

SYSTEM VARIABLES AND AGRICULTURAL
INNOVATIVENESS IN EASTERN NIGERIA

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
BURL EDWARD DAVIS
1968



This is to certify that the

thesis entitled

SYSTEM VARIABLES AND AGRICULTURAL
INNOVATIVENESS IN EASTERN NIGERIA

presented by

BURL EDWARD DAVIS

has been accepted towards fulfillment
of the requirements for

Ph.D degree in Communication


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Date Nov. 22, 1968

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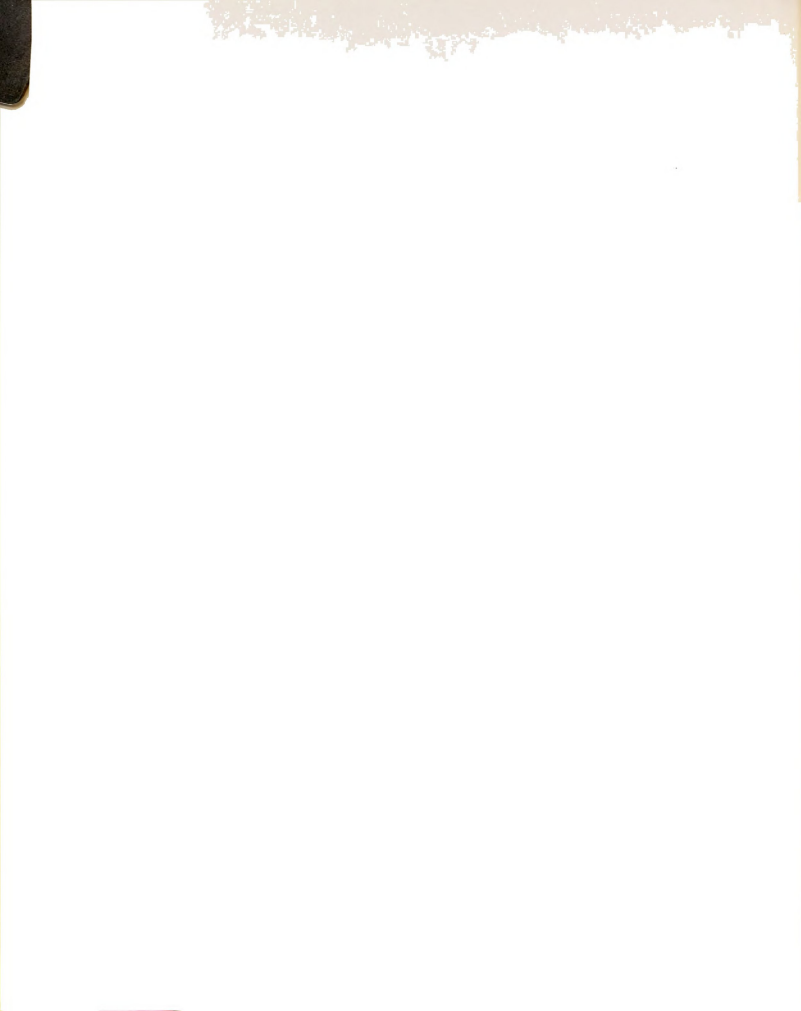
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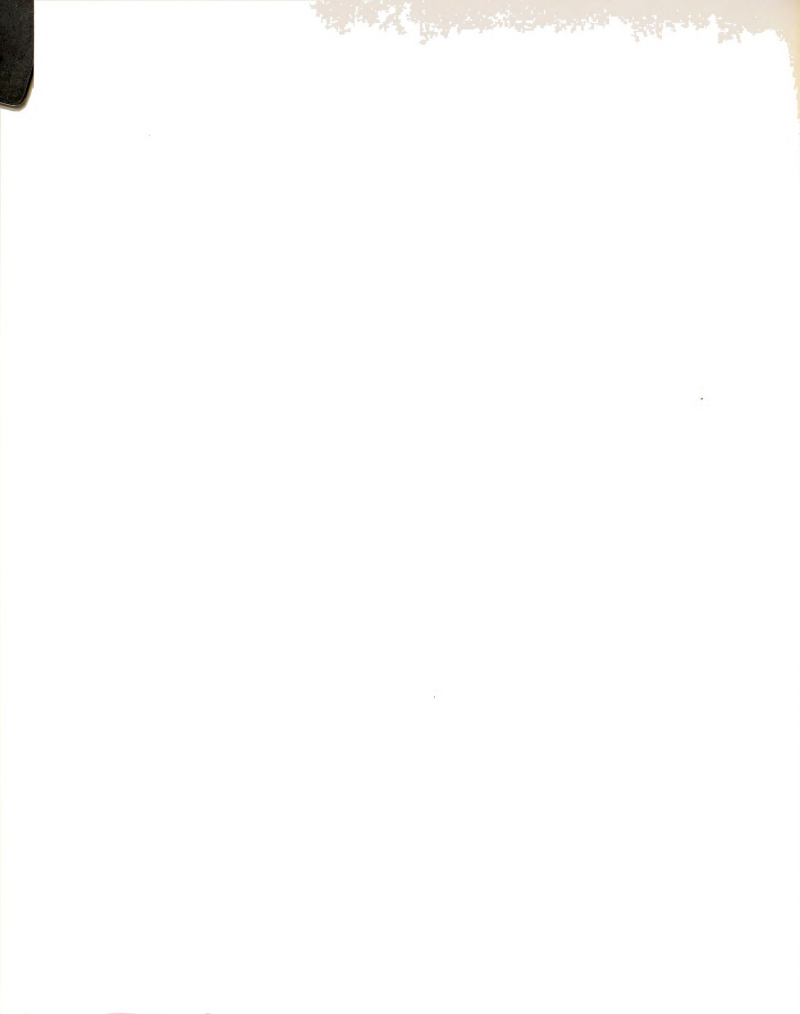
ABSTRACT

The present study was designed to explore the relations between individual modernizing characteristics of Nigerian farmers, the corresponding system characteristics, (the mean level of the individual characteristics in each of the villages), and the individuals' innovativeness. Of primary concern was the interaction between the two levels of modernizing characteristics in explaining greater amounts of variance in innovativeness.

A portion of the data gathered in the three-nation Diffusion Project conducted by the Department of Communication, Michigan State University, and sponsored by the United States Agency for International Development, was analyzed.

Eighteen villages were chosen as the basis for the study. The sample was comprised of 1,142 respondents, who were in each case a male, the head of his household, at least 20 years old, and farming some amount of land.

Fourteen agricultural innovations were selected for the study including: fertilizer, NS-1 maize, Aldrin dust, poultry, oil palm rehabilitation, community plantations, citrus, rice, improved cassava, vegetable seeds, cocoa planting schemes, rubber planting scheme, cashew, and FAID agricultural credit program.



Seventeen characteristics of individuals were utilized as independent variables, including cosmopolitaness, education, familism, educational aspiration, empathy, knowledge of agricultural workers, economic aspiration, literacy, newspaper exposure, radio exposure, film exposure, agricultural media exposure, credit orientation, level of living, correct agricultural knowledge, formal social participation, and achievement motivation. Each of these variables was aggregated through a measure of central tendency (mean) and utilized as an independent variable at the system level.

Three guiding hypotheses were selected as the focus of the analysis: (1) that the individual level of innovativeness for respondents is positively related to the individual variables, (2) that the individual level of innovativeness is positively related to the system variables, and (3) that the individual level of innovativeness is positively related to the joint influence of the individual and system variables.

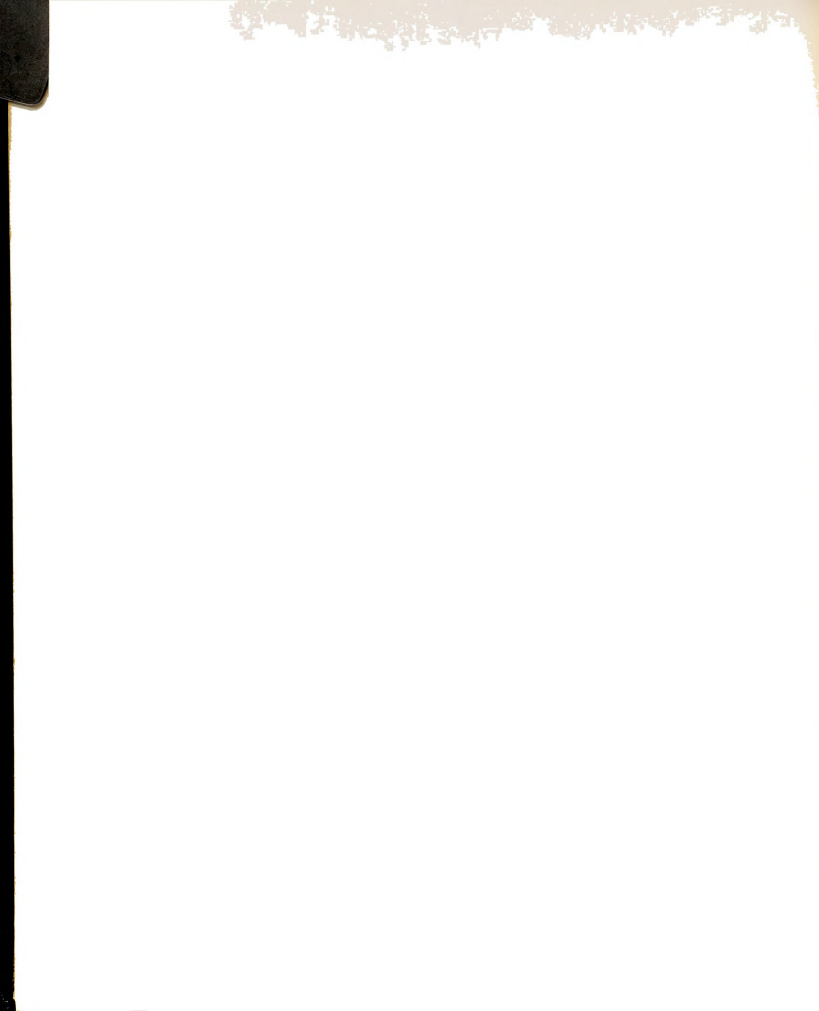
Three statistical methods were utilized in the analysis of the data: (1) zero-order correlation, (2) first-order and higher-order partial correlations, and (3) multiple correlation.

