This study is supported in part by the Land Tenure Center, a cooperative research and training program of the American Nations, the Agency for International Development and the University of Wisconsin. The work was done with the cooperation of the Associacao de Credito e Assistencia Rural (ACAR), of the State of Minas Gerais, Brazil. Financial help for the author's graduate work was also provided by the Interamerican Institute of Agricultural Sciences and the Rockefeller Foundation.

At the time of this study, the author was a research assistant with the Land Tenure Center.

August 1966 RP No. 20

INFORMATION PATTERNS AND PRACTICE ADOPTION AMONG BRAZILIAN FARMERS

By

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This paper is an abbreviated version of the author's Ph.D. thesis of the same title.

INTRODUCTION

It is generally accepted that agriculture plays a very important role in the process of economic development of any nation. In countries where a large part of the rural population is migrating to urban centers, the agricultural sector has to grow rapidly in productivity if it is to provide food and fiber to the growing city centers. Agriculture must also become more productive to provide for the country's natural increase in population. In the case of Brazil, where farm production accounts for about 78 percent of total exports (IBGE, 1960), the development of agriculture is also crucial in the struggle for foreign exchange to use in total development.

Using his traditional methods, today's Brazilian farmer is by no means prepared for the job. In order to accomplish his demanding task, the farmer needs tools which will make his work more productive. First, he needs more knowledge on the form of modern technology. Second, he needs institutional support to provide him with an adequate land use system, credit, education, farm machinery, fertilizers, and other essentials.

This study will focus on the first need and on the situation in the State of Minas Gerais. Mosher (1955) refers to the pressure of population growth on the land and emphasizes the need for policies which will promote industrialization while simultaneously encouraging modernization of agriculture:

> Agriculture is Brazil's dominant field of production, and agricultural production has increased substantially over the past 25 years. Its rate of increase, however, has been much lower than that in industry, and there has not been an appreciable increase in the efficiency of land use.

Agriculture, although the first source of income of the State of Minas Gerais, has never received much encouragement and support from the government. Under these circumstances it should not be expected that modern agriculture methods will be characteristic of the farming of the region. The federal and state agencies in charge of giving agricultural advice to farmers seem to be insufficient in number and apparently are not yet fully committed to bringing about changes in farming methods of their area of operation.

The relative isolation of the region and the lack of sufficient communication channels have until recently prevented the fast dissemination of farm information. Wagley (1963) in his "Introduction to Brazil" refers to this aspect of the state of Minas Gerais:

> In recent years, motor roads have penetrated into the mountainous regions of the Eastern Highlands, breaking its isolation, but the quality of the roads, and hilly country make travel difficult and many of these small towns and villages are relatively isolated.

Increasing opportunities for communication have been brought to the region that is now in a steadfast pace of urbanization. Two Brazilian sociologists, Manuel Diegues Junior and Aires da Mata Machado (1960), see in the radio, newspaper, and movies, important causes of change observed in many aspects of life in Minas Gerais.

The momentum of progress that this region is experiencing has been accelerated in the last five years with the building of Brazilia, the new federal capital of Brazil, which puts Belo Horizonte on the main and direct route from east to west. Mosher (1957) refers to the double effect of increasing urbanization and the introduction of more and more industry in the agriculture of Minas Gerais:

> With the rise of urban markets, there is a tendency for farmers having highway access to cities to increase dairying especially and poultry enterprises to a smaller extent. Rising wage rates for industrial labor draw more and more agricultural laborers into the city.

Rapid urbanization means more people in the cities to feed and fewer people in farm areas to produce. It means also a sure market for products, a specialization of farm operation, and consequently, need for farm information.

This was the picture of the region when ACAR started its program some 16 years ago. There was a climate of rapid change which seemed to be ideal for a program designed to promote technological change. It provided farm information, which was scarcely available, to a considerable number of farmers at a time when they seemed to need it badly. It sought to mobilize and organize some dynamic forces in the rural communities to help in the diffusion of new techniques.

The emphasis that the present study puts on personality characteristics as influencing adoption of farm practices takes into consideration the concern of scholars from Brazil and from outside about the value system of Brazilians and especially of the Mineiros.

Wagley (1963) is concerned about the persistence of ideal patterns and social values in the present Brazilian situation:

> Brazil is changing more rapidly than ever before, and new values and patterns are emerging. But no matter how abstract, how nebulous, how divorced from actuality they may be, these traditional ideal patterns and their underlying values have shown remarkable stability through time and space; they persist, though reinterpreted, despite modifications in the most basic aspects of the social system. This stability makes them important not only in understanding a culture at any given point in time, but also in plotting the potential directions of change.

When focused on the state of Minas Gerais, this persistence of values seems to be even more critical. One of the best known Brazilian

sociologists, Alceu do Amoroso Lima, considers that the current material innovations, generally speaking, have not greatly altered the mineiro "spirit" or the mineiro "genius" that continues to preserve the same mentality, the same orientation toward life, acquired at the time of the early mining period and persisting until the present time. (Cited by Manuel Diegues Junior in his book, "Regioes Culturais do Brasil").

Diegues himself (1960) has an appreciation of the strength of tradition among people from Minas:

> Increase in population and installation of new industries are the ecological characteristics that have mostly influenced the social change. However, there is no tumult or commotion in the life of the people; the pace of industrial growth permits the maintenance of the most traditional characteristics of the mineiro, especially in old centers. The abrupt transformation of habits and social customs is greatly prevented by the characteristic reserve of the mineiro people. The forms of social relation of friendship and godfatherhood, are still maintained. The changes refer especially to the problems material in nature, through the acceptance of new work techniques. (Translation ours)

The scope of the present study does not allow the comparison of modern and traditional types of community. Neither the concepts of conservatism nor modernism will be attempted to be measured here. Nevertheless, in any society members are expected to differ among themselves to a certain degree. What we will attempt to do is to locate in this presumably conservative society those individuals who have made their decisions to break with traditional patterns and venture into new ways of producing their goods. From the complexity of the attitudinal configuration of an individual we have selected but a few aspects for consideration in the present study.

Objectives of the Study

This study investigates some aspects of the diffusion process among rural Brazilians and the effect of farm information in the adoption of new technology. For this purpose it looks at the communications behavior of all dairy farmers in one area in which a continuous program of technological change has been in operation for some eight years. Basically it seeks to assess the nature of exposure of farm people to certain innovative ideas and its effect on the adoption of selected dairy practices. Non-information variables included in the study are brought here because of their hypothesized influence both on the communications behavior of our sample and on the adoption of the practices under consideration.

Our unit of analysis is the individual farmer. We expect to be able to classify this individual according to his communications behavior, some traits of his personality make-up, and some situational factors and to

see how the interaction of these measurements work together for a somewhat defined pattern of his decision to adopt or reject some farm practices.

By no means does this study intend to be an evaluation of the institutional aspects of farm information present in our research area. In other words, we are not comparing the efficiency of any institutions that might be involved, but will rather consider their role as incidental to the adoption of practices.

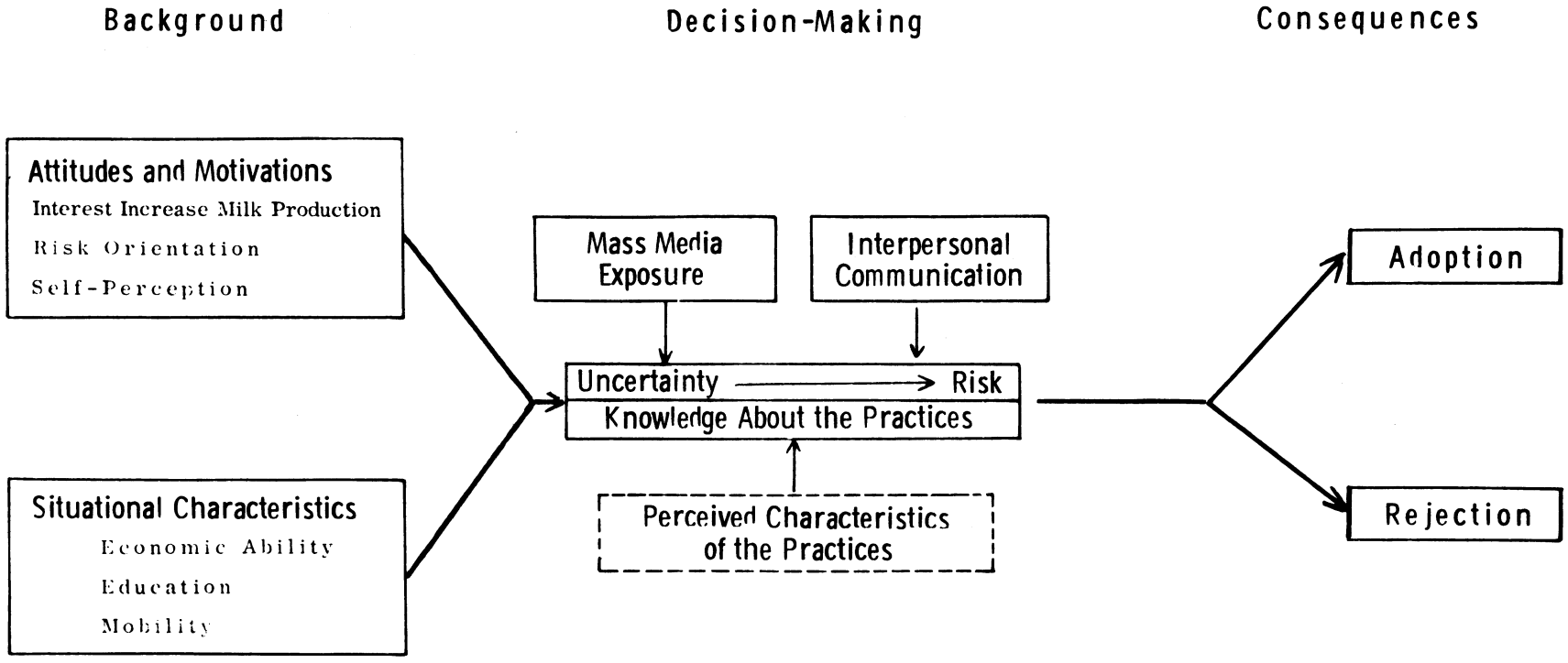
THEORETICAL BACKGROUND

In spite of the voluminous work done in the diffusion area and the multiplicity of innovation studies, a general theory of adoption behavior has not yet been completely formulated. Havens and Rogers (1962) utilize Parsons and Shils (1952) action theory as a frame of reference to study adoption. For Parsons and Shils an act consists of three basic elements: (1) an actor, (2) orienting to, (3) a situation. Havens and Rogers complete the picture by asking what makes an individual act, and propose that the attainment of interpersonal security is the ultimate goal sought by the individual. They suggest that in a decision-making situation, an individual will adopt a new idea when his perception of the potential rewards outweighs the expected efforts required for adoption. Of course this point of view refers to those situations in which the individual perceives himself as free to make a decision and as able to choose among alternatives of action. Evidently, there are many instances in which the decision to adopt or reject a new idea is not in the hands of the individual but rather depends on higher-level decision makers.

The common denominator among most diffusion studies is the fact that no single factor has been able to explain most of the variation in the awareness and adoption of new ideas. The reported studies that have been able to explain more of this variation have included variables of three basic types: (1) situational factors that pre-exist at the time the adoption process is operating, (2) the conditions of the social system in which the individual actor lives, and (3) psychological determinants of behavior present in the personality compound of the individual.

