making informed decisions and simply preferred to be better-dressed than better-fed.

¹⁷ This would not appear to apply to home improvements directed at improving sanitation.

Furthermore, where benefits are positive, there is often little opportunity of them being repeated on a continuing basis.

- (viii) The benefits from programs directed at up-grading the abilities of rural people to manufacture crafts (e.g., weaving baskets) are readily estimated by using market prices for the finished products and raw materials and charging labor at opportunity cost. The results, however, are quite variable and depend primarily on the market potential for the products. Usually this is quite low.
- (ix) The benefits from programs directed at supplying rural people with physical improvements to their homes on a shared cost basis defy easy measurement. However, if one were to ask the question "If the family were given the equivalent cost of the improvements in money, would it create these improvements?" the author hypothesizes the answer would often be "No". If this hypothesis is valid, the benefits from these programs could reasonably be regarded as less than costs. The fact that there is little learned from such programs which can be applied on a continuing basis also tends to limit benefit levels.
- (x) Where incomes are increasing, even slightly, new consumer goods which are not readily adopted on existing incomes may become much more attractive to rural families. This would appear to apply to protein-rich foods such as milk, meat, etc. which, for the most part, are not economical substitutes for existing foods.

The following points appear to apply to the analysis of costs per household of home economics programs:

- (i) The use of mejoradoras, who are semi-professionals, seems to be a significant factor in keeping costs per household low in home economics programs. Not only are their salaries lower than professional home economists but, as with the practicos, they are often willing to live in the rural communities and this tends to keep transportation costs down. (Of course, unless the mejoradoras have adequate continuing support from qualified, practically-oriented professionals, one would expect them to soon exhaust their repertoire of innovations for the communities with which they work.)

- (ii) There does not appear to be any particular cost advantage to having home economics and agricultural extension personnel working together, although in both Valle del Cauca and Antioquia it was noted that they shared the same vehicles. This obtains because home economics programs can often be successful with families of laborers and minifundistas where current agricultural extension programs have little to offer.¹⁸
- (iii) In communities where it is difficult to get a group of twenty or so housewives with common interests who are willing and able to come to regular meetings, the costs per household serviced could very well be much higher than those noted in this study. However, it would appear to the author that there are a good number of communities in Colombia where home economics programs could be operated with groups of sufficient size to keep costs per household low.
- (iv) The costs per household serviced are likely to rise substantially if it is not possible for a mejoradora to visit several communities in a week. This would apply in remote areas where communities are either far apart or transportation methods are primitive.
- (v) One of the possible ways of reducing extension costs of home economics programs is the use of the mass media, especially radio. As many rural families have radios, it would appear that some of the more straight-forward techniques or ideas might be promoted to a larger number of households at a lower cost per household than via existing methods.
- (vi) Those extension programs directed at supplying rural people with improved physical facilities (e.g., houses, water systems, etc.) were probably provided at a higher cost than the rural people could have acquired them for themselves. This obtains because of the administrative costs involved in having the extension agency perform such functions.

¹⁸ Conversely, extension programs directed at agricultural production units may often usefully concern themselves with firms where the operator's family has little to gain from home economics programs. (Indeed, the family may not even reside on the farm.) Hence, offices to service such farms need not necessarily include home economics workers.

Community Organizations

The evidence gathered in this study was not sufficient to warrant drawing any conclusions regarding the possibilities for effective extension work with community organizations in Colombia. While some apparently successful projects of this type were noted in Antioquia, it was not possible to measure the benefits of these projects and relate them to their costs. Furthermore, the actual "success" of these projects was obscured by the extensive financial aid rendered by the extension service itself. However, it is possible to distinguish the following points which are of relevance to an analysis of such extension work.

- (i) There are obviously many functions which community organizations could usefully perform in rural Colombia. Lack of roads, schools, medical and health facilities, electricity, telephone, marketing services, postal services and so on, are the rule rather than the exception. Provision of these could increase the level of living of many rural people and yet, for various reasons, little is being done to provide them.
- (ii) The most apparent barrier to effective extension work of this type is lack of funds for projects. People in rural communities are reluctant to organize because they know few funds are available locally. Once such groups are organized they usually encounter difficulty in obtaining funds from outside sources (e.g., the Coffee Federation and regional or national governments).
- (iii) The lack of adequate funds for public projects in rural areas is the result of several environmental factors. Firstly, it is a reflexion of the fact that resources in general are scarce in Colombia. Secondly, the extreme physical conditions in some areas make some projects very costly (e.g., cement to construct schools in remote areas must be transported long distances by horse or man). Thirdly, the existing institutional environment does not

allow rural communities to have direct control over tax money.

- (iv) Extension workers can sometimes play a useful part in getting local communities organized and in helping them acquire funds from agencies in control of tax money. They can also provide technical assistance once the actual projects begin. A few examples of both types of work were noted in this study.
- (v) A limitation to effective extension work of this sort is the lack of appropriate training among extension people. Extension workers trained in technical agriculture or home economics are not necessarily well-suited to working with community organizations. Training in the areas of sociology, the psychology of group action, the evaluation of public projects, the administration of public funds in Colombia, and the engineering aspects of roads, schools, etc. would be more appropriate.
- (vi) Because of the heavy emphasis on obtaining funds from the existing institutional complex, the economics of public projects has been largely overlooked. Extension agencies are forced to concentrate on promoting projects for which funds may be available rather than trying to assess the merits of different projects on a cost-benefit basis.
- (vii) It can be noted that some public projects may generate enough added income in the local communities to pay for themselves if they are appropriately financed. This could apply, for example, to improved roads which would facilitate the marketing of local products. However, the lack of an institutional structure to capture such incomes and apply them to debt repayment, together with lack of financing discourages such projects.
- (viii) Public projects which do not generate added incomes but instead produce services which are consumed by local people cannot readily be funded locally because they would take funds away from existing incomes which are mainly devoted to food, clothing, and shelter. The use of external funds for such projects does not necessarily imply income transfers as the funds may have originated in the community (e.g., via the coffee export levy). However, it could mean that public goods are over (or under) consumed or that public productive projects are overlooked in favour of public consumptive projects. This could

apply to medical, health or educational facilities, the lack of which forces families to leave rural communities and deters professional extension workers from living there.

- (ix) Because of the severely limiting character of physical conditions in some areas of rural Colombia, the pay-off to public expenditures relative to costs may be quite low relative to other rural areas. This essentially means that extension work directed at community organizations may best be concentrated in a few promising areas, at least until extension budgets expand. The better solution for some communities may be to encourage the residents to abandon them entirely.
- (x) Extension personnel who become involved in work with community organizations may readily find themselves in conflict with the government which provides the funds for their existence. For example, extension workers may find that, to assist local organizations, they must first help them obtain funds or power over funds now controlled by regional or national governments. Thus, it would not appear likely that Colombian extension agencies could readily develop policies to carry out programs designed to assist community organizations in more than a token fashion.

Other Outputs

Because of inadequacies in methodology, it was not possible in this study to perform any analysis regarding the effectiveness of extension agencies in promoting managerial changes in rural society. However, there appeared to be a feeling among extension workers, whom the author met during the course of the study, that this was a significant part of their work. Several expressed the opinion that they were giving their clients something more than just the ability to grow vegetable gardens, to make clothes, or to produce tomatoes more effectively. None, however, suggested that

special, distinct programs were required to do this. This raises the hypothesis that managerial changes can be achieved just as effectively as a by-product of promoting practical knowledge as they can by separate programs for this purpose. If this hypothesis is correct, program benefits from technique-oriented programs will always be greater than those from management-oriented programs because they include the benefits from managerial changes.

The possibility of agricultural extension assisting in the direction of rural people to occupations other than agriculture does not appear to have been given much attention by extension agencies in Colombia. There seems to have been an implicit, or sometimes explicit, intent to do exactly the opposite. This policy seems fallacious for several reasons. Firstly, there is much evidence to suggest that Colombia badly needs agricultural professionals with farm or at least rural backgrounds. While most rural youngsters in Colombia have little opportunity to get even a high school let alone a university education, perhaps it would be worthwhile to develop special programs to assist a few talented young people along these lines. Agricultural extension workers could perform a useful function in informing rural people about such a program and aiding in selecting the people involved.

Also, where extension workers find young people with particular talents which offer them the possibilities of better employment in other areas, there seems to be

little point in not pointing this out to the individuals concerned. As noted in Antioquia, young people who leave a rural community may be able to help both themselves and their families if they find gainful employment. The fact that Colombian cities have difficulty coping with the current influx of population from rural areas is certainly evidence of problems which must be faced and solved. However, if individuals are, in fact, better off by moving to the cities, then the individuals should be informed so they can move.

It should also be noted that the movement out of agriculture need not put pressures on the large cities if rural industry and outlying cities and towns are developed. Where rural people, particularly rural youth, are confronted by a decision to either stay in agriculture or leave, the possibility of local industrial employment may often be more attractive to them than that in a far-off city. If such industry develops in Colombia, agricultural extension workers can and should inform their clients about such alternatives.

The feedback of information on the success or failure of new ideas and the needs of rural people to the developers of technology does not appear to be well-developed in Colombia. There appear to be possibilities for improvement in this area. To test this hypothesis it might be useful for one agency to attempt to set up some

sort of procedure designed to achieve this very objective. If the costs and results of such a test procedure could be compared, and publicized, all agencies would have some basis for deciding whether or not it would be worth their while to do the same or try some modified version. Because of the existing structure of research and extension in Colombia, there appears to be little or no incentive for existing agencies to try to develop such a feedback mechanism. (This, of course, is not unique to Colombia.) Thus, such a test might be doomed to failure before it began.

Extension Management

The first major aspect of managerial efficiency mentioned in Chapter V was the location of the optimal proportion of a fixed budget to be allocated to management. Estimated General Supervision and Administration costs for CVC's Extension Service in 1967 totalled 699,077 pesos or 27.17 per cent of the total extension budget.¹⁹ These can, for the most part, be considered managerial costs for they were largely incurred in the making of decisions and acting to implement these. However, the costs of all field personnel time devoted to activities numbered 4, 5, 8, and 9 in Table 34 were also considered to be managerial costs. The portion of total field personnel costs accounted for by supervision and administration was deducted to avoid

¹⁹Of course, as the means of arriving at the estimate of Administration costs was somewhat arbitrary, its accuracy is open to question.

double-counting and the result was that an additional 278,333 pesos was added to managerial costs. Total managerial costs were therefore estimated at 977,410 pesos or 40.0 per cent of CVC's total 1967 extension budget. As noted in Chapter VIII, between 20 and 40 per cent of the total 1967 extension budget in Antioquia was allocated to managerial activities. As previous arguments did not develop any criteria by which one could conclude this was too high or too low, no comment can be made as to how close this might be to optimal. However, even though it can only be regarded as a rough estimate of the costs of performing managerial functions, it illustrates the relative importance of management as a user of resources and emphasizes the need for managerial efficiency.