First, zero-order correlations were computed between innovativeness and each independent variable. Then, higher-order partial correlations between innovativeness and each of the independent variables were computed, holding constant all other independent variables. To determine the contribution of the system variables, partial correlations were computed for each of the system variables, with the individual level variables held constant.

After submitting the independent variables to both zero-order and higher-order partial correlation analysis, the best predictors of innovativeness (variables most highly correlated with innovativeness) from the system variables and the individual variables were included in the multiple correlation analysis, using the multiple regression least squares delete computer program.

When zero-order correlations were computed between the independent variables and innovativeness, 15 of the 17 individual level variables were significantly correlated with innovativeness: cosmopolitaness, education, familism, educational aspiration, literacy, newspaper exposure, level of living, radio exposure, film exposure, agricultural media exposure, correct agricultural knowledge, and formal social participation. System level variables significantly correlated with innovativeness were education, familism, educational aspiration, achievement motivation, empathy, knowledge of agricultural workers, economic aspiration, literacy, newspaper exposure, radio exposure, film exposure, agricultural media exposure, level of living, correct agricultural knowledge and formal social participation. In general, individual level variables were more highly correlated with innovativeness than system level variables.

First-order partial correlations were computed separately for individual level and system level variables with innovativeness. First, individual variables were correlated with innovativeness with system variables held constant. All but three of the individual level variables were significantly correlated with innovativeness. Next, system level variables were correlated with innovativeness with



individual level variables held constant. Only 7 of the 17 system variables reached statistical significance in this analysis.

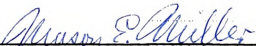
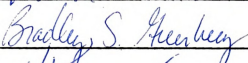
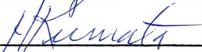
Highest-order partial correlations were then computed, to select variables from both individual and system levels most highly correlated with innovativeness, to be included in a multiple correlation analysis. Of the 34 variables submitted to the least squares delete computer program, 11 were deleted when they did not reach the minimum statistical significance criterion. Thus, a total of 23 variables were retained in the analysis as statistically significant after the highest-order partial correlation analysis, and these were combined in a multiple correlation analysis. The multiple correlation coefficient for these 23 variables was .68, with a coefficient of determination of .47.

When the individual level variables only were submitted to highest order partial correlation analysis, only six were retained as statistically significant. When entered into a multiple correlation analysis, these six individual level variables produced a multiple correlation coefficient of .62, and a coefficient of determination of .38. The difference between the multiple correlation coefficient for individual variables only, and the multiple correlation coefficient including both individual and system variables was statistically significant ($p < .05$).

Accepted by the faculty of the Department of Communication,
College of Communication Arts, Michigan State University, in partial
fulfillment of the requirements for the Doctor of Philosophy degree.


Director of Thesis

Guidance Committee:



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SYSTEM VARIABLES AND AGRICULTURAL INNOVATIVENESS

IN

EASTERN NIGERIA

by

Burl Edward Davis

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

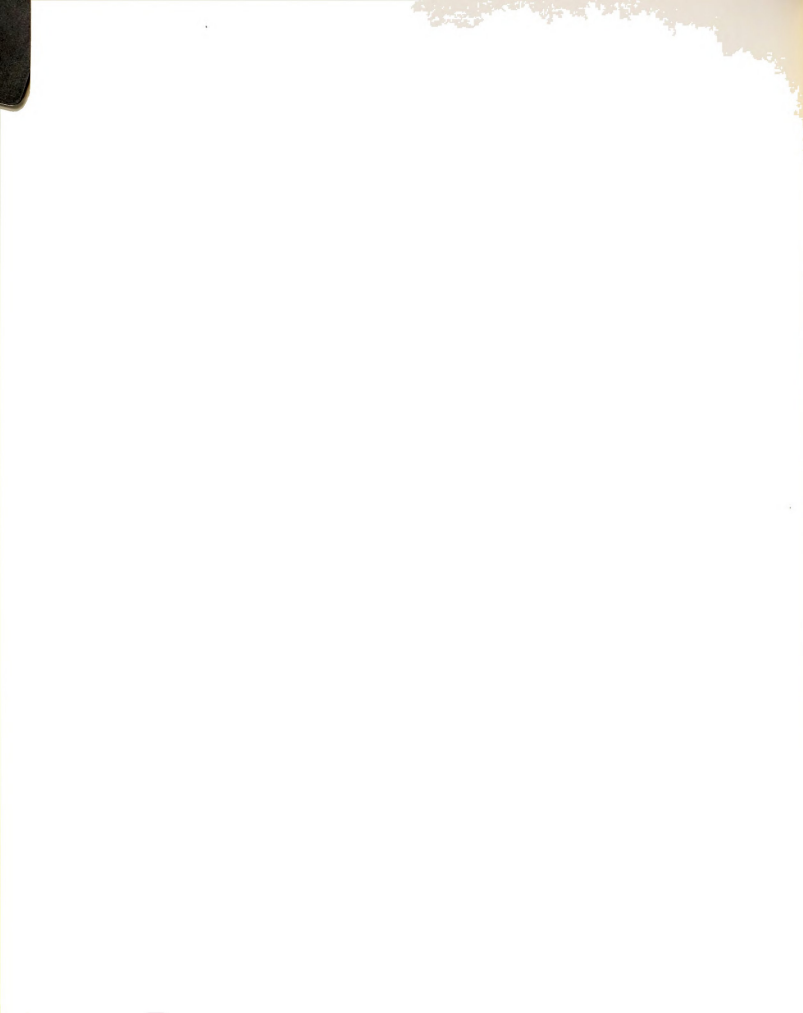
Department of Communication

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PREFACE

The research on which this dissertation was based was conducted in Eastern Nigeria during 1966-67. The Regional Government of Eastern Nigeria seceded from the Federation of Nigeria in May, 1967 and became the Republic of Biafra. As this dissertation goes to press, civil strife is still raging in the area and neither the present nor future status of the territory is not clear. Thus, the name "Eastern Nigeria" is used throughout this report. A tragic aftermath of the civil strife in this nation is that a large proportion of the respondents included in the present study are now no longer living, in all probability.



ACKNOWLEDGEMENTS

The author wishes to express his sincere appreciation to the chairman of his guidance committee, Dr. Everett M. Rogers, for the assistance and counsel tendered, not only during the writing of the author's dissertation, but during his entire graduate program. Gratitude is also extended to the other members of the author's committee, Dr. Hideya Kumata, Dr. Mason Miller, and Dr. Bradley S. Greenberg.

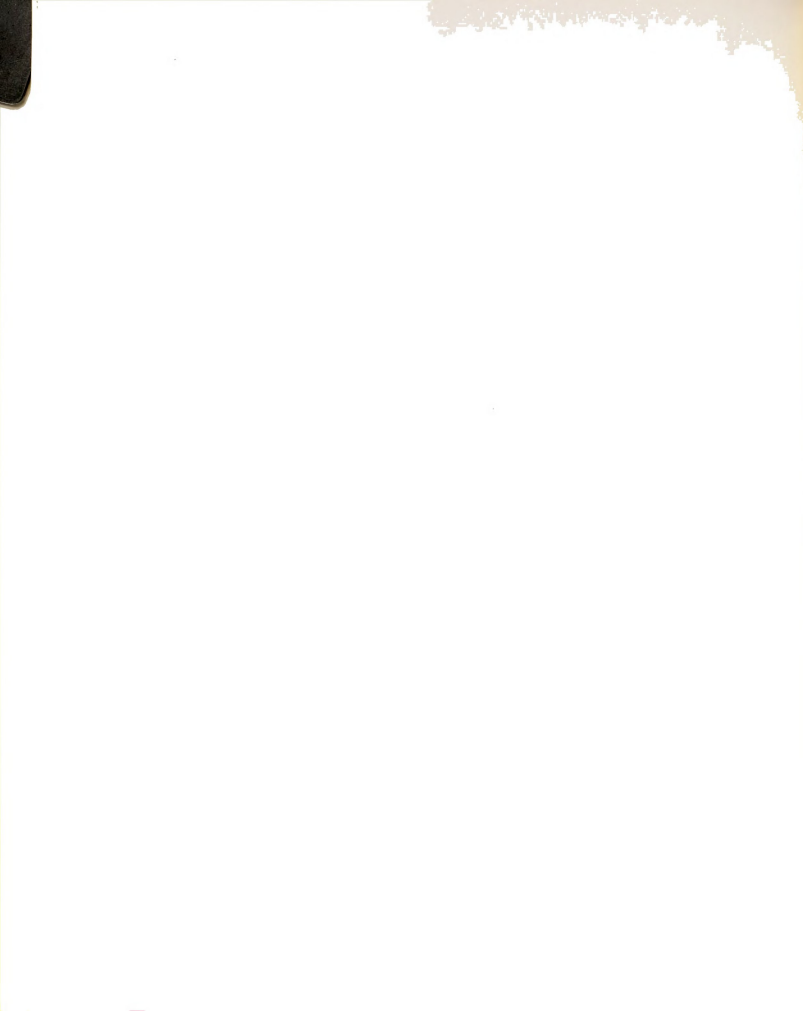
The author is also indebted to the United States Agency for International Development and the Department of Communication, Michigan State University, for permission to make use of data collected in Eastern Nigeria for the project, "Diffusion of Innovations in Rural Societies."