The theoretical guide for this study is a paradigm of the adoption process developed for testing the interrelation of some variables as well as their contribution to the adoption of some selected practices (See Figure 1). The selection of the socio-psychological variables in our model takes into consideration some of the best predictors of other studies but is also influenced by the consideration of the characteristics of the area proposed for the study. Due to the high discriminatory power of the economic ability of the individuals shown by many adoption studies with wide range of economic ability, we sought to isolate for analysis groups of respondents included in the same level of economic ability. The assumption here is that the level of economic ability of an individual sets the background against which other variables will manifest their differential degree of influence.

Figure 1 ADOPTION MODEL



COMMUNICATION BEHAVIOR

The way a potential adopted first comes in contact with a new idea and the feeding of subsequent information about an innovation is generally accepted as being crucial in the decision of adopting or rejecting this same idea. There is a whole array of social and psychological theories as well as empirical evidence that emphasize the nature and the extent of different sources of information in influencing decision making. Most of these studies have been conducted in media-saturated societies where the impact of impersonal communication substitutes for or at least plays much of the information-feeding function which in less developed societies is played mostly by the face-to-face contact. This paper looks at both aspects of communication behavior, personal and impersonal, in an attempt to understand the contribution of each in the spread of new ideas in a definite social setting.

Mass Media

We will consider first the impersonal channels of communication and their bearing on the adoption of new ideas. Some major studies have unveiled the close relationship of mass media use and modernization.

In many developing societies (and Brazil seems not to be an exception to this generality) the meaning of being modern is to be urban-like and to be rural mostly means to be backward. The contribution of mass media tends to further enhance this impression. In spite of the fact that a large share of Brazil's population still lives in rural areas, the content and treatment of messages that reach farmers are disproportionately urban oriented. Paradoxically, high rural users of mass media usually manifest a greater tendency to be more open to new farming ideas.

Considerable research has been focused on the role of mass media in the diffusion of new ideas and practices. Diffusion studies in the U.S. and elsewhere indicate that mass communication plays a very important role in the awareness stage of the adoption process of innovations. There have been some attempts to relate these findings to situations existing in less developed countries, as in Myren's study in Mexico (1962), and Deutschmann and Fals Borda in Colombia (1963).

One upsetting factor here is the availability and adequacy of farm information. Except for a few farm magazines that reach a minute portion of farmers in many of these countries, there is an almost negligible amount of strictly farm information as an input in the mass media channels. So, any results indicating the weak effect of this type of communication should be qualified by the kind and amount of farm information carried in the available mass media channels.

Interpersonal Communication

Under this heading the study will cover some of the work that has been done in the diffusion area relating the transfer of information and the influence of person-to-person contacts to the adoption of new farm practices. It will include the effect of informal communication among neighbors, friends, and relatives as well as the contacts with change agents and commercial agents.

What makes personal communication so much more efficient in actually changing behavior? Lazarsfeld and Menzel (1963) suggest some reasons to explain this efficiency: (1) interpersonal communication usually happens unexpectedly, as a sideline talk; (2) it allows for feed-back and immediate response; (3) it permits raising issues of immediate personal relevance to the listener, and (4) it provides for immediate rewards in terms of approval.

The concept of opinion leadership also becomes of prime importance here. Katz and Lazarsfeld (1955), Klapper (1960), and Rogers (1962) have summarized research findings and theoretical implications of the all-important role of local leaders in the diffusion and adoption of innovations. The two-step flow (with further qualifications of one, three, and multi-step) of information initially formulated by Lazarsfeld, Berelson, and Gaudet (1948) has provided a useful framework for the study of information diffusion. The importance of this concept for devising a strategy of change in situations of limited resources as far as mass media channels and institutional change agents can hardly be overestimated.

Klapper (1960) calls attention to what seems to be the basic functions of individuals in the individual adoption process: (1) innovation, when the first one to adopt serves as a "demonstrator of local adaptability" in situations where most farmers want to see a new practice tried locally; (2) legitimation, which functions to dispell fears while working for a more favorable disposition leading to the acceptance of the innovation; and (3) communication, a function that can be associated with any of the two previous ones or be performed by some other person that does not carry those functions.

This discussion brings us to the consideration of the relative influence of different personal sources in the acceptance of new ideas. Emery and Oeser (1958) used the theoretical formulation developed by Heider, Newcomb, and Cartwright and Harary to look at the influences on the adoption of new techniques by Victorian graziers. All these theories use basically the concept of balance within a system in which two people's attitudes towards themselves affect their attitudes towards a common referent. As an example, "strain towards symmetry" makes possible the successful communication of a new idea from a change agent to a farmer when there is a reciprocal positive attitude between the farmer and the agent. So, the definition of the role of the change agent in a rural community and the perception of this role by the farmer seem to pay a crucial part in the total effort of any program of planned change.

ATTITUDINAL AND MOTIVATIONAL VARIABLES

Risk Orientation

One of the inescapable difficulties a change agent faces when he brings an entirely new idea to his clientele is the fact that this innovation is surrounded by uncertainty. No one knows, for sure, perhaps not even the change agent himself, whether the new idea will be successful under the local conditions. The adoption of a similar or correlated practice after the first one has been successfully adopted tends to present less of this problem. Brandner and Kearl (1964) found that the adoption of hybrid sorghum by farmers who had previously adopted hybrid corn was much faster than by farmers who had not adopted hybrid corn. Our extended conclusion is that the congruity with the first practice decreased the perceived level of uncertainty related to the second practice and consequently eased the adoption of the latter. The concept of risk orientation that is proposed in this study as one component of the innovative personality is directly related to the level of uncertainty the individual can bear in making his decisions.

The concept of risk and uncertainty should be better clarified. Knight (1948) defines risk as a situation involving objective uncertainty, that is, a situation in which the probability distribution of the outcome is known. He calls subjective uncertainty the situation in which the probability distribution of the outcome is not well enough known to set up an insurance scheme.

Myren (1964) touches a point that might have a deep implication for changing programs dealing with low economic level clientele:

> Risk is the component of uncertainty for which various insurance schemes have been devised . . . . However, I will argue that the low level of resources of farmers in subsistence agriculture and the absence of inexpensive insurance schemes, prevents them from making decisions based on the probabilities of obtaining certain types of returns on certain types of investments in a certain proportion of instances.

He goes on to suggest that the subsistence farmer contends with risk and uncertainty through sure bets that possibly do not maximize gains but certainly reduce the chance of having nothing at all.

The main instrument to deal with uncertainty, and the one that we are particularly interested in, seems to be knowledge. The assumption here is that knowledge can move an individual faced with an uncertainty situation (subjective uncertainty, according to Knight) to a real risk situation, where he comes to a point of knowing what are the probabilities associated with the outcome of the proposed action (objective uncertainty). Myren (1964) comments in this respect:

> Although all decision making is done under conditions of imperfect knowledge, the degree of imperfection is of considerable importance to us. It is common to talk of information or extension work and the communication of knowledge in simple terms of making the farmer aware of the existence of a certain practice and the advantages which the technical specialist sees in this practice for the farmer. However, the concept of adequate knowledge for the farmer must be considerably more than this . . . . Nevertheless, in a vast number of cases, adequate information alone would eliminate the uncertainty which makes it undesirable for the farmer to go ahead with a new practice.

Other Attitudinal Variables

Considering that the adoption of innovation is not an end in itself but that rather it is a means to meet the needs of the individual adopter, we sought to look at the acceptance of some specific practices in the context of the manifest interest of the farmers in increasing their milk production. It seems obvious that farmers who are primarily interested in increasing their production will presumably be more alert and more receptive to new ways of attaining this goal. Abell (1953) studying the instrumental use of farm information by Canadian farmers found, among other characteristics, that the farmer's intention about remaining or leaving farming as an occupation as well as his intentions about making future changes in his farm enterprises were significantly related to his search for farm information.

Another concept included in the study is that of credit orientation. There are two main reasons for this inclusion: first, there is a supervised credit program (part of ACAR, the State Extension Service) operating in the municipio for some seven years with funds available to finance the adoption of the practices studied; and, second, the idea of borrowing money seems to involve somewhat a risk situation, and could provide the study with the opportunity of comparing the two concepts. The questions for this part of the study, a Guttman-type scale of five items, were drawn from a previous study (unpublished) conducted by ACAR, aiming at correlating attitude toward credit with actual use of credit in the farm enterprise.

There is a final psychological variable, the self-concept, that was utilized in the study--partly to correlate the self-ratings with other measurements of the same variable (risk orientation, knowledge about selected world events as well as specifics about the practices, and practice adoption scores) and partly as a concept upon which specific hypothesis could be drawn. Rogers (1962) reports his own findings as well as Sheppard's in studies that correlated self-images with innovativeness behavior. Rogers found significant correlation (Robinson's "A" = .79) between adopter categories and self-images, while Sheppard found that self-images on innovativeness were more accurate for some innovations than for others, and in some social systems than in others.

Díaz Bordenave (1966) devised a simple instrument to measure this concept using a variation of the Cantril and Free self-anchoring ladder. The present study also makes use of a similar technique.

Situational Characteristics

One of the main sources of critiques of survey research resides in the fact that this type of study usually does very poorly in terms of exercising control over the data gathered. In fact, many studies of this type have not looked at the gross sheer relationships between the concepts proposed without considering the effects of levels in some crucial background factors. Obviously, the more homogeneous the group of subjects under study, the more controlled findings you get. Laboratory experiment methodology is based on this assumption. In field work, however, part of the control can be exercised "a priori" by selecting subjects with some specific characteristics in common; and part "a posteriori" by classifying the subjects according to some criterion and using these sub-groups as separate units of analysis. In the present study some controls were determined "a priori": all subjects were dairy farmers, owners of their properties, members of a dairy cooperative, all living in the municipio of Esmeraldas. However, even when our subjects met these qualifications, we still had a rather heterogeneous sample, especially in terms of economic ability, education, and geographical mobility. Literacy and sex were also suggested as possible controls but the collection of data showed that only a negligible percentage (16 out of 215) of farmers were illiterate, and that only two out of 215 respondents were women.

The reasons for including economic ability, education, and mobility as controls are rather obvious and need little elaboration here. The effect of economic ability in the adoption of farm practices can be clearly seen in the Rogers (1962) list of studies showing the percent of variance in innovativeness explained: mostly those studies including any form of income or economic measurement were able to explain much of the variance in adoption (fifty percent or more, except in Hobbs (1960) study where the percent of variance explained only reached 29.70).

Education seems to be another crucial factor in opening people's minds to progress and change. Social science literature abounds with theories and research showing how formal learning affects the individual mental processes, creates new needs for him, suggests new ways of solving his problems, and orients the individual towards science and technology.

Urban orientation and mobility are also two concepts that probably interrelate closely with economic ability and education, but that expectedly have an independent effect on the decision making of individual farmers to adopt new technology. Urban orientation as we define it in this study is related to Merton's (1957) cosmopolitan and localite orientation toward the geographical community in which the individual lives.

A word of caution is in order: the operationalization of both concepts, urban orientation and mobility, yielded only crude measurements, which allow us to make only gross classifications of our subjects.

METHODOLOGY

Data and Analysis

The data gathering instrument for the study is a survey-type questionnaire of 37 pages which attempts to assess information in four basic sections:

1. Demographic information, which takes care of the situational variables of the above paradigm. Special consideration is given to questions which permit assessment of the economic ability of the individual farmer. Information about literacy, education, size of family, and age of the respondent were also obtained here.

2. Communication variables. Since one of the basic objectives of the study was to describe the communication patterns of Esmeraldas farmers, a considerable part of the questionnaire is devoted to the nature of information exposure by these dairy farmers. Both face-to-face contact and mass media exposure were measured.