In general, the management practices followed in both Antioquia and the CVC, while they did serve to keep expenditures within budget limitations and detect financial practices of an unorthodox or unacceptable nature for a government agency, they did not serve to provide management with information on the effectiveness of programs, personnel, and extension methods. Neither did they contribute much to acquainting decision-makers with new agricultural technology or extension methods. The reasons for these comments will become clearer in the following discussion which is structured in the form of the managerial process outlined in Chapter II.

Problem Definition

It would be a mistake to say that the extension personnel employed in the two agencies examined in this study did not appreciate the problems of the rural people with which they worked - they obviously did.²⁰ However, they appeared at times to have difficulty in translating their observations into clear statements of problems which they, as extension people, could resolve. Perhaps this was, in part, because so many of the difficulties facing their clientele could not be resolved by extension efforts alone.

The para-professionals (i.e., practicos and majoradoras) seemed to have just as good, if not better, appreciation for problems than the professionals in the two agencies studied. This appeared to be because of their greater familiarity with local conditions. Perhaps they had a better appreciation for the values of the rural families with which they worked than the professionals who were usually from an urban middle-class background and did not normally spend as much time on the farms.

The two agencies examined in this study exhibited two quite different approaches to problem definition. The extension service in Antioquia spent considerable time and effort constructing socio-economic studies directed at defining the problems of people in the communities in which they worked; the CVC on the other hand, relied on a much more

²⁰Some individuals were, of course, much more adept in this regard than others.

informal approach. The socio-economic studies did not, in the author's opinion, reveal much information which could not have been obtained by casual observation. It seemed obvious to even the casual observer, that housing, nutrition, clothing, health and education were poor for most of the families who were extension clients.

However, familiarity with the characteristics of rural people is only one part of the information which extension personnel need to define problems which they are capable of resolving. They also need to be aware of possible alternative ways of doing things. To a large extent, the extension workers in both agencies examined relied upon their formal training for this purpose.²¹ This training was rather heavily oriented to technical agriculture and thus, extension workers tended to think of problems in terms of low yields, poor animal health, excessive insect damage, etc. They did not appear to view low income as a problem which might, or might not, be resolved by techniques capable of increasing yields and improving animal health.

²¹There did not appear to be much reliance upon technology developed at Colombian research agencies. For example, the CVC offices at Palmira did not function as a very strong link with the I.C.A. experiment station as CVC employees did not regard the station as a good source of useful ideas. However, some interaction did exist and if I.C.A. had been conducting more applied research, CVC employees would have probably been aware of the results. This lack of interaction among researchers and extension people perhaps precluded feedback of farmer's problems to researchers. It is difficult to fault CVC for this as time spent consulting with researchers would have probably reduced the time they spent in the field and perhaps would not have improved their existing programs very greatly as there appeared to be little new technology being developed of relevance to their clients.

Collecting Information for Decisions

As this study has illustrated, the information required for assessing extension programs directed at resolving problems faced by rural people includes:

- (i) information on the potential pay-off to individual farms or households.
- (ii) information on the potential extent and rate at which adoption can be influenced.
- (iii) information on the costs of operating the program.

Information on the potential pay-off for individual farms or households should be available, in part, from the idea sources or the research people developing the technology. Of course, this may have to be adjusted for local conditions on the basis of experience and/or field trials. CVC's principal reliance was placed on the experiences of field personnel (either in the field or university) and CVC's own modest research program. Much of the technology being extended was adapted from standard North American texts. An exception to this was the fertilizer program which was based on Colombian research. A similar situation existed in Antioquia where the Coffee Federation was relied upon heavily as a source of ideas. While some cases were noted in which good technical information was available and had not been obtained, extension personnel in both agencies appeared to be doing a reasonably good job of collecting available information for estimating pay-offs to individual farms or households. The principal problem here was that this

information was in limited supply and often had not been tested under local conditions.

Information on the potential extent and rate at which adoption can be influenced should come from previous extension experiences, knowledge of the general characteristics of the region, and communications and/or sociological studies. Unfortunately, all of these sources appeared to be lacking in both the agencies studied. There was little record of previous extension programs to rely on. Extension records indicated assistance given - not assistance actually used by the families concerned.²² Thus, while extension workers themselves may have been able to recall previous successes and failures, this was not available for new members in the area. And, because of the high turnover of employees, most workers were relatively new. Knowledge of the regions in which they worked was limited by the short stay of extension workers in an area and the fact that many did not live in the region. As already noted, the extension service in Antioquia attempted to make up for this by the socio-economic studies, but these were more descriptive than diagnostic in nature. Other sociological and general statistical information (e.g., numbers and types of farms) was not generally available.

Information on the costs of operating programs should be available from extension cost records. While no

²²As noted earlier, there were substantial divergences between these two measures.

two programs are exactly the same, historical data can provide coefficients which will be useful for making program cost projections. Unfortunately, in both the CVC and the extension services in Antioquia, cost data by program was not readily available. The CVC had a very good accounting system for obtaining such information but this was not being used very effectively. While cost records were maintained according to program, costs were often not allocated to the programs to which they were attributable and wrong answers resulted. Furthermore, the program classification was not designed to distinguish programs with distinctly different benefit flows. Several alternative program classifications would have been useful - the one used by the author in this study is by no means the only or best one. The existing accounting system could have easily been adopted to a different classification and accurate allocation of costs. However, it would have been necessary for the extension service to define programs more precisely and require that all expenses (including field personnel time) be coded accordingly. In the author's opinion this would not have involved any more work or any different reporting forms than already existed. The accounting system maintained by the Department of Agriculture in Antioquia was not at all conducive to the collection of good cost information on programs. Thus, there was little that could be done in this regard in that region.

Analysis of Information Collected

The "analysis" portion of extension agency management requires the co-ordination of the three types of information mentioned earlier into some sort of decision criterion such as the benefit-cost ratio used in this study. This appeared to be particularly weak or entirely lacking in the two agencies examined in this study. Table 41 of Chapter VIII illustrates how the problem of comparing programs was approached in Antioquia. The results of this approach are not consistent with the results of the programs themselves (see Table 42). In general, weakness in the "analysis" area seemed attributable to lack of training and experience.

There was some evidence to suggest that the agronomos were weak in farm management, and this resulted in a poor ability to estimate the pay-offs to agricultural technology. An example of this problem was a study of the fertilizer program which was carried out at the end of the first semester. In this study, estimates of income changes were made but, for several reasons, many of these did not accurately represent incomes resulting from the program. Where test plots were not available on the participating farm, regional average yields were used in place of "control" yields. In most cases, these were not good estimates of what would have occurred on that farm in that semester without the new technology. It was noted in the study that some of the yield changes were partly due to bad weather and diseases.

But the question of the probable yield change due to the new technology under these conditions was overlooked. Furthermore, instead of calculating all added costs due to the new technology, only fertilizer costs were considered. As some farms were already using fertilizer and others also increased or decreased the use of other inputs (e.g., sprays or cultivation practices) as a result of recommendations made, fertilizer costs were not a good measure of the added costs incurred by adopting the new techniques. As a result of these combined errors, the estimates of income changes which were made in the study were not representative of the income changes due to the program. In some cases they were too low because negative yield changes were recorded and/or added costs were overestimated. In other cases they were too high because some increased costs had been overlooked and/or "control" yields were underestimated. Data from this project could have provided a more useful base for future advisory work if test plots had been maintained on all farms and the study had been directed at measuring average and extreme results of the new techniques. In the author's opinion, a farmer-oriented pamphlet summarizing the results as they happened would have been tremendously useful to corn and tomato growers in Valle. However, as it was, the study did not even provide a good basis for deciding whether or not the program was a success.

Similarly, there was room for improvement in the

analysis of the effects of risk on adoption of technology. For example, several of the programs examined in this study required farmers or housewives to purchase inputs for techniques which had required no cost outlay whatsoever under traditional technology. While the expected pay-off was in many cases quite attractive, there was often some element of risk involved. In some cases, the possibility existed of losing all of the initial outlay. Extension personnel, while not unconscious of this fact, appeared to exert little effort to try to allow for it. They did not, for example, attempt to develop programs where, if such a catastrophe occurred in the first trial, the participants who suffered could be compensated for their losses. In some cases, special consideration was given on an ex poste basis to unfortunate individuals. This included a second chance to purchase fertilizer on credit, or a second gift of seeds which had not produced well for the first time. However, there seemed to be more of an attempt to preserve the extension service's image on an ad hoc basis than a deliberate, planned program to allow for risk in the adoption of new technology.

The incorporation of potential rate and extent of diffusion into the analysis of extension programs appeared to be overlooked entirely. Most extension personnel did not seem to appreciate that viable knowledge could diffuse from early adopters and innovators to their more reluctant

neighbors. There definitely was an appreciation of the fact that some farmers and their families were more appropriate extension targets than others but the possibility of diffusion seemed to be forgotten or overlooked in assessing potential program benefits. The author attributed this to a lack of training in the social sciences coupled with a poor knowledge of composition of the agricultural industry in their regions. This latter difficulty could have been resolved, in part, by either better statistical information or resident extension agents who stayed long enough to become familiar with the area. However, the prospect of either of these becoming a reality is not bright.

Deficiencies were noted in the analysis of income distribution considerations in comparing programs. Cases were noted where extension personnel preferred to promote low pay-off technology to low-volume producers than to promote apparently high pay-off technology among high-volume producers - even though the gains in the latter case would likely have been passed on to consumers who also would fall into the low income category. Other instances were noted where unsuccessful attempts were made to promote techniques to poorer families who might well have learned of them just as rapidly from their more aggressive neighbors. However, extension personnel were very conscious of the importance of income distribution as a consideration in comparing programs and, in some instances, appeared to approach it quite objectively.

Decision-Making

Because of the lack of comprehensive analysis, decisions among programs were often made on the basis of single-minded reasoning which completely overlooked important factors. For example, in Valle, a decision was made to promote a nutrition program at the expense of a more comprehensive home economics program simply because the extension director felt malnutrition was the most serious problem in the area. Personal preferences and political considerations also appeared to influence decisions rather strongly.

One might hypothesize that extension decision-makers were adopting a mini-max strategy in that they tended to choose programs which would minimize the maximum possible threat to their own future if things did not go well. Such a strategy would result in relatively little experimentation with new extension methods and/or radically different technology. With the exception of the buffalo program in Buenaventura and the house-improvement program in Antioquia - which were really not extension programs anyway - this was, in fact, what was observed.

Nevertheless, decisions were made and, as some of the programs selected did appear to be quite successful, one could not conclude that changes in the decision-making criteria would necessarily have resulted in a better set of programs. However, one would tend to feel that, in the long run, a shift towards choosing among programs on the

basis of their expected benefit-cost ratios would produce better results.

Execution of Programs

As the author is not an extension specialist, he cannot pass judgement on how well programs were actually executed in the field. It seems safe to say, however, that this was somewhat variable because of the varying degrees of enthusiasm for essentially the same technology encountered among similar program participants. Better training in extension methods would have undoubtedly improved field work but few opportunities for training were available. Some extensionists seemed to be having difficulty communicating with their clients but, in the CVC, senior personnel appeared to be aware of this and were trying to resolve the problem. In Antioquia, senior personnel appeared to be more concerned with financial control than the qualities of field personnel.