Thanks are also expressed to the numerous co-workers and fellow graduate students in the Department of Communication for the insights and theoretical assistance gained through many hours of discussion and consultation. Special thanks are due to Anant Saxena, who was of great assistance during the analysis of data for this report, and Niels Roling, Graham Kerr, and Joe Ascroft, who furnished invaluable background knowledge and helpful suggestions based on intimate knowledge of the conduct of the project in Nigeria.

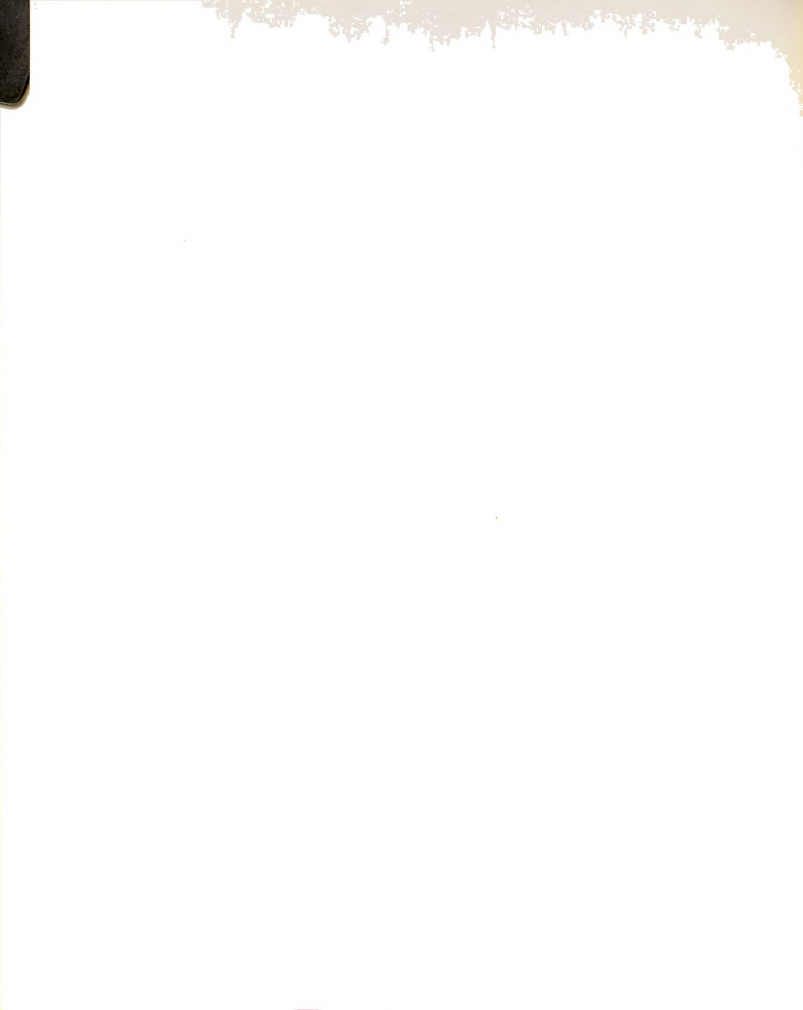
The author expresses his sincere appreciation to Miss Judy MacGregor, for her many hours of work spent in typing and collating the manuscript.

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CHAPTER I

INTRODUCTION AND DESCRIPTION OF PROBLEM

The introduction of technological innovations in traditional agriculture is one of the basic elements in rural development programs in less developed countries. The study described in the present thesis represents an attempt to understand one such development program in Eastern Nigeria. Consideration is given to social, psychological, cultural, and overt behavioral factors in attempting to describe and explain the processes of diffusion and adoption of fourteen agricultural innovations by individuals in eighteen Nigerian villages. Primary attention is given to the influence of system variables in increasing the amount of variance in innovativeness explained.

Diffusion Research

For a number of years, research workers in the field of communication and other social sciences have been interested in the spread and acceptance of new ideas. The diffusion of innovations in social systems and among individuals involves the communication of information about the practices from their sources of origin, and their acceptance by the end-users or adopters. Generally, the analysis of the diffusion of innovations involves four crucial elements: (1) the innovation, (2) its communication from one individual to another, (3) in a social system, (4) over time (Rogers, 1962, p. 12).

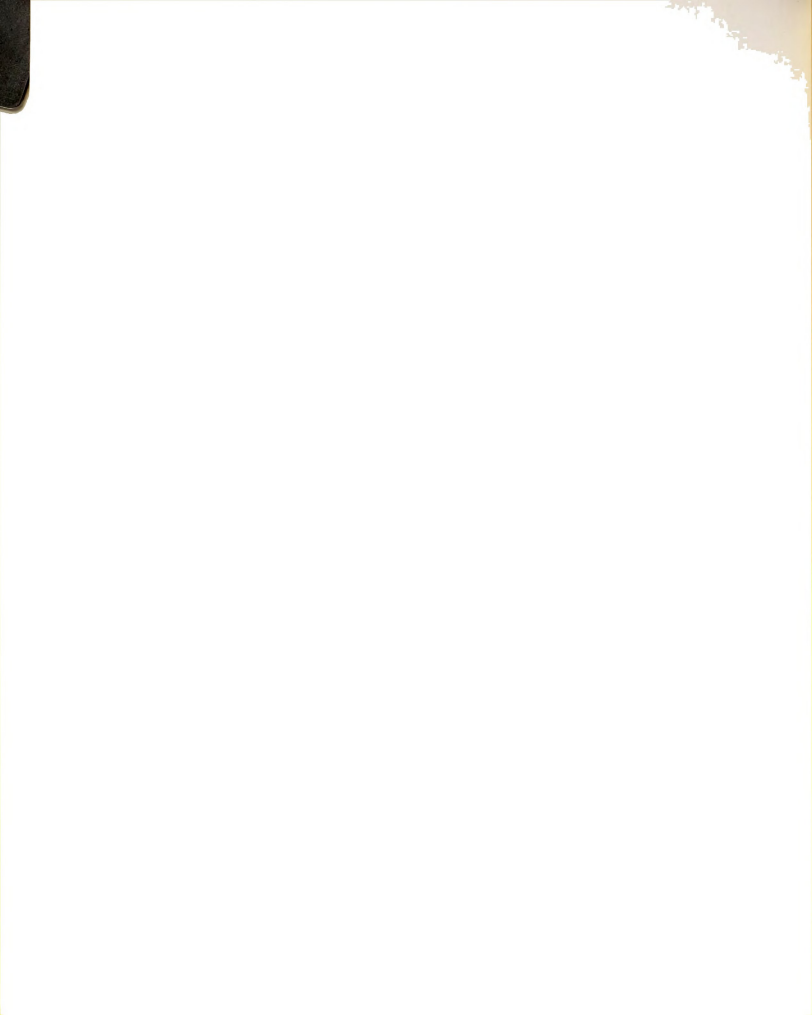
Since its initiation in the 1920's, diffusion research has produced an imposing body of research findings, both in the United States and in

other nations. Typically, the findings have pointed out the individual, group, and situational elements which influence the innovation-decision process. The elements involved in the investigation of diffusion processes are manifold; however, a few have received major emphases, for various reasons.

For instance, diffusion researchers generally agree that adopters can be categorized according to their individual tendencies to be relatively early or late to adopt a new practice. Operationally, receivers are divided into categories according to their relative innovativeness. For any given innovation, the period of time since each adopted the innovation is recorded and standardized across the unit of analysis (e.g., the village, region, or state). Assuming a normal distribution, and utilizing standard deviations, the earliest 2.5 percent are classified as innovators; the next 13.5 percent, early adopters; the next 34 percent, early majority; another 34 percent, late majority; and the final 16 percent as laggards (Rogers, 1962, pp. 160-171).

Another major area of interest in the diffusion research tradition centers around the explication of the innovation decision-making process. The North Central Regional Rural Sociology Subcommittee for the Study of Diffusion of Farm Practices (1961) divided the adoption process into five stages: awareness, interest, evaluation, trial, and adoption. Dissatisfaction with a five-stage conceptualization led others to propose other classifications. Rogers with Shoemaker (in press) speak of four "functions" (rather than "stages"): knowledge, persuasion, decision, and confirmation.

Other major generalizations from the diffusion research tradition deal with the S-shaped curve of adoption, the role of the various



communication channels at the different stages of the adoption process, and the characteristics of the innovation itself that enhance (or retard) its rate of adoption.

Growth of Cross-Cultural Research

One striking development in the field of diffusion research is the marked increase in the number of diffusion studies being conducted in countries outside the United States, especially since about 1960. The value of this trend is illustrated in the testing of the cross-cultural applicability of communication principles and generalizations that emerged originally from intra-national research. To achieve maximum utility, researchers need to find hypotheses about the diffusion of innovations that are generally true, regardless of the geographic and cultural locality of the study.

This trend toward internationalization of the field of inquiry has been prompted both by the overseas migration of North American researchers, and by a growing number of non-U.S. scientists conducting diffusion research. A recent analysis of the publications in the Diffusion Documents Center at Michigan State University revealed that less than 10 percent of the studies listed had been conducted outside the United States in 1960, but by 1965 this percentage had risen to 26.8 percent, or a net increase from 38 to 190 studies conducted in the developing countries over a five-year period (Rogers and Stanfield, 1968, p. 10). A cursory examination of a recent issue of the Bibliography on the Diffusion of Innovations (Rogers, 1967) indicates that well over one-half of the studies listed were authored or co-authored by nationals from developing countries.