3. Attitudes and motivations. This part of the questionnaire looked at those variables which are part of the personality of the individual and which the above model suggests influence the decision-making process, and consequently the process of adoption of new ideas and practices. Several measurements of risk orientation are attempted. In most cases the questions simply presented the respondent a situation in which he had a choice of selecting between a "low-risk, low-reward" and a "high-risk, high-reward" situation. The attitude of the respondent in regard to dairying and his interest in increasing milk production, are the kinds of motivation considered here. A final part of this section dealt with a set of scales aimed at measuring the self-perception of the respondent in different aspects of his life.

4. The adoption of dairy practices. This section consisted of detailed information about five dairy practices for which the adoption history makes up the dependent variable for the study. The questions in each practice look for the awareness of the practice, the way farmers got their first information, which communication channels provided further information, the standing or plans of the individual farmer in regard to the specific practice, as well as when adopted (and disadopted) and who influenced adoption whenever the case. For each of the five practices, three questions are asked to assess how much the adopter or non-adopter farmer knew about relevant technicalities of the practices under consideration.

The interviews were conducted during the months of July, August, and part of September, 1965. The interviewers were five ACAR extension agents recruited from outside the research area. In Esmeraldas, all respondents were located on a map and then the different communities were divided among the interviewers.

After considering the advantages of a random sample of an extended area and a total sample of a single municipio, the latter was chosen. Our main concern in the study was to look at the diffusion of selected practices as well as at some variables expected to influence the decision to adopt or reject them. A total sample would advantageously provide a much clearer picture of the interaction of individuals within the area while still providing good grounds for testing the hypothesis suggested by the adoption model.

Esmeraldas is definitely a milk producing municipio. In practically all cases farmers who have milk production as a source of income belong to one of the two cooperatives in the area. (Only one respondent was located who did not belong to any cooperative and used his milk production to make cheese in his small home factory.) Lists with names of dairy farmers were secured from the two cooperatives with an indication of their milk quota. Identification and location of respondents on the map of the area was simplified considerably by the fact that those lists were supplied with a classification of farmers by "linha de leite" ("milk line," in English; this refers to the route the cooperative truck has to follow in its daily collection of milk). In a few cases, the lists were not very accurate--some farmers had sold their land to other people (new owners were interviewed as well and isolated for separate analysis) and some younger people had taken over the handling of the farm after their parents retired or died. Of 217 identifiable dairy farmers in Esmeraldas only two refused to give an interview.

Since a total sample has been secured, there are no sampling errors in the computations. All differences that might occur are real differences. In most cases tables will be presented only as percentages. In order to get better acquainted with the data, however, some chi-square and correlations were determined. These statistics will be presented in a few instances for illustrative purposes when we feel these statistics help to enhance results or points.

In quite a few cases we had a battery of questions assessing related aspects of a single variable. For instance, our section on risk orientation consisted of 15 questions, each presenting a different situation involving risk. The economic ability of the farmer was assessed through questions about size of land, size of herd, number of employees, as well as whether he owns an automobile, or has electricity and running water in his farm. Mass media exposure, contact with change agents, and some other variables presented similar situations. In the case of risk orientation, we attempted to scale the 15 items on the Guttman-type scale but did not succeed (reproducibility coefficient of .78). After eliminating six items with larger proportion of error we obtained a scale of

nine items with a coefficient of reproducibility of .89. Similar scales were obtained for the plain adoption score of five practices considered in the study with a reproducibility coefficient of .95, as well as for the knowledge about current events (12 items were used with a .92 coefficient of reproducibility) and knowledge about technical aspects of the five practices studied (again, nine items out of 15 were used, with a reproducibility coefficient of .92).

For adoption, an index was also computed taking into consideration the time of adoption. The values assigned to each item are as follows: no adoption equals zero, adoption after 1961 equals one, adoption before 1961 equals two. Our rationale here is that during the first four years of the intensive program of diffusion of the five practices, the early adopters would have had sufficient time to make their decisions to adopt or reject the specific practice.

In the first phase of the analysis, frequencies and percentage counts were computed as a description of the sample and for selection of variables for subsequent analysis. A second phase consisted of the preparation of a correlation matrix to examine interrelations between uncontrolled variables. The final phase of the analysis consisted of fitting the best explanatory variables into a configuration model as an attempt to explain the adoption of selected practices.

The Problem and the Practices Studied

There are no industries in Esmeraldas, and farming represents practically the only source of income. Dairying is by far the most important aspect of farming in the municipio. Its production is easily consumed by the growing market of Belo Horizonte either in fluid milk or transformed into condensed or evaporated milk. The two existing dairy cooperatives in Esmeraldas are sufficiently equipped and organized to handle the milk collecting, processing, and transportation.

In dairying, the main problem seems to reside in the production sector. Handling and marketing are aspects already taken care of by the cooperatives and by the proximity of the one million inhabitants in Belo Horizonte. The problem of production has been assessed and described by a special commission designated by the Brazilian Ministry of

Agriculture to study the milk production situation in the milk-sheds of Rio de Janeiro, São Paulo, and Belo Horizonte. The Minas Gerais study, published by Carneiro et al, (1956), was conducted in 1953, in the region served by the 22 dairy cooperatives in municipios around Belo Horizonte who are suppliers and members of the Central Cooperative of Rural Producers, located in the state capital.

The main drawbacks in milk production found by the commission are as follows: (1) low daily average production per cow (during the rainy season it is around 2.7 liters per cow, during the dry season this low production drops to 1.6 liters per cow), (2) poor breeding as a general rule (94 percent of the dairy cattle had considerable amount of Brahama blood, which certainly adds to hardiness but also works for low milk production), (3) insufficient cattle feeding, basically done through natural pastures supplemented in rather small scale by sugarcane green feeding and concentrates; and (4) inadequate herd management, precarious hygiene and deficient installations. In addition to this ACAR specialists found the technological level of dairy farmers quite low for the whole milk shed.

Upon the recommendations of the aforementioned study, complemented by the observations of dairy technicians and extension supervisors, a long-run project called "Dairy cattle in the milk-shed of Belo Horizonte" was organized among several cooperating agencies: Instituto de Zootecnia (State Animal Husbandry Institute), C.C.P.R., (Central Cooperative of Rural Producers), Escritório Técnico de Agricultura (AID cooperative program with the Brazilian Ministry of Agriculture), Veterinary School of the Minas Gerais State University, and ACAR (Minas Gerais State Extension Service). The implementation of the project in the municipios where ACAR had an office was to be done mainly through the representatives of this entity (this was the case in Esmeraldas). For this purpose, all extension agents from these municipios were trained in the farm techniques they were to introduce or to emphasize in their areas and were encouraged to concentrate heavily in implementing this particular project in their local offices.

The five practices we are considering more in detail in the present study have received close attention from the dairy project in the area. They are: (1) Green feeding plots; (2) Trench silo; (3) Mineral supplements; (4) Vaccination against foot-and-mouth disease; and (5) Spraying against ticks. Some of them are today almost universally adopted, while some never succeeded in being accepted by a substantial number of farmers.

ADOPTION OF THE PRACTICES

Part of the information gathered in the study concerned the process of adoption of five practices--trench silo, green feeding plots, mineral supplements, vaccination against foot-and-mouth disease, and spraying against ticks. The information about the five practices was used to trace

awareness of these practices, source of first information, sources of additional information, actual plans to incorporate the practice into the farmer's dairy operation, and knowledge about specifics of the practices.

Contrary to what we first expected, a relatively high proportion of respondents reported that they were already aware of these practices when the Dairy Project was implemented in the area in the first half of 1957. Over 50 percent of farmers said they were aware at that time of vaccination against foot-and-mouth disease, 45 percent of mineral supplements, and between 20 and 30 percent of trench silo, green feeding plot, and spraying against ticks. The effect of the dairy program, however, can be seen in the acceleration of awareness of the five practices which reached the 90 percent level in approximately five years. This appears to be much more so for trench silo, green feeding plots, and spraying against ticks.

Awareness of these practices is almost universal in Esmeraldas, where a large proportion of farmers have not only heard about the practices but have actually seen the practices in operation.

When asked about the source of first information about the practice, most farmers indicated a person. There is some variation among the five practices, but face-to-face contact seems to be unquestionably the main source of first information. (See Table 1.) This result is much more in accord with Deutschmann findings in Colombia (1963) than with most

Table 1. First Sources of Information for Selected Farm Practices

First Source of Information	Practices				
	Trench Silo	Green Feeding Plot	Mineral Supplem.	Vacc. F & M Disease	Spraying against Ticks
Do not recall	18	19	38	43	31
Another person	170	181	145	149	154
Radio	6	2	12	8	10
Newspaper	2	3	4	0	1
Magazine	16	9	15	11	13
Pamphlet	3	1	-	2	3
Other	-	-	1	1	3

diffusion research conducted in the United States, where impersonal sources play such an important role in the awareness stage. In the Esmeraldas case, however, impersonal sources were not so negligible as in the Deutschmann study in Saucio, Colombia.

Of the reported mass media, the magazine is the most important source of first information. Undoubtedly this is the result of the free distribution of the farm magazine "Realidade Rural" that the cooperatives send along with the monthly check to their members. Seventy-eight percent of respondents in our sample said they receive this farm magazine at least once a month. Another mass medium widely available in the area is radio. Eighty percent of Esmeraldas dairy farmers own at least one electric or battery radio set. (41 percent own a battery set.) It is only logical that this medium would hold the second rank among first information sources.

The importance of personal contacts as first source of information requires us to expand a little more in this aspect. Tabulation of cases in which first information was provided by a personal source and the respondent could identify the person indicates that 14 percent of first information for all five practices together comes from sources living in the same community of the respondent. Sixty-five percent is provided by other people living outside the community but still in the municipio of Esmeraldas. Twenty-one percent comes from people living outside the municipio. Family relationship is not an active factor here: only 8 percent of first information was given by relatives of the respondent, while 92 percent was provided by non-relatives. As far as occupation of first source for all five practices, an even split occurs for farming and non-farming profession.

Certain categories were inflated considerably because ACAR agents were frequently listed as sources of information, live in the same municipio, are non-relatives of the respondent, and have non-farming occupations.

By eliminating the effect of ACAR in the case of Esmeraldas, we have a sharper indication of who carries first information about farm practices in the area of the study--farmers, non-relatives, living in the same municipio.

This study did not try to discriminate information sources used in each stage of the adoption process, as is often done in diffusion research. Exception is made for source of first information where we attempted to understand the idea-introducing channels used by dairy farmers. We secured, however, some indications of sources of any information that the respondent could recall in relation to any of the five practices.

Again, we are dealing with a society in which the word-of-the-mouth is definitely the predominant pattern of communicating farm information. Nevertheless, the contribution of mass media is not at all negligible, especially when we consider the relatively low availability of farm information in the mass media channels of the area. Pamphlets or easy

farm literature seems to be one logical solution for a clientele that is 100 percent literate in the case of these dairy farmers but with a low level of formal education. In fact, our data show that over 50 percent of farmers got information this way. Radio and farm magazines also make a substantial contribution, both providing over 40 percent of farmers with some instrumental information. Agricultural page ranks lower but still not poorly, with some 23 percent of the farmers recalling specific information provided by this medium.

As far as commercial agencies are concerned, cooperatives and other commercial firms do quite well in providing farmers with pertinent information for their dairy operation. Since these agencies sell dairy products, it is only logical to expect that the practices using those products will be the ones on which they provide most information. For both cooperative and commercial agents, farmers most frequently mentioned having received information on mineral supplements and spraying against ticks. Farmers got much information about vaccine against foot-and-mouth disease from commercial agents, but not so much from cooperatives.