The competence of extension personnel in the technology which they were promoting should have been good because of their heavy background in the plant and animal sciences. And there were many cases in which it was evident that the agronomo or practico knew a good deal about insects, sprays, cultural practices, etc. However, some of the comments made by program participants led one to believe that some extensionists did not possess this sort of knowledge.

The responsibilities of the extension directors

tended to centre around financial administration and ensuring that their staff were busy. Tactical decisions regarding programs were left up to field personnel unless they infringed on these two areas. This sometimes meant that programs would suffer because expenditures which were not originally anticipated arose in the middle of their operation.

Responsibility-Bearing

One of the difficulties in connection with the bearing of responsibility for extension work is that extension directors and those persons in authority over them often have little or no way of measuring the results of extension programs. How is it possible to hold a person or a group of people responsible for the results of their efforts when one does not know what these results are? In the two agencies studied this difficulty was bypassed by keeping track of numbers of farm visits, numbers of telephone calls, numbers of meetings, etc. This told senior personnel that their employees were busy but it is doubtful if it made them responsible for program results. Indeed, it may well have encouraged practices which were inconsistent with the bearing of responsibility.²³ It would appear to be possible, with little or no extra effort, for extension workers to keep records of individuals actually adopting technology and of the levels of benefits these individuals received therefrom.

²³The wide divergence between the numbers of people recorded as receiving assistance and those actually recalling and using the assistance in Antioquia is a case in point.

However, it would likely be necessary to devise some means of separating the assessment of programs from the assessment of individuals to ensure that unbiased records were actually kept.

The high turnover of personnel tended to complicate the issue of responsibility bearing. Because a number of employees were in their jobs for relatively short periods of time, it was difficult to assess the performance of the programs in which they were involved or hold them responsible for the results. It is difficult to say what might be done to alleviate this situation. If the high turnover is due to poorly qualified people being hired and then either being released or finding it best to leave, then the answer would be to develop better procedures for selecting the appropriate candidates prior to employment. If the high turnover is due to poor working conditions, then the answer is to improve the conditions. Both of these factors may, in fact, be involved and changes in both areas may be necessary.

The proliferation of extension agencies in Colombia further confuses the issue of who is responsible for what. If a single agency were responsible for extension work in a given region, governments could perhaps judge the performance of the agency on the aggregate trends in the region. However, when so many public and private concerns are involved in extension-type work, it is difficult to assess

where farmers are obtaining their information and for extension workers to plan programs which are not duplicating the efforts of other agencies. Nevertheless, there was noted, in both of the agencies studied, positive and successful efforts at trying to serve clients and areas not being covered by other agencies.

One of the aspects of bearing responsibility is the responsiveness of decision-makers to the success or failure of programs. In the CVC and in Antioquia, it was noted that programs were usually changed or discontinued when it became evident that they were not successful. Field workers were usually the primary force behind such changes as they were the first to notice whether their clients were using their assistance or not. However, there were a few programs which appeared to be relatively unsuccessful (e.g., the apiculture program in Valle) which had been operating for several years and had not been discontinued. Thus, some room for improvement appeared to exist in this area.

CHAPTER XI

SUMMARY AND CONCLUSIONS

This dissertation was directed at suggesting ways and means of improving extension effectiveness in Colombia within existing budget allotments. Both the conceptual and empirical investigation showed that many of the determinants of extension effectiveness are beyond the control of extension agencies themselves. In Colombia, factors limiting extension effectiveness include restricted availability of new, high pay-off technology - particularly for mini-fundistas, poorly-developed transportation and marketing systems in some rural areas, and an institutional framework which provides very limited access to critical resources (such as land and capital) for many rural people. As long as these limitations exist, extension agencies can not do a great deal to improve the economic well-being of their clients and there may be little point in greatly expanding their budget allotments as some other studies have suggested. Within existing budget allotments there are some possibilities for improving effectiveness which, if pursued, could allow existing agencies to perform a useful role until the factors mentioned above are altered.

The Conceptual Structure Used for Measuring the Effectiveness of Extension Programs

The conceptual structure used in this study can be usefully employed to measure¹ the effectiveness of extension programs directed at speeding up technical changes in farm firms and rural households. It does not perform particularly well in evaluating other types of extension programs. This structure involved:

- (i) estimating the costs of the extension program directed at promoting the technology,
- (ii) estimating the pay-off of the technology to individual firms or households,
- (iii) estimating the "shifts" in the adoption curves of the technology,
- (iv) calculating the benefit flow from the pay-off and "shift" estimates,
- (v) calculating with an appropriate interest rate, benefit-cost ratios from the above-mentioned benefit flows and cost estimates,
- (vi) ranking competing programs on the basis of the benefit-cost ratio.

To allow for income distribution effects, benefit flows for different income classes may have to be weighted differently. This thesis did not get beyond assigning such weights on an intuitive basis. Presumably such weights could be provided by extension directors. As the programs being evaluated were not large enough to influence supply curves for agricultural products and/or demand curves for goods purchased by the agricultural sector, no allowances

¹See Chapters IV and V for a detailed description of the measurement techniques used.

for price changes were made in estimating pay-offs.

To allow for uncertainty surrounding the above-mentioned estimates, sensitivity analyses were carried out. The cost, benefit flow and interest rate estimates were all examined in this fashion. However, in most cases only the benefit flow estimates needed to be varied. Fairly precise cost estimates were constructed and program rankings were typically rather insensitive to changes in the interest rate used. Thus, only variations in the benefit flow estimates had a major influence on program rankings.

Extension Programs Directed at Agricultural Producers

Agricultural extension programs examined in this study appeared to vary significantly in their effectiveness. Some, such as the Apiculture program of the CVC, appeared to be so ineffective that they should be curtailed entirely. Others, such as the CVC's Fertilizer program, appeared to be successful but could not be extended much beyond their existing level. It would appear that extension workers will have to be very selective about the programs they operate for Colombian farmers particularly in agencies such as the CVC and the Department of Agriculture in Antioquia. The principal agencies (e.g., the Coffee Federation and producer associations) appear to be already reaching many commercial farmers with much of the relevant technology now available for these producers. Much of this technology is either not relevant for smaller producers and minifundistas

or they will pick it up from their larger neighbors as soon as it is well-established. For example, tractor cultivation and harvesting techniques have no place on small holdings; modern livestock technology is not particularly relevant to farmers with one cow; improved corn varieties are not adapted to the climate of the mountains where most small-holders live; and small-holders in Valle del Cauca often learn from their larger neighbors about varieties and cultural practices which could be applied on their own farms. This latter process is facilitated by the minifundistas or their friends or relatives being employed on the larger farms. The high² costs per day of extension work and the limited number of farmers which can be serviced in a given amount of an extension worker's time often force the costs of providing technical agricultural assistance close to or beyond the relatively small gains that can be realized by minifundistas.

In order to improve the effectiveness of existing agricultural extension programs, extension workers could be exposed to more farm management training so that they would be more capable of assessing the pay-offs to individual farmers. A course in communications would perhaps serve to make them aware of the potential for the diffusion of technology. As the diffusion process provides a natural mechanism for amplifying the results of the extension worker's efforts, it is important for him to be aware of its existence and be able to assess diffusion possibilities for the technology he is promoting. However, for really significant

²High relative to home economics programs.

improvements, extension agencies must await the development of farmer-oriented research designed to produce technology which they can extend. In the meantime, they might try to do some on-the-farm research of their own with field trials and demonstrations of technology which appears to have potential for a given region but has not yet been tested. If they are to be successful in this work, they would require some training in scientific investigation and a better appreciation of the agricultural economy of the region in which they are working. Otherwise they may mistakenly test techniques with a fairly narrow potential. (The CVC's Buffalo program appeared to be an example of this.) If these sorts of training can be acquired, it would probably be worthwhile freeing some of the agronomos and (perhaps practicos as well) from their present duties for this purpose.

Home Economics Programs

Home economics programs examined in this study appeared to be rather successful and could perhaps be expanded at the expense of some of the technical agricultural programs. The reasons for their success seemed to centre around the low costs per day of extension work, the relatively large number of people which could be serviced in a year using the "club" technique, and the nature of the programs themselves. The programs focused on the necessities of life-food, clothing, health, and shelter – and had something to offer most club members in each of these four areas. The programs appear to be applicable to a much larger group of rural families than

have been reached already and should also be relevant for some urban families as well. This does not necessarily call for a large increase in resources devoted to this program however, as the programs can service different communities on a rotating basis. If a club were operated in each neighborhood once every four or five years, this might be adequate to bring many families up-to-date with new techniques applicable to them. Other families would then likely adopt what they could from their neighbors. Such programs should be directed at families earning incomes of approximately 80 to 400 pesos (1967) per week. Lower income families would likely have little interest or capability of applying the acquired knowledge; higher income families would probably already know much of the material presented or would not wish to use some of the techniques suggested.

The Home economics programs could be improved if there were some subject matter specialists available to concentrate on developing techniques to make more out of current income levels (e.g., new ways of preparing foods and reducing wastage, better ways of making and repairing clothes, up-dating field workers on matters in the health and hygiene area, etc.). In the author's opinion this could be done on the basis of research which has already been carried out in various parts of the world. Channeling some of the extension budgets away from low pay-off agricultural extension programs to the areas of providing home economics subject matter

specialists and more on-the-job training for field workers in these programs would appear to be appropriate. Programs which are not educational in nature (e.g., the house building and repairing program in Antioquia) could also be curtailed to provide some resources for this purpose. Home economists could also extend their role slightly in some areas to handle gardening. (They were already doing this in some instances.) This would allow freeing practicos and agronomos for work with commercial agricultural producers³ as, in many cases, vegetable gardens were the only really successful aspect of their work with minifundistas. In order to achieve such changes, it would probably be necessary to teach home economics workers to drive and provide them with their own vehicles. Resources for this purpose would have to come from the above-mentioned adjustments.

Community Organizations

This investigation showed that, in some instances, agricultural extension workers can function as the catalyst to get community projects (e.g., roads, schools, community water services, etc.) rolling and completed. When this is possible and the projects are worthwhile, it would appear advisable for them to do so. Indeed, in some cases, such projects would likely have a high pay-off because of the

³ Some of the existing agronomos could function as subject matter specialists for home economics workers in the gardening area. This would involve providing them with training sessions and searching out ideas and techniques which they could use in the field.

scarcity of rural infrastructure in Colombia. However, care needs to be taken to ensure that worthwhile projects are chosen. (Schools, for example, are of little use if teachers are not available.) In general, it seems advisable to limit the involvement of extension people in community action work to communities where additions of roads, schools, etc. can convert the area into a viable economic one, capable of competing with other parts of the region or country. It seems inappropriate to direct these activities at communities where soils, climate, and other natural resources are so poor that the communities will eventually disappear because of out migration.