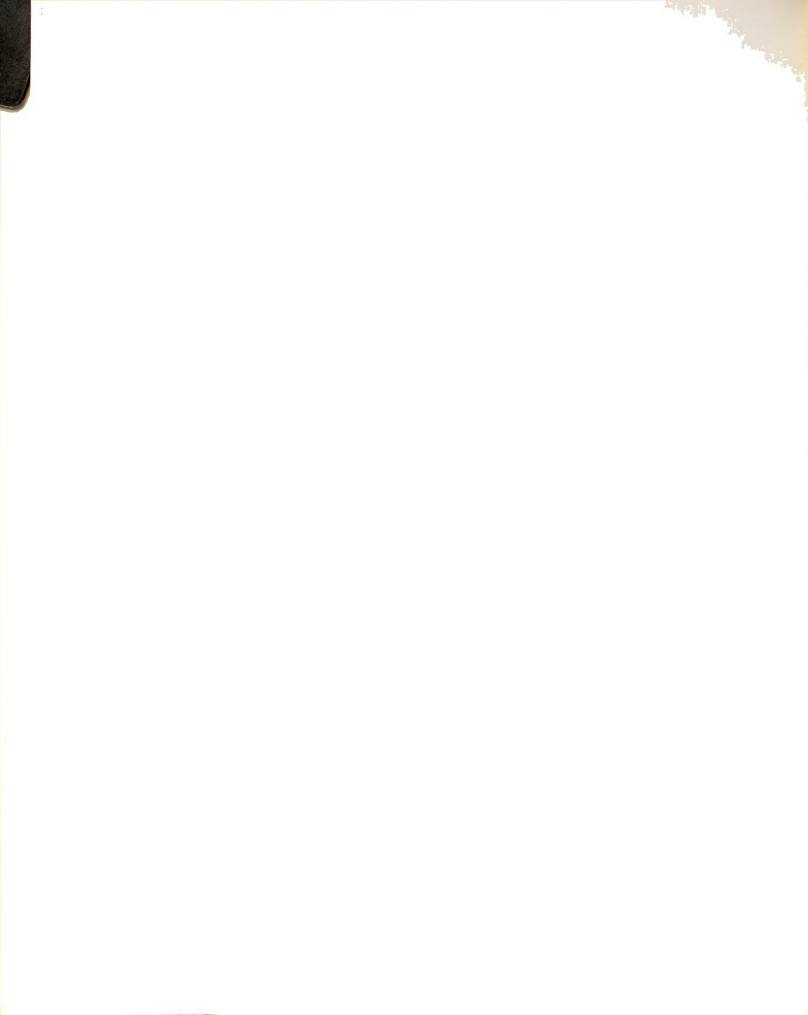
The study described in the present dissertation represents a further contribution to the growing number of investigations of the diffusion of innovations in less developed countries.

Focus of the Present Study

When one considers the various units that may form the bases of analysis in the diffusion of innovations, several possibilities appear. The following simplified typological classification illustrates this point:

		Independent Variable	
		Individual	System
Dependent Variable	Individual	A	B
	System	C	D

In many of the diffusion studies conducted to date, much emphasis has been placed upon the individual characteristics of the receiver, and their effect upon his individual decision to adopt or not adopt the innovation (category A in the paradigm). For instance, the relatively earlier adopters in a social system in the United States have generally been found to be younger in age, have higher social status, a more favorable financial position, more specialized operations, and a different type of mental ability than later adopters (Rogers, 1962, pp. 171-178). Socio-economic, demographic, and socio-psychological characteristics of individuals were utilized widely as independent variables in explaining innovativeness in various individuals.



However, individuals engaged in the innovation decision-making process clearly do not exist in an isolated state. They are surrounded by a myriad of influences, ranging from prevailing social system norms and the level of education, wealth, and age of others in their system, to contact with cosmopolite friends, distance from urban centers of population, and the availability of communications media. Thus, the present study focuses on the additional amount of variance in innovativeness explained by taking into account the "system variables" in the social system under consideration, as well as the "individual variables" (categories A and B in the paradigm). System variables are defined as those structural, compositional, or social-psychological characteristics whose distribution in the system influences the behavior of individuals in that system.¹

The central problem considered in the present study is represented by the following questions:

(1) Do the properties of a social system influence the behavior of its members? If so, what is the nature and the direction of such influence?

(2) How much additional variance in the behavior of the individuals in a social system can be explained by the simultaneous consideration of both individual and system variables?

¹A more detailed definition is given in Chapter II.

The Role of Communication

Members of a number of research traditions have been interested in answers to these two questions, especially sociologists. However, the present study is designed to focus on the communication aspects of the problem, from three viewpoints:

(1) the introduction of innovations to villagers in a less developed country is essentially a communication process. When viewed from the standpoint of the source or instigator of the change, the introduction of innovations may be classified as either immanent change, which occurs when members of a social system with little or no external influence, create and develop a new idea, or contact change, which occurs when the source of the new ideas is outside the social system (Rogers with Shoemaker, forthcoming, p. 17). Contact change is a change phenomenon occurring between systems. The present study is an example of contact change, inasmuch as the agricultural innovations included in the study were introduced into each local social system by an outside source (agents from the Eastern Nigerian Ministry of Agriculture), through their communication with the villagers in the social systems.

Obviously, other types of consideration are inevitably involved in the process of diffusion of innovations (such as economic, political, cultural, etc.), but communication from the change agency to receivers in the receiving social system is basic to the process of contact change.

(2) Once introduced into a social system, the innovation is diffused within the social system by a process of communication. Both interpersonal and mass media channels are utilized in the within-system



diffusion process. If communication is viewed as the process by which messages are transferred from a source to a receiver, it may be illustrated by the SMCR model of communication (Berlo, 1960, p. 72), in which a source (S) sends a message (M) via certain channels (C) to the receivers (R). Communication factors are vitally involved in the various aspects of the diffusion process within the social system, and are an important element pervading the social change process. A number of social, psychological, and cultural attributes of individuals are relevant as antecedent correlates of diffusion and a number of social, psychological, and cultural attributes of individuals will be changed as a result of the diffusion process, but the central area of concern integral to the entire realm of activities is communication, from one member of the receiving social system to another member of the receiving social system. The diffusion process is conceptualized, therefore, as a multi-faceted communication process involving the spread of new ideas from a source to an audience of receivers via a series of sequential transmissions, as well as by direct contact with the change agency itself. Thus, communication is vital to within-system diffusion of innovations.

(3) A number of specific communication variables are considered as independent variables in our analysis of innovativeness within the social system. These include exposure to agricultural communications media, exposure to newspapers, exposure to radio, and exposure to films (see Table 3). In addition, a number of modernization characteristics such as empathy, education, achievement motivation, cosmopolitaness, etc., which are expected to exert influence upon the receivers' perception and reception of the modernization messages, are included.

Value of the Present Study

The investigation of innovativeness described in this dissertation may be justified by the following considerations:

(1) It is a further contribution to the evaluation and testing of theories of diffusion through studies conducted in cross-cultural situations, specifically in less developed countries where studies are few. Many of the generalizations derived from diffusion research have been based on investigations conducted in the United States. The locale of the present study is one of the less developed countries of the world (Nigeria), so that application of existing principles of diffusion in this situation represents an extreme test of their validity and reliability.

(2) The present study represents an extension of the analysis of innovativeness to include elements of the village system which affect the rate of adoption, as well as personal characteristics of each individual in the village. The analysis of both levels of variables is widely discussed and utilized in other social sciences, but very few studies use this type of analysis in diffusion research.

(3) The inclusion of both system variables and individual variables in the analysis helps prevent the commission of the "ecological fallacy" (Robinson, 1950), the "psychologistic fallacy" and the "sociologistic fallacy" (Riley, 1963, pp. 703-709).¹

(4) The present study represents a merging or convergence of the individual level analysis typically employed by psychologists, social psychologists, sociologists, etc., and the aggregative, molar type of analysis typically employed by economists, ecologists, geographers, etc.

¹Definitions of these fallacies are discussed in Chapter III.

The Setting for the Study

The present study is based on an analysis of data representing one portion of a much larger, more comprehensive Diffusion Project conducted by the Department of Communication, Michigan State University. This study was sponsored by the United States Agency for International Development, and was conducted concurrently in three nations in three widely separated and differing areas of the world, Brazil, India and Nigeria. The present analysis derives from the research conducted in Nigeria, where the project was affiliated with the Economic Development Institute, University of Nigeria, Enugu, and the Nigerian Ministry of Agriculture.

The Nigerian diffusion project was designed to investigate the diffusion of health and agricultural information and the acceptance of health and agricultural innovations. Data were gathered on numerous social, psychological, cultural, economic and geographical factors to describe and explain the diffusion and adoption processes. More complete information regarding the collection of data, sampling procedures, etc., are given in Chapter IV.

The Nigerian study was conducted in three phases. In Phase One, the unit of analysis was the village; the purpose was to analyze villages in terms of their success in programs of planned change. In Phase Two, the unit of analysis was the individual head of a farm household, and the purpose was to determine how the individual's social characteristics, family structure, farm business, communication behavior and various social psychological characteristics were related to his innovativeness, attitude toward change, opinion leadership, etc.

The present study utilized data from both Phase One and Phase Two.¹ Phase One data were used to derive measures of the social system's characteristics, and form the basis for the determination of which villages to include or exclude in Phase Two; Phase Two data were used to derive correlates of innovativeness for the individuals.

Objectives of the Present Study

Our objectives for the present study were threefold:

(1) To determine whether various attitudinal, cognitive and overt behavioral characteristics found related to innovativeness in other studies were relevant in diffusion research in a less developed nation.

(2) To determine whether the distribution of modernizing characteristics within a social system influence individuals toward greater innovativeness, in addition to the individual's own personal characteristics.

(3) To derive generalizations and form conclusions which may be helpful in the formulation of a strategy for change by various change agencies.

General Outline of Following Chapters

A brief summary and introduction to the discussion outline to be followed in the following chapters may be helpful at this point.

In Chapter II, a theoretic foundation for the analysis of system effects is presented, including a review of relevant literature, a definitional discussion of system analysis, a description of the methodology utilized to determine system effects, some theoretic and

¹Phase Three of the Diffusion Project is described in Chapter III.

methodological fallacies that must be avoided, and a listing of both independent and dependent variables used in the present study.

Chapter III discusses the research methodology utilized in the investigation, including a description of how villagers, respondents, and interviewers were selected, how data were collected, and how the research instrument was formulated and revised. A brief description of methods of correlational analysis utilized is included, along with a description of how both dependent and independent variables are operationalized.