The value of interpersonal communication at the local level can be fully appreciated by looking at the decline of the average mentioning of information received from increasingly distant farmers. To make this comparison we took the smallest number of farmers receiving information in any of these practices as the basis for proportion. In the case of farmers living in the same community, vaccination against foot-and-mouth disease had the lowest score: only 185 farmers out of 215 exchanged some ideas about this way of preventing the infection. In the case of information received from farmers living in other communities but still in the municipio of Esmeraldas, the lowest score is for spraying against ticks, mentioned only 164 times. For farmers receiving information from other farmers outside Esmeraldas, the lowest rank is also for vaccination against foot-and-mouth diseases, mentioned 116 times. These three lowest scores in each category yield the proportions of .86, .76, and .54 respectively for within the community, outside the community, and outside the municipio. This seems to fit into the low mobility pattern prevailing in Esmeraldas.

Trench silo and vaccination against foot-and-mouth disease are the least widely adopted of the five practices. Forty-seven percent of farmers in Esmeraldas stated their intention not to incorporate trench silo into their dairy operation. It also rates high in disadoption. The main reservations about the trench silo seem to refer to the cost involved in opening the silo and the expensive equipment required to load the trench. Vaccination is also poorly appreciated by these farmers. Thirty-two percent do not intend to vaccinate their herd, even though foot-and-mouth disease is recurrent in Esmeraldas. Also, this practice rates as the highest in disadoption. In justifying their decisions, farmers mostly complain about the ineffectiveness of vaccines which they had tried in their own herd or had seen neighbors or friends trying. The difficulty involved in keeping the vaccine cool, and the high cost of

Table 2. Farmers' Decision in Regard to Specific Practices (Proportion Shown in Parenthesis)

Farmer's Decision	Practices				
	Trench Silo	Green Feeding Plot	Mineral Supplm.	Vacc. F & M Disease	Spraying against Ticks
1. Never used the practice and does not intend to adopt it	99 (.47)	11 (.05)	16 (.07)	69 (.32)	52 (.24)
2. Never used the practice but plans to adopt it	79 (.37)	38 (.18)	11 (.05)	32 (.15)	47 (.22)
3. Adopted the practice once but gave it up later on	14 (.07)	1 (.01)	6 (.03)	33 (.16)	6 (.03)
4. Adopted and is currently using the practice	19 (.09)	165 (.76)	180 (.85)	80 (.37)	108 (.51)
TOTALS	211 (1.0)	215 (1.0)	213 (1.0)	214 (1.0)	213 (1.0)

vaccine are mentioned frequently among other reasons. Testing our sample in regard to crucial information as to good use of this vaccine revealed that knowledge about this practice is quite low for effective use of it.

Spraying against ticks should be able to reach its 80 percent level of adoption not too long in the future. Mineral supplement and green feeding plot are definitely the most successful practices of this series. Green feeding plot is a good example of a simple, inexpensive practice introduced as the solution of the crucial problem of feeding cattle at the time the pastures are weak, and as a result this practice has spread rapidly since the dairy project was implemented in Esmeraldas in 1958.

We asked our respondents who influenced their decision to adopt each of the five practices and this information will be valuable for a sociometric analysis planned for the overall data. For the purpose of this paper, however, the discussion will be confined to a gross

categorization of influentials by their location in reference to the adopter, their family relationship, as well as their urban or farming occupation. (See Table 3.) Adopters, for the purpose of this table includes all farmers of categories 2, 3, and 4 of Table 2.

Table 3. Proportion of Influentials in the Adoption of Selected Practices, by Location, Relationship and Occupation

Practice	Where Influential Lives			Relationship		Occupation	
	Same Comm	Same Munic	Other Munic	Relat	Non Relat	Farm	Non Farm
Trench Silo	.15	.72	.13	.12	.88	.53	.47
Green Feeding Plot	.19	.72	.09	.09	.91	.51	.49
Mineral Supplements	.21	.57	.22	.13	.87	.42	.58
Vaccination Against Foot-and-Mouth Disease	.17	.62	.21	.06	.94	.67	.33
Spraying against Ticks	.16	.66	.18	.12	.88	.56	.44

Altogether, Table 3 suggests that most influentials are located in the same municipio, but not in the same community of the respondent (an indication that they probably live in the municipality seat) are non-relatives of the respondent, and are divided half-and-half between farming and non-farming occupations. This pattern is very similar to the one encountered in sources of first information. Recodification of this data and identification of all cases of influence by any ACAR agent, change somewhat the picture suggested by the last Table. For this reason we are presenting another table with an illustration of modification in the proportions of two practices after direct ACAR influence has been excluded. (See Table 4.)

Separate questions on who gave first information about the practice and who influenced the adoption permitted comparison of the two answers and establishment of the proportion of influentials who are also the first source of information about the practices. Sixty-one percent of the influentials were both a "first information source" and "influential in adoption". Consistent proportions for all five practices seem to indicate that there is considerable overlap in the roles of first source of information and influence on adoption. These results, however, should be

Table 4. Who Influenced the Adoption of Farm Practices: Total and Controlled by ACAR

Practice	Where Influential Lives			Relationship		Occupation	
	Same Comm	Same Munic	Other Munic	Relat	Non Relat	Farm	Non Farm
Green Feeding Plot (ACAR eliminated)	.33	.51	.16	.16	.84	.89	.11
Vacc. Foot-and Mouth Dis. (ACAR eliminated)	.21	.53	.26	.08	.92	.82	.18
Total for Five Practices (ARAR included)	.18	.66	.16	.10	.90	.53	.47
Total for Five Practices (ACAR eliminated)	.27	.49	.24	.16	.84	.79	.21

taken with some reservations for the following reasons: (1) ACAR and the dairy program in Esmeraldas are intended to provide information for farmers at all levels of the adoption process--consequently they are expected to influence both awareness and adoption of these farm practices; and (2) in the computation of these proportions we took in consideration only those cases in which the respondent could recall clearly both personal sources. So, cases of impersonal sources of first information and cases in which one of the sources was omitted did not enter the raw data for these proportions.

We were also interested in the perception of farmers in regard to the characteristics of some selected dairy practices as a possible aid in explaining adoption and rejection. In other words, we expected that if a farmer had a more favorable evaluation of one practice than of some other alternatives, he would favor that particular practice in his adoption decision making. To test this assumption we asked our respondents to rank four dairy feeding practices against four concepts: initial cost, labor requirement, risk involved, and expected profit. The practices used in this case were trench silo, green feeding plot, commercial concentrates, and division of pastures. Table 5 presents the frequencies of first choice of practices according to the four concepts.

This table helps to explain the poor adoption of trench silo as compared to green feeding plot. In all respects green feeding plot is evaluated significantly more highly than trench silo, the only near similarity being in evaluation of the amount of work the practice requires.

Table 5. Farmers Selection of Practices as First Choice According To Selected Characteristics (Proportions Shown in Parenthesis)

Characteristics	Practices							
	Trench Silo		Green Feeding Plots		Feeding Concentrates		Pasture Division	
Least initial cost	27	(.13)	120	(.57)	4	(.02)	58	(.28)
Requires least work	17	(.08)	28	(.13)	114	(.55)	50	(.24)
Least danger of failure	40	(.19)	96	(.46)	37	(.18)	36	(.17)
Most profitable	29	(.14)	139	(.66)	8	(.04)	33	(.16)
Total	113	(.13)	383	(.46)	163	(.19)	177	(.22)
Rank	4		1		3		2	

There is a close relationship between the appraisal and the adoption of each of these four practices. This seems to be a good example of the decision-making model in which different alternatives are present and the differential perception of these alternatives guides the final decision. It is interesting to notice that in the present case, apparently the characteristics related to cost, profit, and security were the selection criteria, while amount of work received less consideration. Unfortunately we could secure evaluation by farmers only of feeding practices and do not have any comparable appraisal of other kinds of practices; consequently we could not include this evaluation variable in our analysis of factors related to adoption.

VARIABLES EXPLAINING ADOPTION

The proposed model to explain the adoption of farm practices calls for the testing of some hypotheses about the interrelationship between adoption and selected variables, as well as among some of the independent variables themselves. This paper will first look at these relationships from a simple correlational point of view in order to establish the extent of the association among factors. In doing so, we will sometimes attempt to control for one variable when we have reasons to suspect its strong interacting influence on associations between other hypothesized variables.

A. SITUATIONAL FACTORS AND ADOPTION

The Economic Ability of the Individual Farmer

GENERAL HYPOTHESIS: The adoption of farm practices correlates highly with the economic ability of the individual farmer. High economic ability farmers adopt more and sooner than low economic ability farmers.

This general hypothesis has been tested so often in the diffusion research that by now it should already be accepted as a principle. The reason we decided to include it in the present discussion is related to the kind of practices for which data were collected. Most of these practices are of a very simple and inexpensive nature. In that sense the prospective adopter does not necessarily have to have much money in order to make his decision to adopt the practice. Even for this type of innovation the economic ability of respondents in our sample appears as the strongest factor affecting adoption.

A Pearsonian r of .44 was calculated between the economic ability index and the practice adoption scale. When we introduced the time element in the adoption of the selected practices the Pearsonian r between economic ability and innovativeness increased to .54. Chi-square values computed for both the index and the scale of practice adoption reached a level of significance beyond .001. We seem to be on safe ground to conclude that even for the adoption of simple and inexpensive farm practices the level of economic ability is a strongly affecting factor.

HYPOTHESIS: In spite of the fact that economic ability and formal education are closely related to each other, they have independent effects on the adoption of farm practices.

As in the case of economic ability, the level of education correlates strongly with the innovative behavior of the individual farmer. A Pearsonian r value for this association is .40, somewhat less than r for the association between adoption and economic ability. The value of r between education and economic ability is .49. Partial correlation runs to eliminate the effect of each of the two variables at a time, yielded coefficients of .42 and .19 when eliminating education and economic ability, respectively. This leaves 18 percent of the variation explained by economic ability after eliminating the effect of education, while reducing the effect of education to only 4 percent after eliminating the effect of economic ability.

We are not formally stating any hypothesis about the interrelation of economic ability with certain variables such as use of mass media, mobility, and urban-orientation, since this has been extensively considered in so many studies. Nevertheless Table 6 will present some indication of how these variables related to the economic ability index in our sample.

Table 6. Correlation of Selected Variables and Index of Economic Ability

Variable	r
Index of mass media use	.66
Index of mobility	.52
Index of urban-orientation	.42

These respectably high correlations as well as the consistent relationship of economic ability with other key variables of the study (especially with our main dependent variable) give us grounds for deciding to make economic ability our first predictor and discriminating criterion in the configurational approach to explain the adoption of these practices. (See next chapter.)

B. COMMUNICATION FACTORS AND ADOPTION

We include here our hypotheses concerning the exposure to mass media information, those about personal contact with change agents, as well as those dealing with informal social participation.

Hypotheses Concerning Mass Media Use

The composite index of mass media exposure includes aspects of the available channels existing in the research area, such as radio, farm broadcast, television, newspaper, agricultural page, farm magazines, and a sample of the literature dispersed by ACAR throughout the municipio. This index will be used in most cases to test our hypotheses relating to mass media. Exception is made on a hypothesis dealing strictly with agricultural information, where frequency of listening to a farm broadcasting program and readership of an agricultural page are used as the mass media exposure measurement.

GENERAL HYPOTHESIS: The extent of mass media use is directly related to the adoption of farm practices: high mass media users adopt more and sooner than low mass media users. This relationship co-varies with economic ability but nevertheless is manifested at all levels of economic ability.

Inspection of the data tells us that for the low economic ability farmers 26 percent of the low mass media users are high adopters, while 63 percent of the high media users qualify as such. Differences are found also for the high economic level farmers but are not as pronounced:

65 percent of low media users are adopters, but 86 percent of high media users rate as high adopters.