Existing extension workers are at a disadvantage in trying to work with community organizations. They do not usually have any training for such endeavours and rely mainly on experience and intuition. It would seem advisable for agencies such as the CVC or the Department of Agriculture of Antioquia to have a few members of their staff specialize in this work. They could then acquire the necessary training in the evaluation of public projects, the technical aspects of getting the job done (e.g., engineering and construction), the sociology of dealing with groups of people, and the legal and institutional requirements of getting public projects accomplished in Colombia. These few specialists could then focus on "prime target areas" (as suggested above) on a rotating basis to get the job done.

Managerial Capacity of Rural People

Extension programs directed at changing the managerial capacity of rural people are much more difficult to evaluate than those directed at speeding up technical changes. However, from a conceptual point of view, they can be examined by considering the sorts of technical changes which the intended managerial changes might influence. As much of Colombian agriculture is oriented to crop production, it would appear that one set of managerial changes which might be extremely useful would be an improved general knowledge of crop-related phenomena such as soils, entymology, climate, plant characteristics, plant diseases, etc. A course such as this could be set up for Colombia as a whole and extension workers in the various parts of the country could use it when they found an opportunity to do so.

However, in general, it may be very difficult for extension workers to bring about managerial changes in rural people unless they also have something of immediate practical use to offer. Thus, it may be best for extension agencies to leave this area of responsibility to the public school system. Perhaps courses such as the one suggested above could be offered by extension people in rural schools for both children and adults.

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APPENDICES

APPENDIX A

THE RATIONALE FOR SELECTION OF THE DECISION RULE USED IN THIS STUDY

There are four rules which are often used for selecting among projects which produce a flow of benefits over time as a result of capital expenditures made in one or more periods.¹ These thereby satisfy the third criterion mentioned in Chapter V. These rules do not apply to projects which are interdependent or mutually-exclusive.² However, they are capable of dealing with a number of discrete (independent) alternative programs. Where only one time period is involved, they can be compared with the marginal productivity rules supplied by the theory of the firm and, under such circumstances, they are equivalent to these. They obviate the necessity of estimating social costs as they use only data on extension program expenditures under the assumption that these are proportional in the same way to social costs for all programs. Finally, they require no

¹A. R. Prest, and R. Turvey, "Cost-Benefit Analysis: A Survey", The Economic Journal, December, 1965, p. 703.

²A project is interdependent with another project if costs and/or benefit flows from either one of the projects vary with the nature or the level of the other. Two projects are mutually-exclusive if the occurrence of one precludes the occurrence of the other. Where interdependent projects do arise it is possible to evaluate them with the rules discussed here only by combining them and considering them as one project.

data on physical input/output relationships providing expenditures and benefits in various periods can be estimated. They apply only where a starting date is given for each project or program although the terminating date of the programs may be infinite. These rules are:³

(a) The Present-Value Rule

Adopt any project for which the associated stream of net benefits or net receipts, discounted at the 'appropriate' rate of interest is greater than zero.⁴

$$(1) \text{ NPV} = -C(0) + \frac{B(1)}{1+i} + \frac{B(2)}{(1+i)^2} + \frac{B(n)}{(1+i)^n}$$

(b) The Internal-Rate-of-Return Rule

Adopt any project for which the internal rate of return is greater than the 'appropriate' rate of interest.⁵

$$(2) 0 = -C(0) + \frac{B(1)}{(1+r)} + \frac{B(2)}{(1+r)^2} + \dots + \frac{B(n)}{(1+r)^n}$$

(c) The Annual-Net-Benefits Rule

Adopt any project for which the annual net benefit is greater than zero when computed at the 'appropriate' rate of interest.⁶

$$(3) \frac{S}{1+i} + \dots + \frac{S}{(1+i)^n} = -C(0) + \frac{B(1)}{1+i} + \dots + \frac{B(n)}{(1+i)^n}$$

³The formulae used in all of these rules are often only approximations to the "true" relationship because they assume that $B(t)$ has no value until the end of period t and that NPV and $C(0)$ occur at the beginning of period one. However, these approximations can be made arbitrarily small by considering shorter periods when the period being used is suspected of producing significant errors.

⁴J. Hirshleifer, James C. Haven and Jerome W. Milliman, Water Supply, Technology, and Policy, (Chicago: The University of Chicago Press, 1963), p. 152. In this situation the

(d) The Benefit-Cost-Ratio Rule

Select all projects where the ratio of the present value of total benefits to the present value of total costs exceeds unity.⁷

$$(4) \frac{\frac{b(1)}{1+i} + \dots + \frac{b(n)}{(1+i)^n}}{C(0) + \frac{C(1)}{1+i} + \dots + \frac{C(n)}{(1+i)^n}} = \frac{PV_b}{PV_c}$$

where NPV = net present value at t=0
 B(t) = net benefits in period t (may be negative)
 i = the "appropriate" rate of interest
 C(0) = the initial capital outlay at t=0
 c(t) = operating costs in period t⁸
 b(t) = gross benefits in period t
 S = annual (periodic) net benefit
 r = the internal rate of return

Simplifications for the above rules can be constructed under certain circumstances. For example, if B(t) is constant for all t=1,..., n and if n is infinite, $NPV = \frac{B(t)}{i} - C(0)$. Also, $NPV = PV_c - PV_b$ under all circumstances. Finally,

$$S = NPV \left/ \left[\frac{(1+i)^n - 1}{i(1+i)^n} \right] \right. \text{ and the denominator is often readily}$$

available from standard interest tables.

"appropriate" rate of interest would be determined by the effectiveness of other government programs.

⁵Op. cit., p. 154.

⁶J. Hirshleifer, et. al. op. cit., p. 155. This might also be stated as: "Select all projects where the constant annuity with the same present value as that of benefits exceeds the constant annuity (of the same duration) with the same present value as that of costs." See Prest and Turvey, op. cit., p. 703.

⁷Prest and Turvey, op. cit., p. 703.

⁸c(t) does not include interest, depreciation, or any form of debt amortization.

All of the four rules assume that the "appropriate" rate of interest (or the internal rate of return) is the same for all periods. Should this not be the case, all except the internal-rate-of-return rule could be modified using different rates in different periods, $i(1), \dots, i(n)$, although calculations would be more complicated.

Also, all of the above four rules are variations of the same basic concept and will often discriminate between acceptable and unacceptable projects in exactly the same way. Rules (a) and (c) are equivalent in this regard. As $B(t) = b(t) - c(t)$, rule (d) is also equivalent to rule (a). However, the exact value of the PV_b/PV_c ratio will vary depending on how the $b(t)$ and $c(t)$ are defined even though the concept of $B(t)$ remains unchanged.⁹ (This, of course, requires that the "error" in b_j would have to equal the "error" in c_j .) These definitions sometimes present serious problems and it is unwise to use the PV_b/PV_c ratio for ranking several projects for this reason. However, no error will occur if the selection

⁹For example, suppose a project has the following characteristics:

$$\begin{array}{lll} C(0) = 1000 & n = 20 & i = .05 \\ b(t) = 105 & c(t) = 20 & \end{array}$$

where $b(t)$ is defined as "sales" less "marketing costs" and $c(t)$ is defined as "other annual costs." If $b(t)$ were defined as "sales" and $c(t)$ was defined as "marketing costs" plus "other annual costs", the project might appear as:

$$\begin{array}{lll} C(0) = 1000 & n = 20 & i = .05 \\ b(t) = 130 & c(t) = 45 & \end{array}$$

In the first case, $PV_b/PV_c = 1.0595$ and in the second, $PV_b/PV_c = 1.0380$. In both cases, $B(t)$ is the same and $NPV = 59.27$.

rule is followed exactly. (That is to say, all projects with $PV_b/PV_c > 1$ will still have $PV_b/PV_c > 1$ no matter how their $b(t)$ and $c(t)$ are defined providing $B(t)$ is always defined in the same way.)

Rule (b) is equivalent to the rule (a) if a unique positive solution exists for r . That is, it will lead to the same conclusions regarding the selection or rejection of projects. However, it is not always the case that a unique positive solution¹⁰ can be found for r and, under such circumstances, it is often ambiguous and cannot be used. Even if a unique positive solution is found, the interpretation of the root requires care as, if $0 < 1+r < 1$, then the rate of return is negative even though the root itself is positive.

The possibility of there not being a unique positive solution for r points up an interesting relationship among the four rules. Actually, there are many cases where a

¹⁰This problem can be more fully appreciated by recognizing that (1) is actually an n th degree polynomial in $(1+i)$ and that, when NPV is set equal to zero to give equation (2), up to n values of $(1+i)$ can be found which satisfy the resulting equation. The variable i is then the internal-rate-of-return, r . Consider the usual case where $C(0) > 0$. The roots of equation (2) can be positive, negative, or complex. There are always n of them but often several are identical resulting in less than n values of $(1+i)$ for practical purposes. Imaginary roots can be ignored because they have no useful economic meaning. (In the case where all roots are imaginary there is no real interest rate for which NPV equals zero and the project could be readily detected as being worthwhile or not without performing any calculation. A series of benefit periods with no costs would be an example). A negative root would imply a rate of return of less than -100% (i.e. less than no benefits) and is also of little practical interest. Multiple positive roots merely imply that there are multiple values of the interest rate which would make $NPV = 0$. Thus, there appear to be multiple "rates-of-return" and the rule is ambiguous.

unique positive root does exist. Where $(1+i)$ is positive, $NPV = f(1+i)$ as specified by equation (1) may be either positive, zero, or negative, depending on the parameters $C(0)$, $B(t)$, and the value of $(1+i)$. Now $NPV \gtrless 0$ as:

$$(5) \quad C(0) \gtrless \frac{B(1)}{1+i} + \frac{B(2)}{(1+i)^2} + \dots + \frac{B(n)}{(1+i)^n}$$

Thus, where $C(0)$ is positive, the expression on the right hand side of (5) determines whether NPV can be zero more than once in any given problem. If the right hand side is positive for all $(1+i) > 0$, NPV can be zero only once (i.e. the polynomial can have only one positive real root). This means that when examining a simple initial investment which produces a strictly positive benefit flow, the problem of several positive roots cannot arise. It is also obvious that as long as several periods of only net costs are followed by periods of net benefits, the problem cannot arise. In other words, once an initial investment has been made (either in one or more periods), if the resultant net income stream is always positive, a unique answer exists.¹¹ As phenomena of interest to economic analysts can often be expected to exhibit this property, there seems little reason to avoid the "internal-rate-of-return" rule in such cases. Indeed, it should be

¹¹For example, if a project is described as:

$$C(0) = 10 \quad B(1) = 50 \quad B(2) = -60$$

then $0 = -10 + \frac{50}{1+r} - \frac{60}{(1+r)^2}$ and $r = 1$, $r = 2$, are solutions.