In Chapter IV, the findings of the investigation are presented, in both verbal and tabular form, and in Chapter V, the findings are summarized, conclusions are stated, and implications for future research are given.

CHAPTER II

THEORETIC RATIONALE

Review of Literature

Although scarcely mentioned by diffusion researchers, the concept of "system effects" is not new. Durkheim (1897) showed not only that suicide rates vary considerably among different religions, but also that suicide rates for members of a given religion are much lower when these individuals are a minority in the society. He maintained that research methods dealing with social groups rest wholly on the basic principle that social facts must be studied as "things"; that is, as realities external to the individual. Although Selvin (1958) subsequently accused Durkheim of ignoring the individual, treating the group as an entity, thus committing the error of reification,¹ Durkheim apparently was one of the first to recognize the influence of system effects in addition to individual characteristics in personal behavior.

Groves and Ogburn (1928) investigated the marriage rates for men and women, and found that they varied inversely with the sex ratios of the communities in which the subjects lived. Faris and Dunham (1939) obtained similar results in studies of rates of psychosis. Stouffer (1949) investigated attitudes toward promotion among soldiers in a military police unit and an air force unit, and found that the individual's attitude toward promotion was influenced markedly by the general

¹Reification is defined as the conversion of an abstraction or mental construct into a supposed real thing (Webster's New Collegiate Dictionary, 1958. Springfield, Massachusetts: G. & C. Merriam Co.)

rate of promotion in the unit of which he was a member. Generally, promotion was evaluated more highly in units where group promotion rates were low, than in units where group promotion rates were high.

Blau (1960) reported that data from an analysis of a public assistance agency showed that the prevailing values in a work group had structural (system) effects. In some cases, the group values and the individual's orientation had similar, but independent, effects on the conduct of the individual; in other cases, they had opposite effects; and in still others, the effects of the individual's orientation were contingent on the prevalence of this orientation in the group, a pattern which identifies characteristics associated with deviancy. Blau further commented that most social surveys tend to make individuals the focus of the analysis, and ecological studies typically examine social units without separating social conditions from the individual's own characteristics. Blau thus called for the simultaneous use of indices of social structure (system effects) and of individual behavior, such as the present study contemplates.

Other sociological studies dealing with system variables include Berelson et al. (1954), who showed the effects of community composition in terms of party affiliation on voting behavior; Lipset et al. (1956), who found system effects in their study of a labor union; and Davis et al. (1961), who encountered system effects in their study of the Great Books reading groups.

A number of research investigations examined the influence of system effects in formal organizations. Becker and Stafford (1967) conducted

a mail survey of 140 savings and loan associations in Illinois, to discover the effect upon organizational efficiency of five independent variables, including the size of the organization (measured in assets), the growth rate of the surrounding community, the adoption of innovations, the size of the administrative component, and the management's leadership style. These five variables explained 40 percent of the variance in the organizational efficiency of the institutions.

Sapolsky (1967) studied nine retail organizations in six department stores, using personal interviews, and found that three major innovations suggested by store executives were not implemented because of the nature of the stores' organization and reward systems. Similarly, in a study of factors associated with the success or failure of various staff proposals (innovations), Evans and Black (1967) found that the structure of the organizations studied, the attributes of the staff-line relationships that affected the innovation process, and the attributes of the innovative proposal were positively associated with the adoption of innovations.

Shepard (1967) classified various organizations as either innovation-resisting or innovation-producing, based on an analysis of numerous system variables which influenced the attitude of the members toward innovations.

Within the rural sociology diffusion research tradition, a number of studies gave further evidence of the influence of system variables on the adoption of innovations. Marsh and Coleman (1954), for instance, studied 393 farm operators in one Kentucky County, and found that socioeconomic characteristics and the neighborhood of residence were both

positively related to the adoption of recommended farm practices. Even when socio-economic characteristics were held constant, it was found that the extent to which farm operators adopted farm innovations was, in part, a function of the neighborhood of residence.

Flinn (1963) investigated the influence of community norms in predicting agricultural innovativeness. Defining norms as a pattern for behavior in a social system with both objective and subjective qualities which can be inferred from overt actions and verbal responses, he found that community norms relative to innovativeness, as inferred from overt action, account for more variation in farmer innovativeness than any other variable studied. Five variables taken together explained 64.1 percent of the variance in innovativeness, with community norms alone accounting for 20 percent of the variance explained.

In a study of 343 farmers in 12 neighborhoods in Kentucky, Young and Coleman (1959) found that farmers in high adoption neighborhoods ascribed scientific farming attitudes to their neighbors, and said they were frequently guided by the influence and opinions of their neighbors.

Van den Ban (1960) studied 47 Wisconsin townships to test the hypothesis that the social organization and culture of locality groups influence adoption more than individual socio-economic factors (such as education, farm size, net worth, etc.). After dividing the townships into four groups according to their innovativeness scores, van den Ban found significant differences in innovativeness among the groups, because of differences in social structure.

Coughenour (1964) analyzed data on the diffusion of five farm innovations in 12 Kentucky localities for speed of diffusion and factors

relating to it, and found positive relationships with socio-economic and attitudinal resources of each locality, along with the nature of social relationships with information sources and media contacts.

Duncan and Kreitlow (1954) matched and compared 19 pairs of rural neighborhoods on the adoption of 30 school innovations, using an index of 25 farming practices and four elements of organizational participation. The neighborhood was the unit of analysis, and the mean score of 10 respondents in each neighborhood was set as the acceptance value for the entire neighborhood. Heterogeneous neighborhoods were found consistently more favorable toward a majority of the innovations, indicating the influence of both social structure and norms.

By including a system variable called "norms on innovativeness," Rogers (1961) was able to improve predictions regarding the innovativeness of truck farmers, when earlier studies had been characterized by low prediction levels.

Qadir's (1966) analysis of "compositional"¹ effects and their influence on the adoption of technological innovations by some 600 villagers in 26 Philippine neighborhoods indicated that system variables (e.g., mean media exposure, mean education level, etc.) were effective as predictors of individual innovativeness. He concluded, "The investigation in the rural area of the Philippines confirms that the barrio as a locality group has an effect on the individual's behavior toward adoption of technological change."

¹Qadir's usage of the term "compositional effects," is practically synonymous with the usage of the term, "system effects" in this dissertation.

Regarding this review of literature, several generalizations may be drawn:

1. Although a number of studies mentioned system effects as part of the overall research design, almost none focused on system effects as the central problem of the research. In fact, many of the studies considered system variables only after other variables were unsuccessful in predicting innovativeness; thus, system effects were considered only secondarily and in a residual capacity.

2. Many studies investigated the effect of the personal characteristics of a large number of individuals upon the dependent variables. Typically, little attention was given to the socio-cultural and communication environment surrounding these individuals. These dimensions are essentially system variables.

3. When the influence of the social system was considered in the analysis, often only one system (e.g., one village, one community, etc.) was analyzed for its influence upon the dependent variable. Almost no earlier studies included a sufficiently large number of communities (or other systems) to permit testing of hypotheses about community characteristics and adoption of innovations with any degree of rigor.

In the study herein described, we go beyond the analysis of the characteristics of individuals, and include characteristics of the system (i.e., the village) in which the individuals (whose behavior we seek to explain) reside.



System Analysis

Because of its emphasis upon the complex functional inter-relations between members of a group, organization, culture, or social system, system analysis seems to be peculiarly appropriate to the study of the introduction of innovations in less developed countries. What are the distinctive characteristics of system analysis? What is the precise meaning of the various terms and concepts utilized in this type of investigation?

Schramm (1965) offers the following definitional discussion of a system:

When we refer to a system, we mean a boundary-maintaining set of interdependent particles. By interdependence, we mean a relationship [among] parts such that anything happening to one component of a system affects, no matter how slightly, the balance and relationship of the whole system. By boundary-maintaining we mean a state in which the components are so related that it is possible to tell where the system ends and its environment begins.

From the standpoint of diffusion research, we can define a development system as a complex of interrelated parts where innovation-receiving units are linked to each other and to a central innovation-introducing unit or change agency through channels of communication. The linkage of the two subsystems--the change agency (or the source) and the adopter population (or the receivers)--is a basic requisite for innovation diffusion and development. For the purposes of the present study, the major components are: (1) the source or the change agent responsible for introduction of (2) innovations (3) in a receiver (or adopter) population

of individuals, groups, or organizations (4) who are linked to each other and to the sources by channels of communication.

An individual variable is defined as any of a group of selected social, psychological, cultural, or communication characteristics of individuals within the social system, which affect their individual innovativeness in adopting a given innovation.

System variables are defined as the mean level of any of a group of selected social, psychological, cultural, or communication characteristics within the social system, which affect the innovativeness of individuals within the social system.

A system effect is defined as any observable or measurable change in the attitude or behavior of the individuals within the social system, that can be attributed to the influence of the system variables.

In certain research traditions, analyses are sometimes made which explore the complete network of interrelationships between the social, cultural, psychological, and communication variables in a given social system. However, such an investigation (often called a "social system analysis") lies beyond the realm of the present study, for several reasons.

First, many attempts to conduct such investigations have been primarily descriptive in nature. The present investigation purposes to find correlates of innovativeness which can be useful in predicting the adoption or rejection of new technologies.

Second, few reliable and appropriate research methods have been devised to conduct such a study. Of course, for many purposes, a full



analysis of the entire social system with all the complexities and interrelationships of its components is not necessary. Most studies have been somewhat selective in their focus.

The present study also is designed as only a partial analysis. It is not designed to present a comprehensive description of every facet of the social systems selected for study, but rather to explore certain rather general hypotheses regarding various socio-cultural and communication variables, at both the individual and system level, and their relation to a single dependent variable (innovativeness).

This study, therefore, deviates from the "system analysis" often utilized in physics, engineering, or the natural sciences. It is a "system analysis" only to the extent that it utilizes selected system variables to explain variance in the dependent variable.