HYPOTHESIS: High media users of our study manifest a significantly higher urban orientation than the low media users.

This hypothesis is based on the idea that mass media in developing societies are predominantly urban oriented and as such they tend to influence farm people towards urban values.

Confirmation of this hypothesis is provided by the data. A significant r of .48 has been calculated for the association of these two variables.

It is interesting to observe that urban orientation is not only correlated with mass media use but actually urban oriented people do better than non-urban oriented as far as adoption and knowledge of specifics of the practices are concerned. Cross tabulation of adoption scale with knowledge about specifics of the practices, controlled by urban orientation, indicated that 65 out of 94 (69 percent) urban oriented farmers are high adopters; of these, 54 percent scored high in a battery of questions assessing their knowledge about the practices under study. Of the non-urban oriented group, only 49 out of 112 (44 percent) were high adopters, with only 40 percent showing sizable knowledge about the five dairy practices.

HYPOTHESIS: High mass media users have a better knowledge of events occuring in their municipio, their state, their country, as well as in international settings, when compared with low media users.

We tested this hypothesis controlling for economic ability. The criterion used here was the nine items scale of knowledge about current events. In all cases, mass media exposure shows a definite influence, being more dramatic at the low economic level.

Chi-square value for cross-tabulation between mass media use and knowledge about current events uncontrolled for economic ability is 48.92, with two degrees of freedom, significant at the .001 level. In both cases of economic ability our hypothesis was supported.

In spite of the fact that mass media channels operating in Minas Gerais ordinarily carry very little farm information, we still expect that what is available will meet some of the farmers' needs. Our hypothesis about this effect of mass media is tested in relation to the knowledge about farm practices by the readers of the agricultural page of the most read newspaper in our sample, and also by the audience of a well known general farm program broadcast by one of the state government radio stations in Belo Horizonte.

HYPOTHESIS: Increasing exposure to "PAGINA AGRICOLA" and to "HORA DO FAZENDEIRO" is correlated with greater knowledge about farm practices.

Table 7 that follows shows the distribution of knowledge about farm practices by those two main sources of farm information through mass media channels.

Taking these results as they are might lead to the quick conclusion that "Página Agrícola" is much more efficient in conveying farm information than "Hora do Fazendeiro". This may not be the case. The high significance shown by the agricultural page can possible be influenced by other factors present in the high newspaper readership subsample. Listening to "Hora do Fazendeiro" did not improve the farmer's knowledge about specifics of the practices under study. These results are a little surprising because we expected smaller farmers (who are definitely the audience for radio programs) to gain more knowledge through listening to these programs. Perhaps the most important information this table brings to us is the existence of an already sizable audience for both media as far as farm information is concerned.

Table 7. Knowledge about Farm Practices by Readership of "Página Agrícola" and by Listening to "Hora do Fazendeiro"

Knowledge About Farm Practices	"Página Agrícola"			"Hora Do Fazendeiro"		
	Never Reads	Occa-sion-ally	At Least Once a Week	Never Listens	Less Than 4 Times a Month	4 Times a Month or More
High (7 to 9)	16	22	30	15	21	32
Medium (5 and 6)	38	18	13	13	22	34
Low (0 to 4)	45	7	6	17	16	25
	Chi-square = 39.79 d.f. = 4 sign. = .001			Chi-square = 1.99 d.f. = 4 sign. = n.s.		

Hypotheses Concerning Contact with Change Agents

Change agents, especially those engaged in promoting specific changes in a definite rural community, are frequently looked upon as important sources of reference by the people they want to change. In most cases, they are not only the repository of certain kind of instrumental information but they also are the distributors of means and facilities that might ease the adoption of proposed ideas. On the other hand, in performing

their functions, these agents make many direct contacts with their clientele, supposedly affecting behavior in the direction of the proposed changes. This is the rationale that leads us to the next hypothesis.

HYPOTHESIS: Farmers securing a high level of contacts with change agents, either in their immediate or remote environments, will adopt significantly more practices and adopt them sooner than farmers having few or no contacts. As a corollary of the above hypothesis, we expect farmers with high contact with change agents to know more about the practices they are to adopt than the ones having low contact with change agents.

The simple distribution of contact with change agent index scores by adoption does not provide grounds for confirming our hypothesis.

The uncontrolled distribution of contacts with ACAR (the agricultural organization that provides by far the most contacts in Esmeraldas) by adoption provides an even less significant chi-square value (chi-square = 3.34, d.f. = 4). However, when we look at the situation from categories controlled by economic ability, we can better appreciate the effect of ACAR in promoting the adoption of farm practices in Esmeraldas.

For the low economic ability group, contact with ACAR agents sharply increases the adoption probability, while it shows no effect whatsoever for the high economic ability group. Our general hypothesis, as such, is not supported by the data. To be tenable it has to be qualified by the economic level of the change agent clientele. Altogether, our data seems to indicate that the availability of contact with agricultural change agents is somewhat limited for dairy farmers of Esmeraldas. ACAR, which makes most of these contacts, seems to concentrate its effect, both in terms of amount of contacts and impact in adoption, in the middle-low segment of the economic continuum.

As far as knowledge about specifics of farm practices is concerned, contacts with change agents seem to have a more marked influence. Knowledge about the practices is significantly associated with adoption. Contact with change agents is correlated with higher level of knowledge about farm practices: of 67 individuals scoring low in the knowledge scale, 52 (78 percent) are in the "low contact with change agent" category. Conversely, of the 68 dairy farmers with sizable knowledge about the five farm practices, 38 (56 percent) also score high in contacts with agricultural agents.

A large number of medium and highly informed people (in terms of knowledge about these practices) who are non-adopters, in both low and high contact with change agents categories, suggests (1) that the information provided by the change agents comes to a definite segment of the society; the other part apparently gets this information from other sources or indirectly from the change agents through their peers or

neighbors; and (2) that change agents are not influencing so heavily the adoption of farm practices; the pattern suggested by the data seems to be the one in which the individual who gets information from a change agent turns to some other source, such as a local opinion leader for instance, before he makes his decision to adopt.

Hypothesis Concerning Informal Social Participation

Informal social participation usually tends not only to increase the chances of exposure to new farming ideas but also in many cases provides the opportunity for local validation of ideas being diffused in the social context. In order to have a composite score for this complex variable we grouped together four types of individual measurements that seem to tap this dimension, especially in the context of the social situation of Esmeraldas: (1) frequency of church attendance; (2) number of godchildren; (3) number of social activities the subject participates in, selected from a list of 10 possibilities suggested as the more apt to occur in that municipio; and (4) frequency of visits to the township of Esmeraldas.

HYPOTHESIS: Informal social participation is directly related to innovativeness. Farmers with high informal social participation adopt more and sooner than farmers rating low in informal social participation. As a corollary of the previous hypothesis, we expect high social participants to rate higher in their knowledge about both current general events and about specifics of farm practices than low social participants.

This hypothesis did not find support of any kind from data on hand. The simple distribution of informal social participation indicates that 79 percent of the sample is classified in the middle range of the index. As far as adoption is concerned there is some slight tendency for high social participants to adopt more, but differences are not very significant.

Controlling by high and low economic ability yielded chi-squares of even smaller values (.03 for high economic ability and .719 for low economic ability, with 1 degree of freedom, and no significance whatsoever). The same occurs with the distribution of informal social participation by scores of knowledge about farm practices: chi-square = 2.45, 6 degrees of freedom, non-significant. Correlation runs between the plain adoption of practices and components of the index consistently presented negligible relationship (the largest r found for correlation between practice adoption and number of godsons - .12). The unexpected loose relationships between informal social participation and our dependent variables, adoption and knowledge, seem to suggest that either the concept was not adequately measured in the study or the kind of social interaction opportunities suggested by the components of the index are not used as channels for instrumental farm information. At least they do not consistently operate in the direction of adoption.

C. ATTITUDINAL VARIABLES AND ADOPTION

This section will present hypotheses concerning risk orientation, motivation towards increasing milk production, and perception of self. Three different types of measurements are represented here: (1) a nine point Guttman scale to assess the individuals's risk orientation; (2) a motivational score obtained by requesting the respondent to state his preference among five concepts, judging two at a time, using the technique called paired comparison; and (3) a 10 point self-anchoring scale, using Cantril and Free ladder device.

Hypotheses Concerning Risk Orientation

The theoretical foundation of this study allows for the formulation of the following hypotheses concerning risk orientation:

HYPOTHESIS: Risk orientation is related to innovativeness and can explain some of the variation in adoption of farm practices. High risk oriented farmers adopt more and sooner than low risk oriented farmers.

The simple distribution of practice adoption by risk orientation seems to confirm our hypothesis in a very clear fashion. (See Table 8).

Table 8. Distribution of Risk Orientation, By the Time/Adoption Index (Percentages shown in Parenthesis)

Risk Orientation Scale	Time/Adoption Index	
	Low (0-3)	High (4 up)
High (6 up)	9 (.10)	24 (.22)
Medium (3 to 5)	28 (.32)	64 (.59)
Low (0 to 2)	50 (.58)	21 (.19)
Total	87 (1.0)	109 (1.0)

Chi-square = 30.66
d.f. = 2
sign. = .001

At this point it should be interesting to note that a first correlation run between risk orientation and practice adoption scale (not corrected by time), yielded a negative r of -.27. Plotting the distribution of adoption superimposed by the curve of risk orientation revealed the reason for this unexpected result: while the adoption plotting follows closely the normal curve shape, the risk orientation curve shows

considerable skewness, with its large majority of low risk scores. The contingency table and chi-square were able to detect the real relationship in a much clearer fashion.

We understand risk orientation as a psychological trait of the attitudinal complex of the individual. However, the behavioral manifestation of attitudes is assumed to be influenced by the situational characteristics of the individual. In the case of risk, economic ability seems to be an important factor allowing or hindering the manifestation of innovative behavior, according to Myren (1964). This leads to the next hypothesis.

HYPOTHESIS: People with high risk orientation but with low economic ability are less innovative than equally risk oriented people but with high economic ability.

By controlling data presented in Table 8 by economic ability, we can test our hypothesis. Medium and high risk orientation increases considerably the proportion of low economic ability adopters (26 to 46 percent). However, this increment does not reach the adoption level of high economic ability people. For this group the influence of risk orientation increases the percentage of adoption from 40 to 86 within the same economic ability subsample. This table seems to indicate that attitudes toward situations with some risk involved but with possibilities of higher reward are directly related to innovativeness, but that situational factors set the pace for the behavioral manifestation of these attitudes.

According to the theory that generated these hypotheses, risk oriented people differ from those who make their decisions on a purely game or chance situation in the sense that they have to know beforehand how much probability of success or failure is associated with the result of their decisions. In other words, they have to reduce uncertainty as a prerequisite for decision. It has been suggested that high risk oriented people will highly expose themselves to the sources that can provide them with pertinent information about new ideas as a way of reducing uncertainty before they are to adopt them. In Esmeraldas extension agents are perhaps the main sources of farm information. We can now state our next hypothesis.

HYPOTHESIS: High risk oriented farmers contact significantly more change agents than low risk oriented farmers.

Data collected in Esmeraldas seems not to support this hypothesis. Risk orientation did not substantially increase the number of contacts with change agents.

One possible explanation for this low correlation between risk and contact with change agents may reside in the fact that the bulk of high risk people are in the high economic ability group, which has very little contact with change agents in general and even less with ACAR in

particular. To better observe the correlation between risk orientation and contact with change agents, we controlled by economic ability. Even here the association was low: for high economic ability, a chi-square of 3.55 was obtained, not significant, with two degrees of freedom. For low economic ability farmers, a chi-square of 8.57 was obtained, significant at the .02 level, with one degree of freedom. This is the only evidence we were able to find to support our hypothesis.