This implies that the net present value, NPV, is only positive for rates of return between 100 per cent and 200 per cent or,

noted that where more than one positive real root exists for the polynomial in $(1+i)$, the other rules are also affected¹² and cannot be considered as means of avoiding the ambiguity problem presented by the "internal-rate-of-return" rule unless the interest rate is known rather precisely. (The level of precision required can be determined by examining the relationship between NPV and $(1+i)$ for each project.)

However, even if the interest rate is known rather precisely the implicit assumption¹³ of no constraints being operative is inappropriate for this study. The difference between the constrained and unconstrained cases may be appreciated by considering Figure A-1. In the unconstrained case, it is merely necessary to decide which projects fall above or below some cut-off line determined by the return on funds in other uses. Thus, in the example shown, projects G, B, I, D, A, E, and F would be accepted and sufficient funds would be made available to operate these. In the constrained

in other words, present value would be zero if the rate of return was 100 per cent or if it was 200 per cent. However, this arises because the income stream became negative after being positive. Had the example been changed to:

$$C(0) = 50 \quad B(1) = 10 \quad B(2) = 60$$

then $0 = -50 + \frac{10}{1+r} + \frac{60}{(1+r)^2}$ and $r = .2$ is the only relevant answer. Note that the roots are 1.2 and -1 in the second case.

¹²Where more than one positive real root exists for the polynomial in $(1+i)$ it would be possible to find a project acceptable ($NPV > 0$) at an interest rate of say 6 per cent, and unacceptable at a slightly lower rate.

¹³As the four rules cited earlier all suggest operating all projects which meet the given criterion, it is implicit that the total budget can be varied.

case, it is necessary to rank projects so that they may be selected in decreasing order of performance until the total budget is exhausted.¹⁴ In the example shown in Figure A-1, the appropriate ranking would be G, B, I, D, A, E, F, C, J, K, H. If the budget was fixed at the level shown, only G, B, I, D, A, and E would be operated.

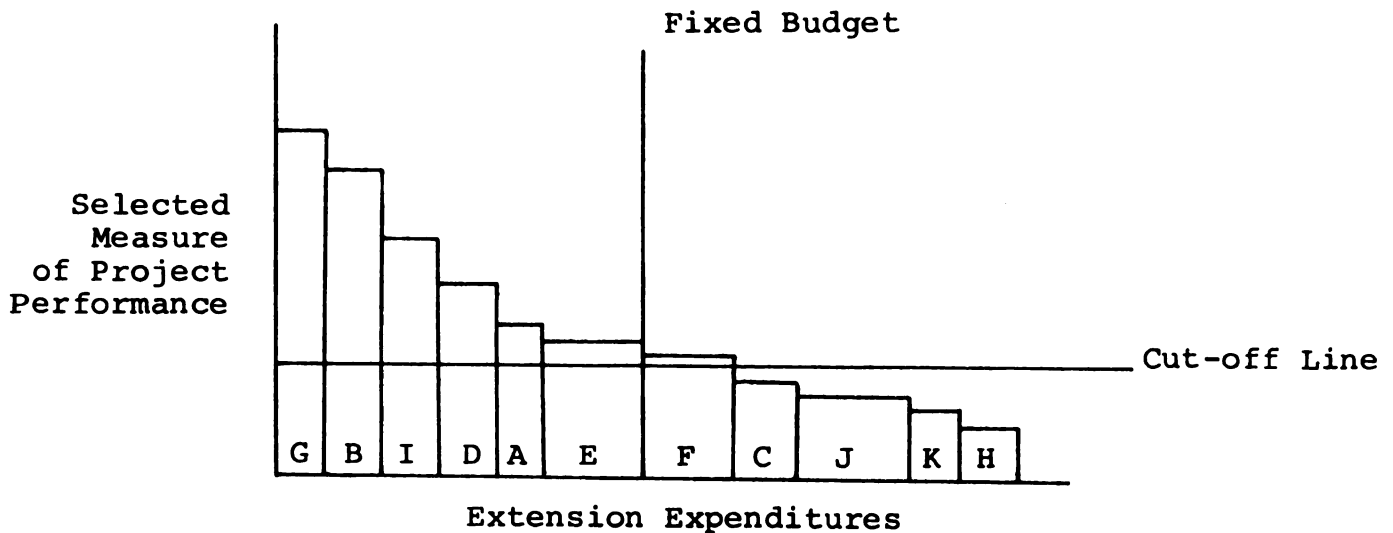


Figure A-1:- Illustration of difference in project selection procedures between the constrained and unconstrained case.

The four rules previously discussed are sometimes regarded as useful for the purpose of ranking projects. In previous discussion it has been established that the use of the PV_b/PV_c ratio can readily lead to inconsistent rankings

¹⁴Of course, this carries the implicit assumption that there are more projects under consideration than could be carried out by the available funds. If this is not so, one merely has to operate all projects being considered and no ranking procedure is necessary.

depending on how benefits and costs are distinguished. As this can be avoided by using other criteria, the PVB/PVC ratio can be discarded as a possible criterion for ranking projects. The "annual-net-benefits" rule can also be discarded because its only advantage lies in the form in which results are presented. Thus, only the "present-value" rule and the "internal-rate-of-return" rule need to be considered.

The "present-value" rule cannot be applied as previously stated but a suitably modified version might be: "Rank all projects according to NPV as calculated by (1) and select from the top of the list until the total budget is exhausted". However, as it is possible for projects with low initial capital cost $C(0)$ to have the same NPV as those with high initial capital costs even though annual net benefits are all positive, this would appear to be unacceptable. This problem can be circumvented by ranking projects according to $PVB/C(0)$ [where $PVB = NPV + C(0)$]¹⁵ which is essentially a measure of returns per unit of capital. If projects are selected according to this method of ranking, no higher returns to any unit of capital will be possible and total returns to the fixed budget will be maximized. For cases in which annual net benefits are not all positive, the rule can be extended to PVB/PVC where PVB is the present value of benefits from all

¹⁵If one allows for the possibility of net benefits being negative (i.e. net costs) in more than the initial period, this generalizes to give the formula cited in Chapter V.

net benefit periods and PVC is the present value of costs from all net cost periods.¹⁶ It will be noted that this criterion appears to break down if $PVC = 0$ as the ratio then goes to infinity. However, this is only an appropriate reflexion of reality as such a project should be chosen before others with finite PVB/PVC ratios. The PVB/PVC ratio does not discriminate between two projects with $PVC = 0$, although there may be an obvious choice on some other basis. In practice it may be advisable to set some lower limit on the performance of marginal projects to ensure that funds are not spent if their return is low in relation to supposed returns in other uses. In such a case the same ranking procedure would still apply except that in some periods the total budget would not be exhausted. If this was not the case, projects with PVB/PVC ratios less than unity or even less than zero could be operated. (In order to incorporate the welfare loss of taxation in the lower limit, only projects with PVB/PVC ratios somewhat greater than unity should be operated.)

¹⁶It will be noted that this is not exactly the same as the "benefit-cost" ratio defined earlier. It circumvents the problem of obtaining different answers depending on how benefits and costs are defined. It implicitly assumes, however, that the total size of outlay in any period is unimportant and therefore only net benefits or outlay is relevant. (Net outlay at time zero is, of course, given by $C(0)$.) If this assumption is not correct, another specification of the problem is required for all criteria discussed here.

To calculate the PVB/PVC ratio, the "appropriate" interest rate must be found and this is usually a difficult task. As noted previously, NPV (and therefore PVB) can, under certain circumstances, increase with an increase in the interest rate; thus, project rankings are by no means invariant to the interest rate selected. In fact, even when PVB is a monotonic function of interest rate, project rankings can vary with the interest rate selected although the possibilities for changes in ranking are less in this case. The problem illustrated in Figure A-2. Thus, as in the unconstrained case, the "appropriate" rate of interest must be known reasonably precisely.

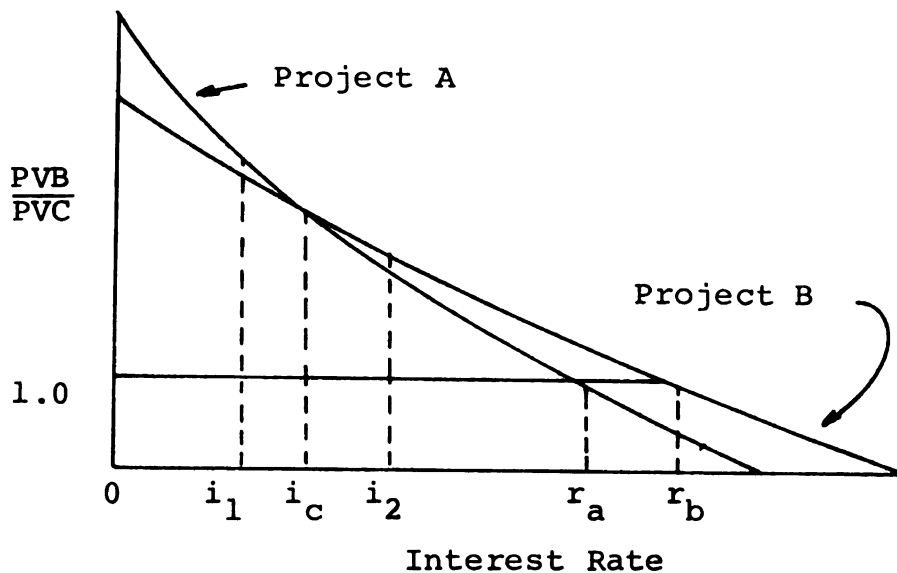


Figure A-2:- Comparison of PVB/PVC ratios as functions of interest rate for two projects.

The internal rate of return offers a possible alternative to this dilemma, when a unique positive solution for $(1+i)$ exists. Here the criterion might be stated as follows: Rank all projects according to r as calculated in (2) and

select from the top of the list until the total budget is exhausted, or some minimum r is encountered. This ranking will be unique and, as it does not utilize an interest rate, it does not depend on knowledge of the "appropriate" rate of interest. Unfortunately, it can lead to conclusions which are inconsistent with the modified "present-value" rule. The problem can be understood clearly by examining Figure A-2 again. The points r_a and r_b represent the calculated internal rates of return for Projects A and B respectively. The resultant ranking would be inconsistent with the modified "present-value" rule if the appropriate interest rate was, in fact, i_1 as then $\frac{(PVB)}{(PVC)} A > \frac{(PVB)}{(PVC)} B$. In fact, it would be inconsistent with the "present-value" rule for any "true" interest rate below i_c as, at this rate project rankings reverse. The problem arises because the "internal-rate-of-return" rule compares projects by setting $NPV = 0$ when, in reality, one is interested in operating projects with $NPV > 0$ and this is how they ought to be compared. Another way of looking at it is to recall that the basic problem is one of comparing different benefit streams over time in relation to their respective costs. This usually cannot be done unless one has a method of appropriately weighting the benefits produced at different times. The appropriate weights are provided by the interest rate.