The essential feature of system analysis pertinent to this study is that data for selected characteristics are gathered from various levels in a total system (i.e., from the sub-systems composing the total system), and analysis is made of their function, both independently and jointly, within the system under study. Thus, one is concerned in the system approach not only with the major or primary effects of the independent variables, but with their interaction effects as well.

Various terms have been used by different authors in describing the various elements involved in systems analysis. Blau (1957) gave the following definition of structural effects:

The general principle is that if ego's X affects not only ego's Y but also alter's Y, a structural effect will be observed, which means that the distribution of X in a group is related to Y, even though the individual's X is held constant. Such a finding indicates that the network of relations in the group with respect to X influences Y. It isolates the effects of X on Y that are entirely due to or transmitted by the process of social interaction.

Contextual analysis has been described by both Sills (1961) and Riley (1963, pp. 700-703) as an approach by which the effects of the properties of groups or collectives on individuals have been studied. Davis et al. (1961, pp. 215-225) use the term compositional effects to describe the analysis of the influence of variables formed from the properties of members of the collectivities. Another term used (Valkonen, 1966) is ecological analysis, which may take either of two forms: (1) taking areal units as wholes in their own right, for somewhat global analysis, or (2) taking properties obtained by aggregating properties of smaller units (e.g., of individuals).

Selvin and Hagstrom (1963) classify the properties of a system into (1) aggregate properties, based on characteristics of smaller units within the system being described, and (2) integral properties, which are not based on smaller units, but on the system as a whole. Lazarsfeld and Menzel (1961) disagree with these terms, and speak instead of analytic and global properties of a system. To illustrate these concepts, an aggregate or analytic property of a system might be the mean level of exposure to the mass media of communication, whereas an integral or global property might be the presence or absence of a mass media facility such as a radio station, in the system under consideration.

Cattell posits three categories of system variables (1951):

(1) syntality variables, which describe the behavior of the social system acting as a whole, (2) structure variables, which describe internal characteristics, and interaction among members, and (3) population variables, which describe the distribution of status, personality, and attitude-interest variables among the members of the system.

Undoubtedly these semantic disagreements have been occasioned by efforts to speak more precisely and accurately about the variables being considered by various researchers. In the present study, our primary concern is not to end this debate but to ascertain whether variables of this general description help explain additional amounts of variance in the innovativeness of the respondents in the study. We employ two broad categories of variables in this respect: (1) individual variables, which pertain to individual characteristics of the respondents, and (2) systems variables, described elsewhere as contextual, compositional, structural, aggregate, analytic, or population variables.

Theoretic Rationale

In considering the effects of system variables within the Nigerian villages studied, we ask: How do they influence the innovativeness of the individuals in these villages? In what ways do the system variables affect the individual's decision to adopt or not adopt the innovations? Several possibilities exist.

1. There is, first of all, the possibility that the differences between the villages included in the study are random. This would mean

that the variance in the system variables from village to village simply is an expression of the normal distribution of such variables, and has no systematic relationship to the dependent variable. Thus, one would expect to find differences regarding the system variables as one moves from village to village, but these differences would not be significantly correlated; i.e., they would not covary concomitantly beyond chance expectations with differences in innovativeness in the various villages. Such a situation would be expressed by the null hypothesis:

H_0 = The various elements of the total system in the villages are not related to the innovativeness of the residents of these villages.

2. A second possibility is a situation in which the differences in the adoption of innovations by the villages are associated with variance in a single independent variable among the villages. Take, for instance, a situation where innovativeness varies beyond chance expectations from village to village. If the presence of a single variable (e.g., educational level) also varies from village to village, one might hypothesize that different levels of education among the villages explain the different adoption rates. Such a situation may be expressed by the following mathematical equation:

$$Y'_{ij} = a + b_1 \bar{x}_j + b_2 x_{ij}$$

In this expression, Y'_{ij} is the expected value of the dependent variable of individual i living in the social system j and having the value x_{ij} of the independent variable; $\bar{x}_j$ is the aggregated (e.g., the mean) level of the independent variable in the social system j , and a , b_1 , and b_2

are constants. For example, if Y is the innovativeness of individual farmers in Nigerian villages, the individual level variance of it in the whole population would be explained by the education (for example) of the individuals (assuming $b_2 \neq 0$), and additionally, by the mean level of education in the social system (assuming $b_1 \neq 0$). If b_1 and b_2 have the same sign, both individual level education and mean level of education have an effect in the same direction. If b_1 and b_2 have different signs, the variables on the two levels have opposite effects. Further, if $b_1 = 0$ and $b_2 = 0$, there is no non-random effect at all; if $b_1 = 0$ while $b_2 \neq 0$, there is only an individual level effect; if $b_1 \neq 0$ and $b_2 = 0$, there is only a systems effect. In the last case, education would affect the behavior of individuals only through the mean level of education in the given social system.

In most cases, however, because of the complexity of the total situation confronted by the villages, it is probably not realistic to assume that the variance in the dependent variable (such as innovativeness) can be explained by one independent variable, such as level of education. We therefore must look further.

3. A third possibility, which occupies the position of central concern in the present investigation, is one in which a number of individual variables and a number of systems variables operate to explain the variance in the dependent variable. Individual A, living in social system Z, would have some score on the dependent variable Y, produced both by his individual score for independent variable X, and by its interaction with the mean level for independent variable X,

throughout his social system. Similarly, individual A would have individual scores for every independent variable considered ($x_1, x_2, x_3 \dots x_n$), and the social system would have a mean level for every independent variable considered ($\bar{x}_1, \bar{x}_2, \bar{x}_3 \dots \bar{x}_n$). Thus, the individual variables and the system variables (aggregated individual variables) act independently and jointly to influence the dependent variable for individual A in the social system. The entire system's position on the dependent variable is represented by some measure of central tendency (such as the mean) for every individual included in the sample.

In summary, the present study is designed to examine the effect on the individual's innovativeness of individual independent variables plus system independent variables. We hypothesize that the two levels of the independent variables (i.e., individual and system) operate linearly and interactively to explain the variance of the dependent variable within the individuals studied.

We propose to examine whether the level of the independent variables within the system operates as an intervening variable, to augment the effect of the level of the independent variable within the individual. Figures 1a and 2a illustrate this point.

Many studies have been designed to explicate direct relationships (1a in the paradigm, the effect of individual characteristics upon innovativeness). We propose to investigate whether these individual characteristics are mediated in some way (i.e., either increased or decreased impact) by the characteristics of the system in which the individuals are found. We therefore are proposing to compare 1a, the

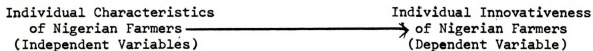


Figure 1a: Conventional Direct Effects Model
of Individual Innovativeness.

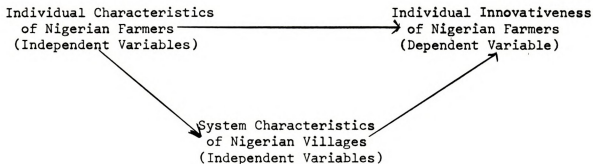


Figure 1b: Hypothesized Direct-Plus-Mediational
Model of Individual Innovativeness

Figures 1a and 1b: Comparison of Direct Effects Model
and Direct-Plus-Mediational Effects
Models of Individual Innovativeness

direct effects, with B, the individual or direct effects as mediated by the system effects, and are hypothesizing that lb will be greater.

The guiding hypotheses on which this analysis is predicated may be stated^d formally in the following manner:

- H₁ The individual level of innovativeness for Nigerian villagers is positively related to the individual level of selected modernization characteristics.
- H₂ The individual level of innovativeness for Nigerian villagers is positively related to the system level of selected modernization characteristics within each village.
- H₃ The individual level of innovativeness for Nigerian villagers is positively related to the joint influence of the individual level and the system level of selected modernization characteristics within each village.

Naturally, if H₃ is supported, H₁ and H₂ must also be supported.

How to Determine System Effects

As indicated earlier, Durkheim (1938, 1951) was one of the first social scientists to give attention to the study of systems effects. In calling for the recognition of influences external to the individual, * Durkheim (1951, pp. 37-38) observed:

But if no reality exists outside of individual consciousness, it [i.e., sociological method] wholly lacks any material of its own...On the pretext of giving the science a more solid foundation by establishing it upon the psychological constitution of the individual, it is thus robbed of the only object proper to it. It is not realized that there can be no sociology unless societies exist, and that societies cannot exist if there are only individuals.

Thereupon Durkheim described a method for isolating these social influences (roughly comparable to system effects) by finding the relationship between the distribution of a given characteristic in a social system and an effect criterion, while holding this characteristic constant for individuals. Since individual differences have been thus controlled, any significant covariation between the variables and the effect criterion is due to the characteristics of the system, or system effects.

Blau (1960) also argued for the simultaneous consideration of individual and system characteristics, so as to isolate the effect of the system's characteristics. He pointed out:

...by treating individuals or even subgroups as independent units of analysis that can be classified and re-classified according to any one of their characteristics, this procedure (i.e., the observation of regularities among individual members or subgroups) necessarily ignores the unique constellation of relationships between groups and individuals in the organization--its Gestalt.

Blau therefore proposed a type of analysis similar to that described by Durkheim. In speaking of the influence of values, he stated: "To isolate the external constraints of social values from the influence of the individual's internalized values, it must be demonstrated that the prevalence of a value in a group is associated with social conduct when this value is held constant for individuals" (Blau, 1960, pp. 178-179). He outlined the following 3-step strategy:

(1) An empirical measure Z is obtained on some characteristic of individual members of a system.



(2) These individual scores are aggregated into one index for each system, Z_{gp} .