Our last hypothesis concerning risk orientation is somewhat related to the previous one since it deals with knowledge as an uncertainty reducing device.

HYPOTHESIS: High risk oriented farmers know more about farm practices than low risk oriented farmers.

From all correlations run between risk orientation and other variables, the largest coefficients obtained were between risk orientation and knowledge about current events ($r = .64$) and knowledge about farm practices ($r = .65$).

A small N in the high risk category puts some restriction on the findings. Nevertheless the pattern seems to be that high risk oriented people do better on knowledge of farm practices than low risk oriented ones. Forty-eight percent of high risk people show a sizable knowledge about the five farm practices, against 28 percent of the low risk oriented; 81 percent of high risk people with high knowledge about the practices adopt them, against 63 percent of the low risk oriented farmers.

Hypotheses Concerning Motivation to Increase Milk Production

The hypotheses tested in this part deal essentially with the respondent's commitment to farming in general and to dairying in particular. The assumption here is that the individual who has as his first objective (selected among a series of other alternatives) the improvement of his dairy production, will likely be the one who is more receptive to more efficient ways of pursuing this goal.

HYPOTHESIS: Farmers selecting "increase in milk production" as their first choice among other concepts adopt more than those selecting any other concept.

The ranking of the concept "increase milk production" by adoption indicates that there is a general favorable attitude towards dairying, since each high score in the concept holds increasing proportions of our sample. There are some differences in the percentages of adopters and non-adopters ranking the concept as first or second choice, in favor of the adopters. These differences, however, do not reach significant levels in the test for significance of differences between proportions.

A high percentage of adopters who say they are not interested in increasing their milk production can perhaps be explained by the present dissatisfaction with dairying as an enterprise by many farmers in rural Esmeraldas. The distribution of the concept by economic ability shows that .48 of the medium-low ability group selected this concept as their first choice, as comparable with the next high of .31 for the low economic group, and .30 for the high economic group.

The data seem to indicate that those interested in increasing milk production neither belong to the higher level of economic ability nor are the larger producers of milk at Esmeraldas. They show high contact with ACAR and many of them participate in the supervised credit program offered by that institution. They are strongly committed to dairying, which they consider not only a good business, but also as bringing satisfaction to them; they are the farmers who have definite plans of increasing milk production. The loose interrelation of the concept and contact with the dairy cooperative seems to suggests: (1) that the cooperatives are not entirely pleasing the farmers, and (2) the cooperatives are failing in promoting milk production while ACAR seems to be more successful in this respect.

Farmers motivated to increase milk production expectedly manifest more search behavior for instrumental information that can help them to pursue their goal. We have seen that contact with ACAR and being a borrower in the credit program of this institution are highly associated with first choice of the concept. Our next hypothesis deals with knowledge about farm practices as a result of the high motivation towards dairying.

HYPOTHESIS: Farmers who are primarily interested in increasing their milk production know more about technicalities of farm practices than farmers having any other first concern.

Data for testing this hypothesis are shown in Table 9.

The fact that the farmers highly motivated to increase their milk production are not the wealthiest or the best educated in our sample makes these proportions even more meaningful. Further inspection of data seems to indicate that contact with change agents, and especially with ACAR, are the main sources of information for this group. Cross-tabulation of this variable with mass media index and its components (including radio farm program and agricultural page) did not yield any significant relationship.

Table 9. Ranking of Concept "Increase Milk Production" by Knowledge About Farm Practices (Proportions shown in Parenthesis)

Ranking of Concept	Knowledge about Farm Practices		
	Low (0 to 4)	Medium (5 & 6)	High (7 to 9)
First Choice	15 (.20)	25 (.34)	34 (.46)
Other Choices	50 (.39)	46 (.36)	24 (.24)

Chi-square = 12.06
d.f. = 2
sign. = .01

Hypothesis Concerning Self-perception

The first question we ask here is concerned with the behavioral correlates of attitudes. How critically does the individual see himself and what is the correspondence between this perception and his actions? Two concepts we are concerned with in this study, risk orientation and innovativeness, were measured both in a self-perception scale and in a more active type of measurement. In both cases, the correlation between self-perception and behavior was significantly high: the correlation between risk orientation scale and self-perception as a risk taker yielded a pearsonian r = .56, while the cross tabulation between adoption/time scale and self-perception as an innovator, yielded an r = .40, and a chi-square value of 34.10, significant at the .001 level, with two degrees of freedom. We take these results as an indication of the internal consistency of our measurement instruments.

HYPOTHESIS: Self-perception is directly related to innovativeness. In particular, individuals who see themselves as innovators, risk takers, free to make their own decisions, and well informed adopt more and sooner than those rating themselves low in those concepts.

We will use chi-square values to indicate the strength of the relationship between selected measurements of self-concept and adoption. (See Table 10.)

Since these ratings of self-perception present similar association with economic ability we gain some insight by looking at the effect of self-perception in adoption for high and low economic level people. We will use data provided by a measurement of economic ability, milk production, to compare with those variables.

Table 10. Chi-square Values for Self-perception and Index of Time/ Adoption

Self-perception as:	Value	d.f.	Significance Level
An innovator	34.10	2	.001
A risk-taker	10.15	2	.01
An informed person	32.17	2	.001
Index of self-perception	42.22	3	.001

These data indicate that self-perception seems to have a positive influence on adoption only for high economic level farmers. It shows no influence whatsoever for the low milk production group. A possible explanation for this can be that economic ability usually increases the likelihood of a man accomplishing his desires and aspirations, which in turn tends to strengthen his confidence in himself, with reflects on the favorable perception of himself.

As a summary of analysis of this concept we would like to refer to some associations of self-perception with selected variables. (See Table 11.)

This table emphasized once more the dual pattern present in Esmeraldas: a clustering tendency of higher class dairy farmers, with a favorable evaluation of themselves in many respects, with more education, more land, more production, more knowledge about current events and about farm techniques, and a lower economic class rating low in self-concept and in all those variables. Even in the communication channels and media preference these two groups are distinct: the high economic ability, for instance, prefers newspaper and other forms of printed word, while the low economic group shows a definite preference for radio as main mass communication media.

Table 11. Chi-square Values and Level of Significance Between Index of Self-perception and Selected Variables

Variable	Chi-square value	d.f.	Level of Significance					
			20 or more	.10	.05	.02	.01	.001
Education	34.19	3						X
Size of land	37.58	4						X
Milk production	49.28	6						X
Listens to radio	11.51	6		X				
Newspaper readership	53.87	4						X
Contact with ACAR	10.06	6	X					
Anomie (Lipman & Havens 1965 anomie scale)*	17.39	3						X
Knowledge current events	65.44	2						X
Knowledge farm practices	53.26	6						X

* High self-perception associated with low anomie.

A CONFIGURATIONAL EXPLANATION OF ADOPTION

In the preceding analysis we had an opportunity to look at certain variables and their hypothesized relationship to the adoption of selected farm practices. In a few instances we were able to control for one factor in order to have a better understanding of the effect of the isolated factor in our dependent variable. However, consideration of variables in this fashion makes only a limited contribution to the understanding of the adoption process in our research area. In other words, by themselves or by using one single control, those variables give us very limited power for predicting future adoption under similar conditions. As our paradigm suggests, the adoption of a new idea in a social system is of a complex nature that can only be adequately explained by taking into consideration the interactive effect of the factors involved.

The configurational method we used for predictive purposes was first developed by Stuckert (1958). It uses the predicting-by-classification approach, where the accuracy to predict is assumed to be a function of the homogeneity of the groups under study. Basically, the instrument predicts a criterion usually dichotomized (in the present case, innovativeness), from a combination of discrete or continuous factors (our independent variables) on the basis of maximum probability. Its operation consists mainly of dividing a sample into relatively homogeneous sub-samples according to variables associated with the predicted outcome. In all cases, a "critical value" arbitrarily selected, represents the point the probability associated with given outcome has to exceed in order to complete a configuration. In the present case we selected as critical value .90 for either high or low innovativeness. In other words, every time the addition of a new variable increased the probability of adopting to .90 or more we stopped adding any other factors and considered that configuration complete. The same for non-adoption.

An illustration of how this operates seems to be in order. We take an example from the first configuration used to explain adoption of medium-high economic representants in the sample:

Economic ability — Medium-high (N - 52)

37	15
.71	.29
(Adopters)	(Non-adopters)

Mass media use

High (N - 20)		Medium Low (N - 32)	
19	1	18	14
.95	.05	.56	.44
(Adopters)	(Non-adopters)	(Adopters)	(Non-adopters)

From the 52 cases scored as medium-high in economic ability, 37 (or 71 percent) are adopters, while 15 (29 percent) are non-adopters. The next step in building the configuration is to raise the probability associated with both adoption and non-adoption to the required level of 90 percent. By classifying the 52 farmers according to their use of mass media, we end up with 20 subjects scoring as high media users, and 32 as medium or low media users. Of the 20 high media users, 19 are adopters, which makes the probability associated with adoption for medium-low economic ability plus high mass media exposure group go over the 90 percent required level. So, these 20 cases are considered as explained by those two variables and are not included in the rest of the analysis. The probability associated with adoption and non-adoption for the remaining 32 cases are respectively 56 and 44 percent. For these 32 cases other variables should be added until either outcome (adoption or non-adoption) reaches the required level of 90 percent.

The main advantages of the configurational approach over other predictive techniques seems to reside in the fact that (1) no assumptions of equality of unities, dimensionality, and linearity of measurements are required; and (2) each subsample is considered a separate unit for analysis, since it is defined by a unique configuration of factors. The first advantage prevents the spurious situation of finding relationships among data forced into an analysis before they meet the assumptions they are supposed to meet. The second advantage, works for homogeneous subsamples and makes allowance for examining the effect of a particular variable at different levels of the main criterion. For instance, in our case, some variables affecting adoption of medium-high economic ability subjects did not fit into the configuration of medium-low economic ability subsample.

The operation of this instrument calls for the dichotomization of the dependent variable. The index of innovativeness representing the dependent variable was used for the configuration analysis and its breaking point was set at the score 4. All subjects who were scored as 4 or more were considered as high innovators (N = 113). Those scored at 3 or less were considered as low innovators (N= 82). The setting of the cutting point at score 4, although arbitrary, is defensible on the following grounds: if the subject had adopted only two of the five practices at a time when the level of adoption was low, he would score 4 and enter the high innovativeness category. One who adopted four practices more recently, (after 1961) still would score four because his tardiness of adoption would be outweighed by the larger number of practices adopted. We isolated from this particular analysis those individuals who had been in the municipio of Esmeraldas four years or less as well as those for whom we had incomplete data on the variables entering the configuration.

Inspection of the data on contingency tables and of correlations indicate that from all variables included in the study, economic ability undoubtedly is the one that has the most discriminatory power in relation to the dependent variable. So this variable was selected as the background against which other combinations of factors are examined in their

capacity of influencing the decision of adopting or rejecting the farm practices. Scores in this index range from 0 to 10; they are distributed into four categories roughly representing quartiles. Percentages associated with the innovativeness outcome are calculated for each of these categories (see Table 12). These percentages are taken as representing the probabilities associated with innovativeness of individuals classified into these categories. For instance, a farmer with medium-low economic ability has a 50 percent chance of adopting early practices of this type, while medium-high farmers have a probability of adopting of 71 percent.