It thus seems relevant to postulate the question, "Why are the weights that apply to benefits occurring in different periods determined once an interest rate is known?" The answer to this appears to be that it is implicitly assumed that, if the receivers of the benefits in any period would prefer to have them in another, they can simply exchange them in the market by saving or dissaving. The market prices at which they can be exchanged are defined by the rate of interest. For example, $\$x$ today can be exchanged for $\$x \cdot (1+i)^t$ t periods from now. But is this assumption strictly correct for public decisions? If benefits from public projects accrue to individuals in society and these individuals can, in fact, make such an exchange if they desire to do so,¹⁷ it would appear that the assumption is correct. It is sometimes argued that this reasoning breaks down when one generation must invest so that another may reap the benefits. However, this is not a problem of determining the appropriate exchange rate over time - it is one of making interpersonal utility comparisons. Thus, there does appear to be a good reason for using an interest rate to reduce benefits occurring in different periods to a common denominator, namely present value.

¹⁷If they cannot make such an exchange at the selected rate then, it would seem likely that they could make an exchange at some rate and the problem revolves around finding the "appropriate" rate. This problem can become quite complicated if different beneficiaries face different rates and/or the rates for saving differ from those for dissaving.

APPENDIX B

**SUPPLEMENTARY DATA ON THE 1967 OPERATIONS
OF C.V.C.'S EXTENSION SERVICE**

Table B-1.--Breakdown of the Costs of Operating the Extension Service of the C.V.C. for the period April 1, 1967 to March 31, 1968.^a

Description of Cost Items	General Supervision	Livestock Program	Apiculture Program	Fertilizer & Farm Planning Program	Home Economics Assistance	Boys' 4-H Club	Pacific Coast Programs	Total
<u>Personnel Costs</u>								
Wages and Salaries	127,817	177,291	58,970	218,295	136,843	115,512	162,293	997,021
Fringe Benefits	69,021	95,737	31,844	117,880	73,896	61,393	86,291	536,062
Professional Fees	---	2,050	---	---	---	---	22,128	24,178
Sub Total	196,838	275,078	90,814	336,175	210,739	176,905	270,712	1,557,261
<u>General Expenses</u>								
Materials and Supplies	8,810	9,427	2,224	3,282	5,407	7,466	53,806	90,422
Travelling Expenses	124,676	86,563	90,564	102,630	42,195	79,518	62,521	588,664
Office Rental	3,217	4,200	---	---	---	---	6,933	14,350
Maintenance and Upkeep of Offices and Equipment	3,272	200	470	777	---	---	4,866	9,585
Miscellaneous	4,784	4,721	2,730	2,493	864	688	20,087	36,367
Sub Total	144,759	105,111	95,988	109,182	48,466	87,672	148,213	739,391
Administration	537,330 ^b	---	---	---	---	---	---	537,330
TOTAL	878,927	380,189	186,802	445,357	259,205	264,577	418,925	2,833,982

^aSupplied by the C.V.C. Accounting Department.

^b Administration costs for the first quarter of 1968 were estimated by using the average of the three preceding quarters.

Table B-2.--Breakdown of Fringe Benefits (Prestaciones Sociales) for C.V.C. in 1967.

Item	% of Basic Salary
Bonuses (Primas)	8
Vacations (<u>Vacaciones</u>)	7
Termination Bonus (<u>Cesantias</u>)	14
Family Allowance and SENA (<u>Subsidio Familiar y SENA</u>)	6
Medical (<u>Servicio Medico y Drogas</u>)	7
Other Payments (<u>Prestaciones Extralegales</u>)	12
	54

Table B-3.--Costs of Operating C.V.C. Vehicles in 1967.^a

Item	Colombian Pesos	%
Gasoline and Oil	368,140	27.1
Tires and Batteries	130,416	9.6
Other Materials	28,277	2.1
Transportation Services ^b	5,568	0.4
Communication Services ^c	1,024	0.1
Garage Rentals	26,481	1.9
Contracted Repairs	363,566	26.7
Insurance	40,380	3.0
Replacement Parts	296,054	21.8
Washing and Greasing	30,500	2.2
Miscellaneous Expenses	5,839	0.4
Depreciation ^d	64,068	4.7
Total Costs (excluding chauffers) ^e	1,360,313	100.0
Average Costs per kilometer ^f	0.6088	

^a Provided by Accounting Division, C.V.C.; includes all C.V.C. vehicles.

^b Includes towing charges, taxi and bus services in case of breakdown.

^c Includes communication services related to breakdowns.

^d Calculated on the straight line basis using a rate of 10 per cent per annum.

^e Costs of chauffers are included in direct project costs.

^f Based on 2,234,371 total kilometers.

Table B-4.--Program Costs and Number of Days of Field Personnel Time by Program for the Extension Service of the C.V.C. during the period April 1, 1967 to March 31, 1968.

Program	Number of Days of Personnel Time				C Program Costs	[^] C Expected ^a Costs	[^] C-C
	x ₁ Agronomos and Veterinarios	x ₂ Mejoradoras de Hogar	x ₃ Practicos or Asistentes	x ₄ Obreros			
Livestock	855 ^b	---	---	---	376,330	370,462	5,868
Apiculture	229	---	230	---	208,129	160,109	48,020
Fertilizer and Farm Planning	341	---	16	---	138,140	151,987	-13,847
Home Economics Assistance	162	1,862 ^c	217 ^d	---	535,510	539,288	-3,778
Boys' 4-H Clubs	399	36	1,055 ^e	---	450,074	460,121	-10,047
Pacific Coast Programs	514	---	---	1,200	453,312	456,591	-3,279
Fruits	236	---	---	---	98,478	102,256	-3,778
Other Programs	618	---	245	---	313,820	332,630	-18,810
All Programs	3,354	1,898	1,763	1,200	2,573,973	2,573,444	349

^aCalculated from the following regression equation: $\hat{c} = 433.29x_1 + 221.08x_2 + 264.72x_3 + 194.90x_4$

$$R^2 = 0.978$$

^bIncludes one agricultural economist for 57 days.

^cIncludes one home economist for 183 days.

^dIncludes a movie projector operator for 111 days.

^eIncludes a movie projector operator for 118 days.

Table B-5.--Results of C.V.C.'s 1967 Fertilizer Program with Tomato Producers.

Period	Farm No.	Total Yield Change (boxes)	Average Price per Box (pesos)	Change in Gross Income (pesos)	Total Change in Costs (pesos)	Change in Net Income	Number of Plazas	Change in Net Income per Plaza	Number of Semesters Sooner Than Otherwise	Tech-niques Learned but not Adopted?	Number of Producers Learning from Participants		
											Same Semester	Semester Following	Two Semesters Later
Semester #1	P- 1	+50	15	+750	+470	+280	0.85	+329	4	No	-	-	2
	P- 2	+85	11	+935	-230	+1,165	0.35	+3,329	2	No	-	-	-
	P- 3	+127	14	+1,778	+60	+1,718	1.00	+1,718	2	No	1	3	-
	P- 4	+50	20	+1,000	+300	+700	0.75	+933	1	No	2	3	-
	P- 5	+80	24	+1,920	+754	+1,166	1.50	+777	2	No	1	2	-
	P- 6	+90	14	+1,260	+1,200	+60	1.29	+47	4	Yes	-	-	-
	P- 7	+12	14	+168	-	+168	0.38	+442	4	Yes	-	-	-
Totals		+494	112	+7,811	+2,554	+5,257	6.12	N/A	19	N/A	4	8	3
Averages		+70.6	16	+1,116	+365	+751	0.87	+859	2.71	N/A	0.57	1.14	0.43
Semester #2	P- 1	+218	15	+3,270	+470	+2,800	0.85	+3,294	Already considered in Semester #1 above.				
	P- 2	+85	11	+935	-230	+1,165	0.35	+3,329					
	P- 5	+400	24	+9,600	+777	+8,823	0.71	+12,427					
	P- 8	+60	20	+1,200	-210	+1,410	1.00	+1,410	1	No	-	-	3
	P- 9	-	20	-	-	-	2.00	-	4	No	-	-	-
	P-10	+150	7	+1,050	+770	+280	3.00	+93	2	No	-	4	-
	P-11	-	20	-	+1,170	-1,170	2.00	-585	4	Yes	-	1	-
	P-12	-	12	-	+580	-580	1.00	-580	4	No	-	3	-
	P-13	+50	15	+750	+650	+100	0.60	+167	4	No	-	-	-
	P-14	-	14	-	+300	-300	0.23	-1,304	4	No	-	-	-
	P-15	-	10	-	+480	-480	0.60	-800	4	No	-	-	-
	R- 1	+772	12	+9,264	-	+9,264	1.00	+9,264	2	No	-	-	-
	R- 2	+1,860	12	+22,320	-500	+22,820	4.00	+5,705	6	No	-	-	-
Totals	R- 3	-	12	-	+300	-300	0.50	-600	4	No	-	-	-
	R- 4	+214	12	+2,568	-300	+2,868	2.90	+989	2	No	-	-	-
	Averages	+3,809	216	+50,957	+4,257	+46,700	20.74	N/A	41	N/A	-	8	3
		+253.9	14.4	+3,397	+284	+3,113	1.38	+2,252	3.42	N/A	-	0.67	0.25

Table B-6.--Results of C.V.C.'s 1967 Fertilizer Program with Corn Producers.

Period	Farm No.	Total Yield Change (kilos)	Average Price per kilo (pesos)	Change in Gross Income (pesos)	Total Change in Costs (pesos)	Change in Net Income (pesos)	Number of Plazas	Change in Net Income per Plaza
Semester #1	P-16	-	1.10	-	+1,320	-1,320	2.5	-528
	P-17	+550	1.07	+589	+1,230	-641	3.0	-217
	P-18	+192	1.26	+242	+372	-130	1.5	-87
	P-19	+3,412	1.26	+4,299	+2,376	+1,923	4.0	+481
	P-20	-	-	-	+2,400	-2,400	4.0	-600
	P-21	+1,500	1.07	+1,605	+1,230	+375	2.0	+188
	P-22	+1,005	1.20	+1,206	-	+1,206	2.34	+515
	P-23	-	-	-	+756	-756	0.75	-101
	P-24	-	-	-	+1,200	-1,200	2.0	-600
	R- 5	+2,000	1.20	+2,400	+2,100	+300	4.0	+75
	R- 6	+6,500	1.20	+7,800	+3,730	+4,070	7.8	+522
	R- 7	-	1.26	-	-117	+117	7.8	+15
	R- 8	+1,300	1.20	+1,560	+747	+813	1.5	+542
	R- 9	-	1.20	-	-3,730	+3,730	7.8	+478
Totals		+16,459	13.02	+19,701	+13,614	+6,087	46.99	N/A
Averages		+1,176		+1,407	+972	+435	3.36	+130
Semester #2	P-25	+4,500	1.24	+5,580	+3,500	+2,080	8.0	+260
	P-26	-	1. ?	-	+3,480	-3,480	7.0	-497
	P-27	-	?	-	-	-	1.5	-
	R-10	-	1.36	-	-4,918	+4,918	7.8	+631
	R-11	-	1.33	-	-400	+400	7.8	+51
	R-12	+977	1.36	+1,329	+546	+783	1.02	+768
	R-13	+106	1.33	+141	+300	-159	1.93	-82
	R-14	+695	1.20	+834	-300	+1,134	7.8	+145
	R-15	+300	1.20	+360	-200	+560	1.5	+373
	Totals	+6,578		+8,244	+2,008	+6,236	44.35	N/A
	Averages	+731		+916	+223	+693	4.93	+141

Table B-7. --Summary of Club Membership Statistics for Program #4, Home Economics Assistance and Program #5, Boys' 4-H Clubs.