(3) Determine the relationship between the system attribute (Z_{gp}) and some dependent variable (W), while holding the individual variable (Z) constant. Thus, the effect of Z_{gp} on W will be system effect.¹

Tannenbaum and Bachman (1964) criticize this strategy of Blau's on the grounds that Blau dichotomizes continuous variables, both for individual (rows) and system (column) characteristics. Two serious weaknesses are pointed out: (1) the problem of contaminating individual differences with system effects, and (2) the problem of contaminating system effects with individual effects. Tannenbaum and Bachman say these weaknesses may be remedied in several ways.

One method is to utilize more precise matching of the individual variable (Z). The larger the number of categories of the individual variable used in matching, the greater the accuracy. Instead of a 2×2 table, this would produce a $N \times 2$ table, N being the number of categories used in matching on the individual variables. This method could also be utilized to expand the range of group variables (Z_{gp}).

Another method described by Tannenbaum and Bachman utilizes correlational analysis. By the use of partial correlation, a system effect can be isolated by correlating between Z_{gp} and W with Z partialled out. An individual level effect can be determined by correlating Z and W , with Z_{gp} partialled out.

¹Blau's Z_{gp} corresponds to $b_1\bar{x}_j$, z to b_2x_{ij} , and W to Y_{ij} as used in the present dissertation.

If linearity between the variables can be assumed, the individual and group variables may be used as independent variables for multiple regression analysis.

In the present study, we utilize correlational analysis, including Pearson product-moment zero-order correlation, partial correlation, and multiple correlation techniques. For further details of the plan of analysis, see Chapter III.

Some Possible Fallacies

In analyzing the data gathered in a study of individual and system variables, and in subsequent generalizations from the analysis, several fallacies are possible.

Riley (1963) describes two general sets of fallacies that may be committed: (1) fallacies arising because analytical methods fail to fit the model, and (2) fallacies arising because methods fail to fit the facts. If the analyst's model refers to individuals in roles, but the analysis is based on systems (large or small collectivities or aggregates), there is a possible aggregative fallacy. On the other hand, if his model refers to the system, but his analysis is based on individuals, there is a possible atomistic fallacy.

Perhaps the best known error commonly committed in the form of an "aggregative fallacy" was pointed out by Robinson (1950): the ecological fallacy. This is the error of assuming that relationships found between characteristics of groups of people, taken as a group, hold true for the individuals within those groups. In Robinson's example, census data for groups of individuals indicated a negative



correlation between foreign birth and illiteracy. However, it cannot be assumed, on the basis of this data, that a foreign-born individual will necessarily be literate. Thus, a group analysis is inappropriate if the hypothesis refers to the individual.

Conversely, a conclusion about groups of individuals in census areas based only upon individual data is subject to a possible atomistic fallacy. If the hypothesis refers to the group, then the analysis must be based on groups.

The second set of fallacies described by Riley, in which the method fails to discover the relevant facts, also subsumes two easily committed errors.

A psychologicistic fallacy is committed if the researcher, when explaining individual behavior, looks only at the characteristics of each individual, disregarding or overlooking the significance of factors such as the character of the village or community. Rogers (forthcoming) remarks that, in much previous diffusion research, "Because the data were gathered from individuals as the units of response, our focus has been upon individuals' intra-personal variables, largely to the exclusion of social structural and interpersonal variables." By including an analysis of the characteristics of the social system, in addition to individual intra-personal variables, the present study avoids this error.

The second error, the sociologicistic fallacy, is committed when the individual level processes are disregarded when interpreting relationships between variables describing collectivities. For example,

a group analysis might show a positive correlation between transiency rates and suicide rates. If suicide rates are explained in terms of a social process, and individual level variables are omitted, a sociologicistic fallacy may have been committed.¹

Selvin (1958) reanalyzed the methodological reasoning in Durkheim's Suicide (1951) and concluded that Durkheim paid too little attention to the individual. He accused the early sociologist of treating the group as an entity, and committing the error of reification.²

Kendall and Lazarsfeld (1950) contend that the principle of analyzing group composition can lead to positive gains if the data allow for simultaneous group and individual level analysis.

There is no reason why unit data cannot be used to characterize individuals in the unit. A man who does not have malaria in a unit where the incidence of malaria is very low probably feels differently about his state of health than does the man who has no malaria but serves in a unit with high incidence.... In terms of actual analysis, the matter can be restated in the following terms: Just as we can classify people by demographic variables or by their attitudes, we can also classify them by the kind of environment in which they live. The appropriate variables for such a classification are likely to be unit data. A survey analysis would then cover both personal and unit data simultaneously.

In the investigation described herein, we have attempted to avoid the psychologistic and sociologicistic fallacies by including both system

¹Riley's psychologistic and sociologicistic fallacies are similar to Scheuch's (1965) description of the individualistic fallacy, which is the negation of the usefulness of an explanation that treats the collectivity as collectivity, and the group fallacy, which is the converse of the above.

²Reification is defined in a footnote on page 12.

and individual variables in our analysis, and avoid the aggregative and atomistic fallacies by basing the analysis on the appropriate level (i.e., system or individual). The partial correlation technique also aids in preventing confounding system variables with individual variables, and vice versa.

Dependent Variable

The dependent variable utilized throughout the present study is innovativeness, defined as "the degree to which an individual is relatively earlier in adopting new ideas than other members of his social system" (Rogers, 1962, p. 20).

Over the ten years preceding this study, the Eastern Nigerian Ministry of Agriculture introduced and actively promoted a number of agricultural innovations, some 14 of which were chosen for inclusion in the second phase of the Nigerian study (see Table 1). Although these 14 innovations vary widely in type, in amount of skill required for successful cultivation, in adaptability to various climatic and soil conditions, initial investment required, etc., they are available and economically feasible for a large number of Eastern Nigerian farmers. Many of these innovations are utilized simultaneously, and others are complementary. It is therefore held to be theoretically logical to use adoption or non-adoption of these 14 innovations as a criterion of innovativeness.¹

¹See Appendix B for analyses using two additional indices of innovativeness.

Description of Innovations

Aldrin dust is an insecticide manufactured by the Shell Oil Company. Although it kills all kinds of insects, it is especially used against the yam beetles--a pest that flies in from its breeding grounds near a river at or near planting time, sustains itself temporarily on the yam seed tuber, and later attacks young tubers. Applying Aldrin dust to the seed tuber before planting kills the yam beetle. The insecticide is distributed by extension agents.

GCH-7 Cassava is a new cassava variety that was introduced because of its high-yielding characteristics. From the standpoint of quantities grown and consumed, cassava is the most important food crop in Eastern Nigeria. Stem cuttings, about one foot long, are interplanted on the sides of the yam heaps.

Three innovations--oil palm rehabilitation, rubber planting, and cocoa planting--are highly similar. These are major tree crops, and are an important part of the six-year development plan of the Eastern Region. In order to adopt one of these innovations, a farmer is required to furnish a relatively large amount of land, a minimum of five acres. He signs a formal contract with the Ministry of Agriculture, which obligates him to clear, space, mulch, and maintain his land according to specific procedures. The Ministry supplies seedlings, fertilizer, and instructions without charge for a period of five years.

Fertilizer is a chemical compound designed to supplement the natural fertility of the soil. An aggressive promotion program has been conducted to encourage its purchase and use. This program has a

specially trained staff, its own sales campaigns, and distributors, and special demonstrations are conducted to show farmers how to apply fertilizers on cassava, yam, and maize.

The Fund for Agricultural and Industrial Development (FAID) is an organization established to encourage the use of government agricultural credit. At the time of the study, however, the program was suffering from administrative difficulties, and loans were difficult to obtain.

Community plantations are organized by representatives of the Ministry of Rural Development to encourage coöperative use of village land for agricultural development. Generally, the plantation is devoted to one of the major tree crops being promoted by the Ministry of Agriculture. The rural development officers organize village cooperatives, formally register the association with the government, survey and measure land, instruct villagers as to the availability and requirements of Ministry of Agriculture programs and other development projects, and assist them in getting supplies and services from the Ministry of Agriculture.

Improved livestock is an innovation designed to promote the breeding and raising of higher quality farm animals. Generally, the adoption of this innovation required economic means for purchasing the necessary foodstuffs, veterinary services, and pens for the animals. Only a few farmers have adopted the program, and most of the beef and pork consumed was imported from other parts of the country.

NS-1 Maize is a hybrid corn variety that has high-yielding qualities. The new variety was developed specifically to supply food for the poultry program, but many people use it for food also. The Ministry of Agriculture supplies the seed without charge and it supposed to purchase the farmer's harvest later. However, the latter feature of the program was suffering from administrative difficulties at the time of the study.

Improved poultry breeding consisted mainly of teaching farmers proper management, supplying them with chicks and foodstuffs, providing them with disease preventives, and making markets available for the eggs. Problems such as high cost of feed, high incidence of disease and death among chicks, and low price of eggs were besetting the program at the time of the study.

Improved rice is an innovation that requires a whole complex of new technologies, and is characterized by considerable expense. Rice improvement programs include improved seed, new cultural practices, seed and nursery preparation, weeding, use to fertilizers, and of dams, irrigation, and drainage. Because of its complexity and expense rice improvement is sometimes incorporated into village plantations.

The Stork oil press is a hydraulic hand press for obtaining oil from palm nuts. Although it is a considerable improvement over the conventional screw presses and other traditional methods, the new press costs a great deal of money (about \$612.00) in addition to relatively high labor costs. Detailed, technical operating instructions are also required. These disadvantages probably prevented wide scale purchase and utilization of the innovation.



Vegetable seeds are sold in small packets at minimal cost, and include onions, tomatoes, and other European vegetables, as well as local varieties. At the time of the study, vegetable planting was receiving increasing attention, with some 80,000 packets being sold in 1966.

From the standpoint of their use and characteristics, these 14 innovations can be classified according to the following pattern:

1. Food Crops--Cassava, maize, rice, vegetables, and cocoa.
2. Land-Commitment¹ Innovations--Oil palm, cocoa, rubber, community plantations, and cassava.
3. Divisible Innovations²--Aldrin dust, fertilizers, NS-1 maize, and citrus crops.
4. Elite innovations³--FAID agricultural credit, livestock, rice planting, and the Stork oil press.