Table 12. Probability Values Associated with Economic Ability Categories

Economic Ability Score	N	Probability	
		Hi Innov.	Low Innov.
8 - 10 (High)	39	.95	.05
5 - 7 (Med-high)	52	.71	.29
2 - 4 (Med-low)	62	.50	.50
0 - 1 (Low)	50	.20	.80
Total	203	.57	.43

High Economic Ability Group

The 39 subjects who scored high in economic ability present many other characteristics in common. Thirty among them (77 percent) have completed at least fourth grade of primary school, while only 41 percent of subjects in other categories had that much education. They are the owners of most large farms (72 percent represented in this category own farms larger than 200 hectares; of the medium-high economic ability group, only 26 percent have farms as large as this). They are similarly the "larger" milk producers of Esmeraldas; 84 percent of this sample have herds that produce more than 40 liters a day, while in the second best category only 56 percent reach that production. There are some interesting patterns in the comparative access to and use of mass media channel by farms in different economic ability categories.

The data show that the high economic group consumes considerably more mass media than the next category, but the media preference changes with economic ability. Newspaper and farm magazines are significantly preferred by the upper group, while radio seems to be more heavily used by the lower group. The differences between the high economic ability group and the lower ones, however, do not seem to be significant for contact with change and commercial agents. Chi-square values are

presented here as an illustration of the loose relationship of the two variables for all subjects in the total sample (N = 203).

Table 13. Chi-square Values for Selected Variables with Economic Ability Scores

Variable	Chi-square Value	df	Sign. Level
Contact with ACAR	4.44	6	ns
Index of Contact with Change Agents	6.53	9	ns
Contact with Cooperatives	1.69	3	ns
Contact with Commercial Agents	7.45	6	ns

A previous correlation run using components of both indices--economic ability and contact with change agents--provides us with grounds for detecting a sub-pattern that the overall indices tend to ignore (see Table 14).

Table 14. Correlation Between Selected Variables and Size of Herd

Variable	r
Contact with ACAR	-.15
Contact with Veterinary School	.27
Contact with Cooperative	.07
Contact with SIVAN (dairy commercial agent)	.35

Even though these correlations are not very impressive, still they seem to indicate that there are differential uses of the change and commercial agents channels in Esmeraldas. On one hand, ACAR seems to serve generally these dairy farmers, but still reaches significantly more the farmers located in the middle-low level of the economic continuum. On the other hand, farmers in the upper levels seem to make more use of other types of change agents, like the veterinary school professors and the technicians of CAMIG, FOMENTO--agencies

located in Belo Horizonte, the state Capital. The same holds true for the commercial agents--the cooperatives are equally good contacts for the whole sample, but well-to-do farmers are the ones that get in direct contact with representatives of dairy products laboratories.

Confirming our expectations, these people are by far the most mobile and urban oriented group in the whole sample. Oddly enough, however, they are the ones who manifest least satisfaction with dairying, which they do not consider as a good business, and also do not feel it important for themselves to increase milk production and do not have definite plans to do so.

When we consider the psychological make-up of this group we find that besides manifesting more favorable attitude towards risk and change situations, they consistently perceive themselves as higher risk takers and more prone to change; as a matter of fact they are the higher self-raters in the composite index of self-perception. (See Table 15.)

Table 15. Percent of Farmers Showing High Self-perception, by Economic Ability

High Self-perception	Economic Ability			
	High	Med-Hi	Med-Low	Low
As an innovator	56	41	35	13
As a risk-taker	15	06	04	07
In General (index)	69	36	14	00

One last comparison of this group with the others refers to their position in the two Guttman-type scales used to measure knowledge about current events (about the municipio, the country, and the world) and instrumental knowledge about the five practices under study. The inspection of the contingency tables by economic ability shows that both types of knowledge sharply increase with increasing economic ability (in both cases chi-square values are significant at the .001 level). Percentages are shown in Table 16 for subjects scoring high in those two scales.

Medium-high Economic Ability Group

In this unit of analysis we start with 52 subjects who have a clear tendency to rate high in innovativeness: 71 percent of farmers in this group are classified in our configuration as high-adopters. Six variables of our paradigm were called to explain the variation in adoption of this group.

Table 16. Proportion of High Scores in Two Knowledge Scales, by Economic Ability

Economic Ability	Knowledge about current events	Knowledge about farm practices
High	.76	.50
Medium-high	.44	.46
Medium-low	.28	.26
Low	.03	.16

Nineteen cases (38 percent of this sub-sample) are readily explained by adding mass media use: 95 percent of high mass media users among the medium-high economic ability farmers rate high in innovativeness. The theoretical formulations about the effect of mass media in developing societies and individuals seem to have an additional bit of empirical confirmation here. Medium and low use of mass media, however, did not have discriminatory power to raise the adoption or non-adoption probabilities to the levels previously set. Informal social participation, among all other variables of our model, was the only one able to raise the probability of adopting to above .90. Inspection of the data tells us that this is the group with higher amount of social participation. They participate more in local events and activities, have more god-children, go more frequently to church and to the town of Esmeraldas. In this social interaction they certainly increase their exposure to new ideas and make themselves available to the interpersonal influence of peers and other farmers.

The remaining 19 cases are mostly associated with no adoption (.68 percent are non-adopters). The four persons in this group who had a sizable knowledge of the techniques of the practices adopted them. The remaining two adoption cases had to be put into the residual class of this subsample since the two other variables added did not help to explain their innovativeness. The last two configurations of this group are used to explain non-adoption. Medium-high economic ability associated with medium-low mass media, low informal social participation, low knowledge of farm practices and low concept of dairying as a good business leads to disadoption (100 percent, in the case of our data). Of the remaining eight cases, six are non-adopters. By classifying the eight subjects into high-medium and low risk orientation, we find that of the three high-medium risk takers, two are adopters, while the five low-risk takers are all non-adopters. The distribution of risk orientation score by economic ability indicates that only 10 individuals (20 percent) of the medium-high economic group falls into the low-risk category. It is interesting to observe how five of these farmers were

"filtered" through all four previous variables, and finally had their non-adoption explained at the bottom of the configuration in terms of their low risk orientation.

This completes the set of five configurations that explain the adoption and non-adoption behavior of medium-high economic ability farmers of Esmeraldas, leaving only three individuals in the residual class that could not be classified into any configurations.

Medium Low Economic Ability Group

Only two variables were included in the configurations used to explain the innovative behavior of the 62 farmers in the medium-low economic ability group. The fact that an almost even probability was initially associated with adoption and non-adoption and the lack of strong variables to discriminate adopters and non-adopters at the required level of .90, help to explain why two classes of 11 and 21 subjects respectively had to be considered as residual.

This seems to be the group that gets most influence from the change agent in the municipio. Effectively, by classifying the 62 subjects according high and low contact with change agents we achieve a sharp increase in the probabilities associated with the two possible outcomes. High contact with change agents raises the adoption probability from .48 to .63. This seems to be the group that makes up the bulk of direct ACAR clientele in the municipio of Esmeraldas, especially for the supervised credit program. Participants of ACAR's credit program meet regularly with the county agents for demonstrations, tours, and discussions about dairying techniques. It is only logical to link this continuous reinforcement of farm information plus the facilitating effect of favorable farm credit to the adoption of recommended techniques.

Table 17 indicates that 65 percent of medium/low economic ability group entertains high contact with ACAR, followed by the low economic group (58 percent), medium/high (41 percent), and finally, high (39 percent). When we look at the shares of the four different groups in contacts provided by ACAR we find that 37 percent of high contacts are with the medium/low group, followed by 27 percent with the lowest economic ability group, 22 percent with the medium/high, and 14 percent with the high economic ability group.

The second best explanatory variable for this group is again the use of mass media. From the 21 farmers who have high contact with change agents, 10 are also high mass media users. There are nine adopters (.90) in this sub-group. No variable could explain at the required level the adoption or disadoption of the remaining 11 individuals in this configuration and consequently they were assigned to a residual class.

Table 17. Distribution of Adopters and Non-adopters, by Contact with ACAR and by Economic Ability

Economic Ability	Non-adopters		Adopters	
	Contact with ACAR		Contact with ACAR	
	Low	High	Low	High
High (N - 39)	--	2	24	13
M/High (N - 52)	8	7	21	16
Med/Low (N - 62)	16	16	6	24
Low (N - 50)	18	23	3	6

Mass media use had also a good discriminatory effect in the classification of the medium-low economic ability, low contact with change agents subsample. High mass media users (there were 10 farmers with such high scores in this group) are decidedly adopters (with exception of one case.) Low mass media users of this subsample present exactly the opposite pattern: 10 percent adopters for 90 percent non-adopters. Medium mass media users (index score of 4 to 6) are about evenly distributed among adopters and non-adopters. This subsample with still a sizable number of subjects (21 individuals) resisted all efforts to classification, and no explanation for adoption was found at the level of 90 percent.

Low Economic Ability Subsample

Eighty percent of the low economic ability subjects in this sample are non-adopters. That is, the discriminatory power of the selected criterion for the configuration is manifested at the lower end of the continuum almost as strongly as in the higher. No single variable could alone lead the configuration to the desired probability, but the best predictor in this case, the choice of increasing milk production among four other concepts, increased the adoption

probability from .18 to .29, while the choice of any other concept raised the non-adoption probability from .82 to .85. This choice situation was tested using the paired comparisons technique, in which five concepts--increasing milk production, buying more land, buying more cattle, living without debts, and moving to town--were presented to the respondent two at a time in such a way that each concept had to be compared with all the others, and for each comparison the respondent was asked to make a choice. Further analysis of this information will be completed but will not be included here. For the purpose of the present report we are merely assessing the rank of the respondent in the "increasing milk production" concept as an indication of his motivation to improve his dairying situation.

For the 17 cases of farmers primarily interested in increasing milk production, five had a weak orientation toward credit and none of them were adopters. Twelve subjects of this low-economic-ability subsample rated high in the credit orientation scale, with five being adopters and seven non-adopters. Although these 12 cases are included in another residual class the variable makes a good contribution by raising the adoption probability of this low economic level group to almost 50 percent. Closer examination of respondents in this subsample reveals that they are part of the low economic dairy farmers fringe still assisted by ACAR, through the supervised credit program and through meetings and demonstrations.

Risk orientation score pushed the probability of non-adoption to the desired level for non-adopters, very much in accordance with our hypothesis of low risk associated with low economic ability working together to prevent adoption of farm practices. The small number of cases of high risk orientation along with low economic ability (only 4 subjects) prevents us from testing our hypothesis of high risk as a psychological determinant of innovative behavior at this low economic level.

This completes the possible configurations of the present study. The relatively small number of cases in the different residual classes makes in unproductive to add other variables. It should be noted however, that even the residual classes can be used for predictive purposes, since they have a probability associated with the configuration they represent; of course, those residual classes in which the probabilities of either outcome are considerably different from 50 percent offer the best predictive power.

What follows is offered as a brief summary of the adoption process in Esmeraldas as suggested by our proposed model and empirically tested with data on hand. For the kind of practices studied--simple, inexpensive, and not involving major changes in dairying operations--both ends of the economic ability continuum consistently discriminate adopters and non-adopters. High economic ability farmers are high mass media users, with a greater preference for the written word media than is displayed with other economic levels. They are also more mobile and urban oriented than other groups. Since they do not differ from other subsamples in contact with change agents, it seems logical to assume that they do have their own channels of information, such as mass media, specialized farm information and contact with innovative farmers outside the municipio area.

Mass media use and informal social participation play the decisive role in explaining adoption for medium high economic group. Attitudinal components of risk orientation and satisfaction with dairying only help to explain non-adoption for this subsample. Direct contact with change agents and mass media use are the only really discriminating variables to explain both adoption and non-adoption in the medium-low economic group. Increasing motivation along with facilitating credit seem to be the only conditions to move low economic people to adoption even in the case of simple and inexpensive practices like the ones considered in this study.