Program	Type of Statistic		All Locations	Rold-anillo	Tulua	Palmira	Cali	Buenaventura
Home Economics Assistance	Number of Clubs		45.7	11	5	15.7	6	8
	Number of Club Members	Beginning	370	135	32	98	27	78
		Ending	387	136	24	103	46	78
	Average		378.5	135.50	28	100.5	36.5	78
	Girls	Beginning	616	102	122	286	72	34
		Ending	629	110	95	277	113	34
	Average		622.5	106	108.5	281.5	92.5	34
	Total Number of Members ^a		972	241.50	136.5	353	129	112
	Ave. Membership per Club		21.2	21.95	27.3	22.5	21.5	14.0
	Boys ' 4-H Clubs	Number of Clubs		16.7	4	2.7	4	6
Number of Club Members		Beginning	34	-	-	15	19	Boys' 4-H Clubs were not operated in the Buenaventura area
		Ending	29	-	-	9	20	
Average		31.5	-	-	12	19.5		
Boys		Beginning	244	45	87	48	64	
		Ending	251	45	79	37	90	
Average		247.5	45	83	42.5	77.0		
Total Number of Members ^a		251.6	45	55.6	54.5	96.5		
Ave. Membership per Club		15.1	11.2	20.6	13.6	16.1		
Both Programs		Total Number of Clubs		62.4	15	7.7	19.7	12
	Total Number of Members		1,223.6	286.5	192.1	407.5	225.5	112

^aSum of two averages except where clubs did not operate for the whole year.

Table B-8.--Comparison of Selected Extension Cost and Resource Use Factors for the Home Economics Assistance program and the Boys' 4-H Clubs program. (Costs are in Colombian pesos.) Field personnel time in days.

Program	Description of Factor		All Locations	Rold-anillo	Tulua	Palmira	Cali	Buenaventura
Home Economics Assistance	Total Costs		535,510	117,918	90,752	187,870	91,020	47,950
	Per Member	Extension Costs	511	488	665	532	706	428
		Field Personnel Time	2.3	2.2	2.7	1.8	2.6	2.2
	Per Club	Extension Costs	11,777	10,719	18,150	11,966	15,170	5,994
		Field Personnel Time	49.0	49.2	75.6	47.3	55.7	30.6
		Kilometers	1,948	957	1,458	2,285	3,290	N/A
	Extension Costs per Day ^a		239	218	240	253	273	196
	% of Time with Participants		62	61	61	62	59	68
	% of Time Travelling		21	18	17	25	20	20
	% of Time in other Activities		17	21	22	13	21	12
Boys' 4-H Clubs	Total Costs		450,074	118,999	91,874	127,693	111,508	Boys' 4-H Clubs were not operated in Buenaventura
	Per Member	Extension Costs	1,789	2,644	1,652	2,343	1,156	
		Field Personnel Time	5.9	8.2	5.5	6.9	4.0	
	Per Club	Extension Costs	26,950	29,750	34,027	31,923	18,585	
		Field Personnel Time	89.2	92.2	132.2	94.3	64.5	
		Kilometers	6,619	8,501	3,442	9,280	4,275	
	Extension Costs per Day ^a		302	322	257	339	288	
	% of Time with Participants		51	54	42	64	44	
	% of Time Travelling		22	24	16	24	25	
	% of Time in other Activities		27	22	42 ^b	12	31	

^aDay of field personnel time.

^bOne employee was in training course at SENA.

APPENDIX C

SUPPLEMENTARY DATA ON THE 1967 OPERATIONS OF THE
EXTENSION SERVICE OF THE DEPARTMENT OF AGRICULTURE
OF ANTIOQUIA

Table C-1.--Estimated costs of operating the Extension Service of the Department of Agriculture of Antioquia in 1967.^a

	Rural Extension	Communications Division	Agric. Assistance
Salaries of Employees	1,572,532	75,680	222,700
Wages of Labourers ^b	657,686 ^b	--	637,627
Christmas Bonus	172,339	6,690	72,332
Vacation Bonus	9,904	--	10,005
Miscellaneous Bonuses ^c	10,533	696	5,604
Purchase of Equipment	91,085	550	4,298
Maintenance and Upkeep	158,912	1,700	40,015
Travelling Expenses	108,382	--	41,296
Materials and Supplies	81,508	24,808	39,389
Printing and Publications	--	48,446	--
Total Direct Costs ^d (4,094,717)	2,862,881	158,570	1,073,266
Transfers to Extension ^e (1,416,915)	881,131	19,932	515,456
Share of Administration ^f (249,896)	169,804	8,097	72,045
Share of Research ^f	191,835	--	--
Total Costs (5,953,017)	4,105,651	186,599	1,660,767
Adjustment for Communication Services	+149,279	-149,279	
Total Rural Extension Costs	4,354,930		

^aCalculated from data supplied by the Accounting and Controlling Departments of the Government of Antioquia.

^bThis expense category is believed to include chauffeur's salaries and costs of service personal because the total wages of obreros in the sectors totalled less than 350,000 pesos.

^cIncludes two special bonuses (Sobre remuneración de Trabajo and Prima de Clima), and a transportation subsidy (Subsidio de Transporte).

^dTotal Direct Costs do not agree with corresponding 1967 budget breakdown of projected expenses as these are actual expenses.

^eSee Appendix Table C-2.

^fSee Appendix Table C-3.

Table C-2.--Calculation of Transfers to the Extension Service Division of the Department of Agriculture from other Departments of the Government of Antioquia.^a

	Rural Extension	Communication Division	Agricultural Assistance
Medical Services ¹	33,899	1,150	13,077
Life Insurance ²	6,468	219	2,495
Public and Communication Services ³	4,237	144	1,635
Termination Bonus (<u>Cesantias</u>) ⁴	204,511	6,939	78,892
Social Insurance (<u>Seguros Sociales</u>) ⁵	6,690	227	2,581
Pensions (<u>Pensiones</u>) ⁶	323,828	10,989	124,919
Rentals (<u>Arrendamientos</u>) ⁷	3,568	121	1,377
Family Allowance (<u>Subsidio Familiar</u>) ⁸	293,693	--	288,845
Other (<u>Otras gastos generales</u>) ⁹	4,237	143	1,635
Total	881,131	19,932	515,456

1. 1.52% of Salaries and Wages
2. 0.29% of Salaries and Wages
3. 0.19% of Salaries and Wages
4. 9.17% of Salaries and Wages
5. 0.30% of Salaries and Wages
6. 14.52% of Salaries and Wages
7. 0.16% of Salaries and Wages
8. 45.3 % of Wages less Transportation Subsidy
9. 0.19% of Salaries and Wages

^aCalculated from the 1966 Statement of Income and Expenses for the Department of Antioquia as contained in the Controller's Report for 1966-67, Emilio Cuartos Agudelo, controller.

Table C-3.--Calculation of Administration and Research Costs
Attributable to the Extension Division of the
Department of Agriculture of Antioquia in 1967.

1. <u>Total Direct Costs</u> (pesos) ^a			
(a)	Department of Agriculture-	9,111,252	
(b)	Office of the Minister of Agriculture-	395,217	
(c)	Research Division-	731,892	
2. <u>Extension's Share of Total Direct Costs</u>			
(a)	Administration (Minister's Office)	= 395,217	($\frac{5,511,236^b}{9,111,252}$)
		= 249,896	(for all three divisions)
(b)	Research - Total Direct Cost	731,892	
	Share of Administration	<u>35,451</u>	[calculated as in (a)]
	Total	767,343	
Extensions Share of Research			
	767,343 x 0.25 ^c	= 191,835	

^aAs transfers from other parts of the Government of Antioquia to the extension division were 34.6% of expenditures; total direct costs for the areas were calculated on this same basis (i.e. 1.346 times expenditures).

^bTotal extension expenditures plus transfers.

^cBased on proportion of time estimated by research and personnel.

Table C-4.--Calculation of average total costs per day of field personnel time for the various classes of extension workers employed by the Department of Agriculture.

Assume: $y = ax_1 + bx_2 + cx_3 + dx_4$

Where : y = Total Extension Costs = 4,354,930 pesos
 x_1 = Total Days worked by Agronomos and Veterinarios = 2,254
 x_2 = Total Days worked by Mejoradoras de Hogan = 3,312
 x_3 = Total Days worked by Practicos Agrícolas = 5,601
 x_4 = Total Days worked by Obreros = 10,910

$$a = \left(\frac{4000^a}{19.2} \times 1.5 \right) + e = 312.5 + e = 407.9715$$

$$b = \left(\frac{1370}{19.2} \times 1.5 \right) + e = 107.0 + e = 202.4715$$

$$c = \left(\frac{1370}{19.2} \times 1.5 \right) + e = 107.0 + e = 202.4715$$

$$d = (30 \times 1.8) + e = 54 + e = 149.4715$$

a, b, c, and d represent average total costs per day for various classes of personnel. Their general expression is given by:

$$\left(\frac{\text{Monthly Salary}}{\text{No. of Days worked per month}} \times \text{Correction Factor} \right) + \text{Overhead Costs/Day}$$

The correction factor represents an adjustment for prestaciones sociales and was supplied by the accounting department of the Government of Antioquia. Overhead costs per day were arbitrarily assumed to be higher for higher paid workers as shown above. Solving the original equation for e provided the estimates of a, b, c, and d shown above.

^aSupplied by extension service.

Table C-5.--Estimated costs of operating 1967 extension programs in the districts serviced by the Sectors of San Jeronimo and Santa Fe de Antioquia.

<u>Sector of San Jeronimo</u>		
1. District of El Brasil		
<u>Agronomos and Veterinarios</u>	90 days	36,720
<u>Mejoradoras de Hogar</u>	246 "	49,815
<u>Practicos Agricolas</u>	278 "	56,295
<u>Obreros</u>	350 "	<u>52,325</u>
Total Cost of Programs in El Brasil		195,155
2. District of Urquita		
<u>Argonomis and Veterinarios</u>	110 days	44,880
<u>Mejoradoras de Hogar</u>	286 "	57,915
<u>Practicos Agricolas</u>	505 "	102,263
<u>Obreros</u>	364 "	<u>51,727</u>
Total Cost of Programs in Urquita		256,785
Total Cost of other 1967 Programs in Sector		<u>19,766</u>
Total Cost of all 1967 Programs in Sector		471,706
<u>Sector Santa Fe De Antioquia</u>		
3. District of Tinajitas		
<u>Agronomos and Veterinarios</u>	69 days	28,152
<u>Mejoradoras de Hogar</u>	138 "	27,945
<u>Practicos Agricolas</u>	272 "	55,080
<u>Obreros</u>	307 "	<u>45,897</u>
Total Cost of Programs in Tinajitas		157,074
4. District of Pinguro		
<u>Agronomos and Veterinarios</u>	68 days	27,744
<u>Mejoradoras de Hogar</u>	97 "	19,643
<u>Practicos Agricolas</u>	206 "	41,715
<u>Obreros</u>	615 "	<u>91,943</u>
Total Cost of Programs in Pinguro		181,045

Table C-5 - con't

5. District of Buenos Aires

<u>Agronomos and Veterinarios</u>	31 days	12,648
<u>Mejoradoras de Hogar</u>	256 "	51,840
<u>Practicos Agricolas</u>	272 "	55,080
<u>Obreros</u>	-	-

Total Cost of Programs in Buenos Aires	119,568
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6. District of El Espinal

<u>Agronomos and Veterinarios</u>	74 days	30,192
<u>Mejoradoras de Hogan</u>	41 "	8,303
<u>Practicos Agricolas</u>	269 "	54,473
<u>Obreros</u>	614 "	91,793

Total Cost of 1967 Programs in El Espinal	184,761
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Total Cost of 1967 Programs in Sector	642,448
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Table C-6.--Distribution of man-days of field personnel time by office location for the Extension Service of the Secretary of Agriculture of Antioquia in 1967.

Office Location	<u>Agronomos and Veterinarios</u>	<u>Mejoradoras de Hogar</u>	<u>Practicos and Expertos</u>	<u>Obreros</u>	Total
Antioquia	242.5	531.5	1018.5	1536.0	3328.5
San Jerónimo	240.5	531.5	797.5	695.0	2265.6
San Pedro	502.0	478.5	784.0	1740.0	3504.5
Cisnoros	156.5	266.0	713.0	1044.0	2179.5
La Unión	293.5	424.5	567.0	1217.0	2502.0
Santuario	177.0	562.0	730.5	164.0	1633.5
Yolombó	215.5	--	240.0	878.0	1333.5
Medellin	426.0	578.0	750.0	1895.0	3589.0
Nursery	--	--	--	1740.0	1740.0
Total	2253.5	3312.0	5600.5	10910.0	22076.0

Table C-7.--Calculation of projected benefit flows from extension work in Tinajitas.

Year	Extension-Influenced Distribution		Probable Alternative Distribution		Benefits Attributable to Extension Work				
	No. of Families Affected	Benefits Per Family	Total Benefits	No. of Families Affected	Benefits Per Family	Total Benefits			
							0%	4%	8%
1968	59	330	19,470				19,470	18,721	18,028
1969	63	350	22,050				22,050	20,386	18,904
1970	67	370	24,790				24,790	22,038	19,679
1971	71	390	27,690				27,690	23,670	20,353
1972	75	410	30,750				30,750	25,274	20,928
1973	79	430	33,970				33,970	26,847	21,407
1974	83	450	37,350				37,350	28,383	21,793
1975	87	470	40,890				40,890	29,878	22,092
1976	91	490	44,590				44,590	31,329	22,306
1977	95	500	47,500				47,500	32,089	22,002
1978	99	500	49,500				49,500	32,154	21,230
1979	101	500	50,500				50,500	31,542	20,054
1980	101	500	50,500	5	100	500	50,000	30,029	18,385
1981	101	500	50,500	10	120	1,200	49,300	28,470	16,785
1982	101	500	50,500	15	140	2,100	48,400	26,875	15,258
1983	101	500	50,500	20	180	3,600	46,900	25,041	13,690
1984	101	500	50,500	25	200	5,000	45,500	23,359	12,297
1985	101	500	50,500	30	220	6,600	43,900	21,671	10,986
1986	101	500	50,500	35	240	8,400	42,100	19,983	9,755
1987	101	500	50,500	40	260	10,400	40,100	18,301	8,603
1988	101	500	50,500	45	280	12,600	37,900	16,632	7,529
1989	101	500	50,500	50	300	15,000	35,500	14,980	6,530
1990	101	500	50,500	55	320	17,600	32,900	13,349	5,603
1991	101	500	50,500	60	340	20,400	30,100	11,743	4,747
1992	101	500	50,500	65	360	23,400	27,100	10,166	3,957
1993	101	500	50,500	70	380	26,600	23,900	8,621	3,231
1994	101	500	50,500	75	400	30,000	20,500	7,110	2,566
1995	101	500	50,500	80	420	33,600	16,900	5,636	1,959
1996	101	500	50,500	85	440	37,400	13,100	4,201	1,406
1997	101	500	50,500	90	460	41,400	9,100	2,806	904
1998	101	500	50,500	95	480	45,600	4,900	1,453	451
1999	101	500	50,500	101	500	50,500	---	---	---
Totals							1,047,150	612,733	393,420

Table C-8.--Calculation of projected benefit flows for extension work in Buenos Aires.

Year	Extension-Influenced Distribution		Probable Alternate Distribution		Benefits Attributable		
	Number of Families	Benefits Per Family	Number of Families	Benefits Per Family	Total Benefits	0%	4%
1968	68	465				31,620	30,404
1969	72	480				34,560	31,953
1970	76	495				37,620	33,444
1971	80	510				40,800	34,876
1972	84	525				44,100	36,247
1973	88	540				47,520	37,556
1974	92	555				51,060	38,802
1975	96	570				54,720	38,668
1976	100	585	6	300	1,800	52,920	38,404
1977	104	600	12	320	3,840	54,660	38,021
1978	108	615	18	340	6,120	56,280	37,533
1979	112	630	24	360	8,640	57,780	36,951
1980	116	645	30	380	11,400	59,160	36,287
1981	120	660	36	400	14,400	60,420	35,550
1982	124	675	42	420	17,640	61,560	34,749
1983	124	690	48	440	21,120	62,580	32,419
1984	124	700	54	460	24,840	60,720	29,776
1985	124	700	60	480	28,800	58,000	26,557
1986	124	700	66	500	33,000	53,800	23,429
1987	124	700	72	520	37,440	49,360	20,392
1988	124	700	78	540	42,120	44,680	17,448
1989	124	700	84	560	47,040	39,760	14,600
1990	124	700	90	580	52,200	34,600	13,065
1991	124	700	96	600	57,600	32,200	9,191
1992	124	700	102	620	63,240	23,560	6,632
1993	124	700	108	640	69,120	17,680	4,170
1994	124	700	114	660	75,240	11,560	1,803
1995	124	700	120	680	81,600	5,200	---
	124	700	124	700	86,800	---	---
						1,183,760	738,925
							497,839

Table C-9.--Calculation of projected benefit flows for extension work in Pinguro.

Year	Extension-Influenced Distribution		Probably Alternate Distribution		Benefits Attributable to Extension Work				
	No. of Families Affected	Benefits Per Family	Total Benefits	No. of Families Affected	Benefits Per Family	Total Benefits	0¢	4¢	8¢
1968	44	280	12,320				12,320	11,846	11,407
1969	48	290	13,920				13,920	12,870	11,934
1970	52	300	15,600				15,600	13,868	12,384
1971	56	310	17,360				17,360	14,839	12,760
1972	60	320	19,200				19,200	15,781	13,067
1973	64	330	21,120				21,120	16,691	13,309
1974	68	340	23,120				23,120	17,569	13,490
1975	72	350	25,200				25,200	18,413	13,615
1976	76	360	27,360				27,360	19,223	13,687
1977	80	370	29,600				29,600	19,997	13,711
1978	84	380	31,920				31,920	20,735	13,690
1979	88	390	34,320				34,320	21,436	13,629
1980	92	400	36,800	5	135	675	36,125	21,696	13,283
1981	96	410	39,360	10	150	1,500	37,860	21,863	12,890
1982	99	420	41,580	15	165	2,475	39,105	21,714	12,328
1983	99	420	41,580	20	180	3,600	37,980	20,278	11,086
1984	99	420	41,580	25	195	4,875	36,705	18,844	9,920
1985	99	420	41,580	30	210	6,300	35,280	17,415	8,829
1986	99	420	41,580	35	225	7,875	33,705	15,998	7,810
1987	99	420	41,580	40	240	9,600	31,980	14,595	6,861
1988	99	420	41,580	45	255	11,475	30,105	13,211	5,981
1989	99	420	41,580	50	270	13,500	28,080	11,849	5,165
1990	99	420	41,580	55	285	15,675	25,905	10,510	4,412
1991	99	420	41,580	60	300	18,000	23,580	9,199	3,719
1992	99	420	41,580	65	315	20,475	21,105	7,917	3,082
1993	99	420	41,580	70	330	23,100	18,480	6,666	2,499
1994	99	420	41,580	75	345	25,875	15,705	5,447	1,966
1995	99	420	41,580	80	360	28,800	12,780	4,262	1,481
1996	99	420	41,580	85	375	31,875	9,705	3,112	1,042
1997	99	420	41,580	90	390	35,100	6,480	1,998	644
1998	99	420	41,580	95	405	38,475	3,105	921	286
1999	99	420	41,580	99	420	41,580	---	---	---

Table C-10.--Calculation of projected benefit flow for extension work in Urquiza.

Year	Extension-Influenced Distribution		Probable Alternate Distribution		Benefits Attributable			
	Number of Families	Benefits Per Family	Number of Families	Benefits Per Family	Total Benefits	0¢	4¢	8¢
1968	38	325				12,350	11,875	11,435
1969	41	340				13,940	12,888	11,951
1970	44	355				15,620	13,886	12,400
1971	47	370				17,390	14,865	12,782
1972	50	385				19,250	15,822	13,101
1973	53	400				21,200	16,755	13,360
1974	56	415				23,240	17,661	13,560
1975	59	430				25,370	18,538	13,707
1976	62	445				27,590	19,384	13,802
1977	65	460				29,900	20,199	13,850
1978	68	475				32,300	20,982	13,853
1979	70	490				34,300	21,424	13,621
1980	70	500	5	175	875	34,125	20,495	12,548
1981	70	500	10	200	2,000	33,000	19,057	11,235
1982	70	500	15	225	3,375	31,625	17,560	9,970
1983	70	500	20	250	5,000	30,000	16,017	8,757
1984	70	500	25	275	6,875	28,125	14,439	7,601
1985	70	500	30	300	9,000	26,000	12,834	6,507
1986	70	500	35	325	11,375	23,625	11,214	5,474
1987	70	500	40	350	14,000	21,000	9,584	4,506
1988	70	500	45	375	16,875	18,125	7,954	3,601
1989	70	500	50	400	20,000	15,000	6,329	2,759
1990	70	500	55	425	23,375	11,625	4,717	1,980
1991	70	500	60	450	27,000	8,000	3,121	1,262
1992	70	500	65	475	30,875	4,125	1,547	602
1993	70	500	70	500	35,000	---	---	---
Totals						556,825	349,147	234,222

MICHIGAN STATE UNIVERSITY LIBRARIES



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