As a whole, our proposed model seems to make sense in explaining the adoption process of farm practices under the situation present in the study. It is particularly relevant for the middle-high and middle-low economic levels, where the different types of variables have an opportunity of showing their independent effect. The high and low segments are largely explained by economic conditions. However, it is our suggestion that by increasing the complexity, cost and total changing effect of the practices in the dairy operation, the attitudinal and information variables might be called on to aid in explaining the variance in adoption of the high level economic ability group.

CONCLUSIONS AND IMPLICATIONS

The model used in the study seemed to be a useful frame of reference for looking at the adoption of farm practices in Esmeraldas. The variables included in it were able to explain a great part of the variation in adoption and rejection of selected practices. Also most hypotheses it

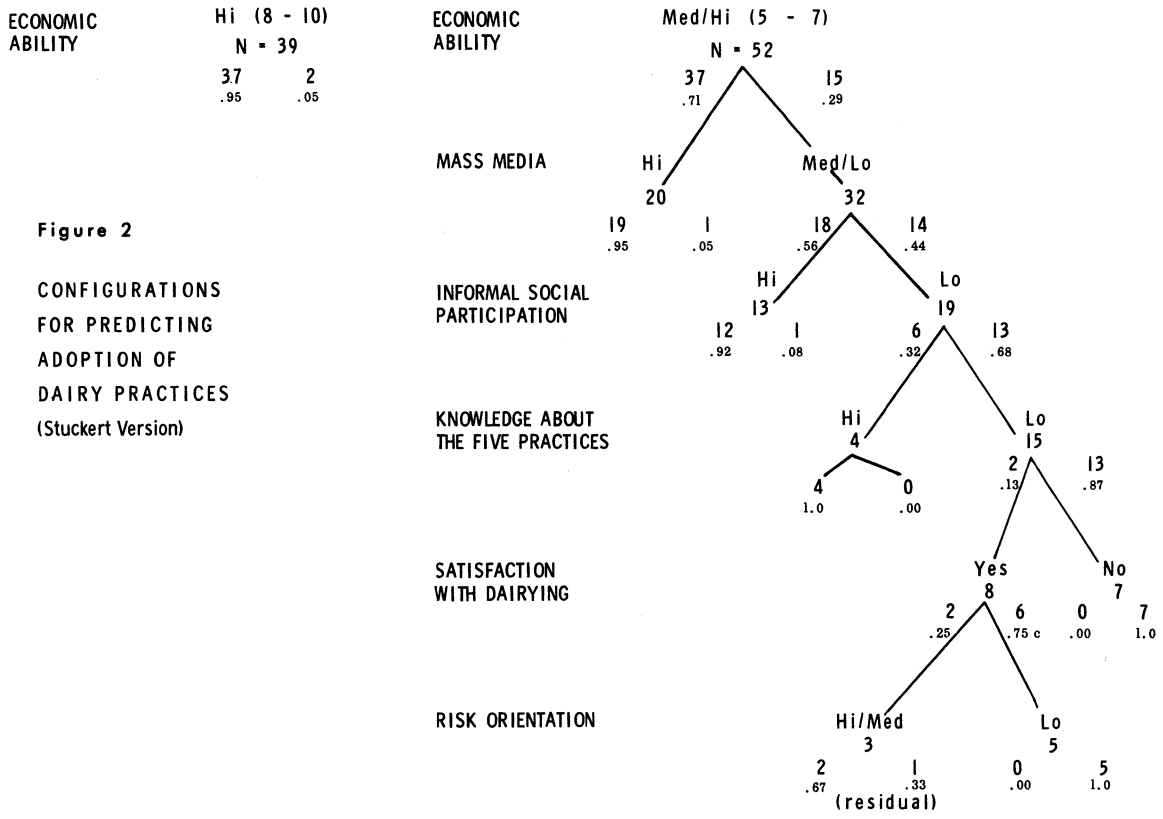
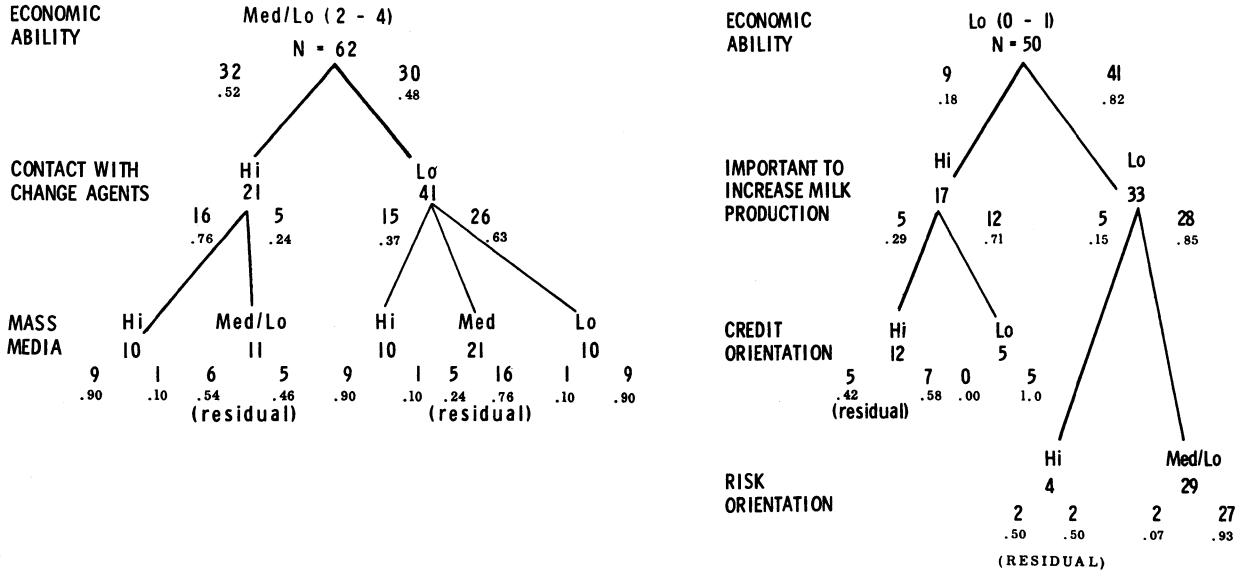


Figure 2

CONFIGURATIONS FOR PREDICTING ADOPTION OF DAIRY PRACTICES (Stuckert Version)



generated found support from data collected among dairy farmers. The method of configurations was particularly useful for allowing the analysis of homogeneous subsamples formed by the interplay of variables at different segments of the economic ability continuum. Positively, there seems to be some gain in this type of analysis when compared with multiple correlation analysis, another predictive approach extensively used in diffusion research.

Unquestionably economic ability is the variable with most predictive power. Consistently, high economic ability farmers adopt more and sooner than low economic level farmers. In Esmeraldas, to a considerable extent, the target audience of the agricultural change agent has been primarily the middle-low level farmers, but the high level dairy farmers place themselves far ahead in the adoption scale. This certainly bears a practical implication for any program aiming at bringing about adoption of new farming techniques. This is that when the objectives of the planned change program is to increase production, for instance, the economy of action suggests to work first and more intensively with the higher strata of the economic continuum.

Mosher (1955) refers to this very point in his analysis of the ACAR program in Minas Gerais, when he suggests that the program had so far not brought appreciable increases in agricultural production, especially because of its concentration in working with low economic farmers. Nevertheless, what our analysis seems to indicate is that even when the larger farmers do not do any better than the small farmers in their contacts with change agents, they do make better use of the information they get. Another clear suggestion of the data refers to the snowball effect of awareness and adoption in the municipio after the dairy project came into operation. The curve of green feeding plot adoption is a good example of how a practice could become rather general in the municipio with a sharp rate of adoption at all levels of economic ability. This seems to indicate the importance of the indirect influence of change agents in a society so inclined to exchange farm information through personal communication.

The psychological variables included in the theoretical model--risk orientation, and self perception--showed a marked relationship to the dependent variables. However, their isolated effect, in general, could explain very little of the variation in adoption. Because they are so interrelated with situational factors, especially economic variables, their pure effect becomes confounded and hard to assess in the low economic level people, where in only a few cases could appreciable measurements be made of these factors.

In the case of risk orientation, for instance, there is some indication that high risk oriented farmers with low economic ability tend to innovate more than low risk oriented farmers of the same economic level. The limited numbers of cases with that characteristic, however, prevents the adequate testing of this risk hypothesis. The conclusion here is

that this sort of variable has limited value in studies covering a very diversified sample, but that it should be more productive in extensive samples manifesting more homogeneity in situational factors. An indication of this is found in the better performance of these variables when the data were controlled for economic ability.

The communications behavior of farmers appeared as a strong factor in the awareness, adoption, and knowledge about farm practices, this effect being manifested with both mass media and interpersonal communication. An important finding of the study was that an already sizable audience for mass media exists in rural Esmeraldas.

Another finding that might have an implication for policy makers of change programs is that mass media exposure correlated significantly with our dependent variables at all levels of economic ability, but much more so at the low economic level. The fact that mass media use is highly correlated with urban orientation and that urban oriented farmers do significantly better as far as adoption and knowledge about farm practices is concerned should provide some hints as how to shape the message intended at changing knowledge, attitudes and behavior of farm people. The study suggested that mass media users have a more favorable attitude toward change. The implication here seems to be that change messages sent through these channels have a good chance of reaching people who are psychologically more open to try new ideas in their daily farm operation. The fact that there is a considerable audience for both the agricultural page and the farm broadcast considered in our questionnaire seems to support the point made above.

The importance of interpersonal communication as first source of information as well as influence in adoption was clearly demonstrated when we considered the adoption of five selected practices in Esmeraldas. So far, we learned that both the informative and the influential function in adoption are performed primarily by other farmers living in the same municipio, but not necessarily in the same community, in most cases by no relative of the informed and influenced person. Who these farmers are, however, and how different they are from their neighbors and peers we do not know yet. We do expect further analysis of our data to answer this question and to clarify the patterns of interpersonal communication that really affects the spreading and adoption of new farming techniques. Data also indicated that sheer social participation as measured in the study had no effect whatsoever on the adoption of the selected practices.

One last aspect deals with the role of change agents in the adoption of dairy practices. The study suggests that in general, there is low rate of contacts between change agents and dairy farmers of Esmeraldas, and that as a whole the sheer amount of contacts is not significantly correlated with adoption. ACAR is by all means the most active change program in the municipio. Its promotion of dairy practices probably can be considered quite successful, especially in regard to feeding practices not requiring complex or expensive equipment. The bulk of ACAR's contact and direct action resides in the middle-low segment of the economic

ability continuum, concentrated in a restricted section of the municipio, but its indirect influence can be seen on practically every farm in the municipio. In this respect this organization seems to have a catalytic effect in the technological change of Esmeraldas.

To summarize our findings about the adoption process of farm practices in Esmeraldas we can say that the high level economic ability farmers definitely represent the higher adopter group; their decision to incorporate practices such as the ones studied is independent of their particular psychological make-up of risk orientation and even of motivation to increase milk production. In other words, the sheer size of their operation is a good predictor for the adoption of these techniques. The medium-high economic ability sector is also very receptive to this kind of farm practice, but here their more intense communication behavior in terms of mass media and informal social participation works positively for prompt adoption. For this group psychological variables of risk orientation and motivation mainly explain only the non-adoption of a small proportion of the components of this group. For medium-low farmers the prevailing outcome of non-adoption is modified by the intense contact with change agents and exposure to mass media. For the low economic level, the definite expected outcome of non-adoption is only modified by an intense motivation to increase milk production and a favorable attitude towards farm credit, this last aspect being clearly a consequence of high contact with change agents in the municipio. Motivation and risk orientation are consistently low for all non-adopters of this low economic level group.

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