Independent Variables

Three criteria were utilized in the determination of the variables to be included in the present analysis:

¹Land ~~commitment~~ innovations are innovations which require the setting aside of a considerable portion of land in order to adopt.

²Divisible innovations are innovations which may be tried on a small scale prior to complete adoption.

³Elite innovations are innovations which, because of high capital requirements, and agricultural skill demanded, can be adopted only by farmers in an advantageous economic situation.

Table 1: List of Innovations Studied in
Phases I and II in Eastern Nigeria

Name of Innovation	Percent of Farmers Adopting ^a	
	Phase I	Phase II
Fertilizer	22	39
Oil Palm (rehabilitation scheme)	20	17
NS-1 Maize (hybrid variety)	16	32
Aldrin dust (insecticide)	12	33
Poultry (improved breeds)	6	19
Rice production	5	8
Rubber production	5	4
Vegetable production	5	7
Cocoa production	4	5
Community plantations	4	13
Cassava (improved variety)	2	7
Livestock	1	NS ^c
Cashew	1	3
Pineapple	- ^b	NS
Citrus crops	-	10
FAID	-	2
Farm settlements	-	NS
Stork oil press	-	NS
Adopted no innovations	53	37

^aPercentages are based on 947 respondents in Phase I and 1,347 respondents in Phase II.

^bDashes indicate that the percentage adopting is less than one percent.

^cNS means this innovation was not studied in Phase II.

(1) Previous research, both in the United States and in cross-cultural settings, with special attention to research in less-developed nations.

(2) Earlier analyses of similar data from the Nigerian Diffusion Project by coworkers on the staff.

(3) Intuitive and theoretical reasoning. Very little research has been conducted earlier in diffusion studies which deal with the influence of system variables on innovativeness, so that background and previous investigations afford limited empirical assistance in the final choice of variables to be included.

On the basis of the above criteria, the following independent variables were selected and included in the data analysis:

(1) Cosmopolitaness. Cosmopolitaness is "the degree to which an individual's orientation is external to a particular social system" (Rogers, 1962, p. 183). It is hypothesized that earlier adopters are more cosmopolite than later adopters. In the United States, Ryan and Gross (1943) found that hybrid corn innovators traveled more often to urban centers such as Des Moines than did average farmers. Menzel and Katz (1955) found that innovative medical doctors made more trips to out-of-town professional meetings than non-innovators. Goldsen and Ralis (1957, pp. 25-28) found that Thailand farm innovators were more likely to visit Bangkok. Out of 73 publications in the Diffusion Documents Center at Michigan State University dealing with the relationship between cosmopolitaness and innovativeness, almost 81 percent reported a positive relationship (Rogers and Stanfield, 1966, p. 26).

(2) Education. As a social characteristic that can enable potential adopters to perceive the relative advantages of innovations more readily, and can assist in implementing the break with traditionalism, education is expected to be positively related to innovativeness, at both the individual and system levels. Rahim (1961) found education positively correlated with innovativeness in Pakistan, and Rogers and Stanfield (1966, p. 22) reported that 74.6 percent of 193 publications in the Michigan State University Diffusion Documents Center dealing with education's relation to innovativeness indicated a positive relationship.

(3) Familism. To the extent that an individual farmer's orientation toward his own primary family group is superordinate to his orientation toward other groups within the social system, he will be disinterested or resistant to change, especially if change is perceived as threatening maintenance of the family. Familism is therefore expected to be negatively related to innovativeness at both the individual and system level.

(4) Educational Aspiration. Educational aspirations are defined as the level of education individuals would desire if they could be young again. Since a high level of educational aspiration is believed to indicate a more modern outlook, this variable is expected to be positively related to innovativeness at both the individual and systems level.

(5) Achievement Motivation. A precise and consensually acceptable definition of achievement motivation is yet lacking in diffusion literature. McClelland defined achievement motivation as "the desire

to do well, not so much for the sake of social recognition or prestige, but to attain an inner feeling of personal accomplishment" (1961, p. 76). Neill and Rogers stated that achievement motivation is "that value, instilled in the individual through the socialization process, in which the individual feels a need or desire to excel in reaching certain goals only for the satisfaction of reaching the goals and not for the rewards of the goals or ends involved" (1963, p. 2). Generally, achievement motivation is taken to indicate a desire for excellence.

McClelland reported that this variable was positively related to levels of entrepreneurial activity, economic growth, and rate of national economic growth. Neill and Rogers (1963, p. 12) found occupational achievement motivation among Ohio farmers positively related to productive man work units, man days of labor on the farm, size of farm and innovativeness. There is, therefore, considerable theoretical reasoning to indicate that villagers with high levels of achievement motivation are more innovative in adopting new ideas and practices.

(6) Empathy. Empathy was described by Lerner (1958) in various ways: "the capacity for identification with new aspects of [the respondent's] environment" (p. 49), "the capacity to see oneself in the other fellow's situation" (p. 50), "the capacity for rearranging the self-system on short notice" (p. 51), "mobile sensibility" (p. 49), and "psychic mobility" (p. 51). Throughout all these descriptive phrases, the central theme is "the individual's ability to put himself in another's role." Although findings regarding the role of empathy in the modernization process have been mixed, it is generally believed

that empathy is positively related to innovativeness, at both the individual and system level.

(7) Knowledge of Agricultural Change Agents. Contact with change agencies has been found to be positively related to innovativeness in a great many studies reported in diffusion research literature. Rogers and Stanfield (1966, p. 26) report that, out of 136 studies dealing with the relationship between change agency contact and innovativeness, 91.9 percent reported a positive relationship. In Nigeria, agricultural workers from the Ministry of Agriculture were the change agents seeking to introduce change into the rural areas. It is hypothesized that acquaintance with these agricultural workers and familiarity with their work is positively related to innovativeness, at both the individual and systems level.

(8) Economic Aspiration. As measured in the Nigerian study, economic aspiration is more oriented toward a desire for economic development of the entire village, than toward a desire for personal aggrandizement. Thus, a high degree of economic aspiration should indicate a high level of desire for modernization, economic advancement, and improvement of the village conditions. It is therefore hypothesized that economic aspiration is positively related to innovativeness, at both the individual and system level.

(9) Literacy. In many research investigations conducted, literacy (along with education) seems to emerge as one of the general correlates of innovativeness. The innovative person is likely to be literate, as well as have more education than others in his social system. The

weight of evidence seems to overwhelmingly indicate a positive relationship between these variables and innovativeness. Rogers and Stanfield (1966, p. 22) found that 19 out of 27 publications dealing with the relationship between innovativeness and literacy reported a positive relationship.

(10) Newspaper, Radio and Film Exposure. Taken together, these three variables form a mass media exposure index. They are somewhat interrelated, as Table 2 indicates. However, because there are marked differences in the mean exposure to these three communications media, they will be included in this analysis as separate variables. When ranked according to mean amount of exposure to these three media, the order is: (1) radio, (2) newspaper, and (3) film (see Appendix D.).

Table 2: Intercorrelations Among Newspaper Exposure, Radio Exposure, and Film Exposure (N = 1,142).

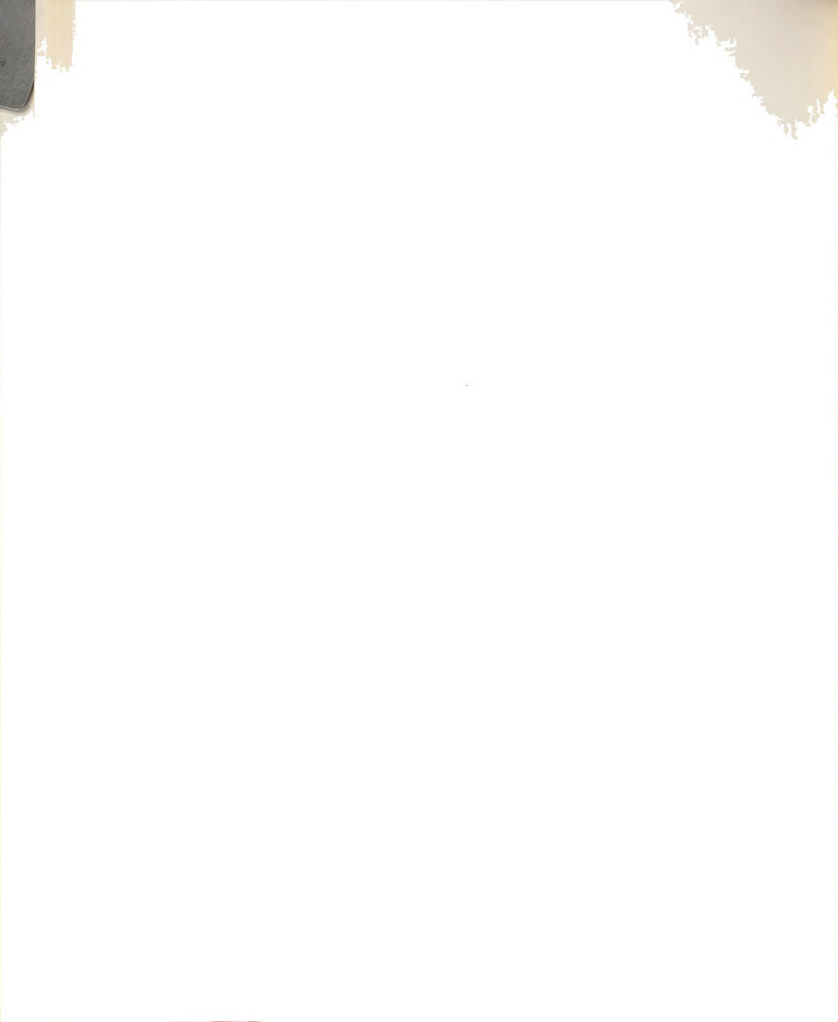
Variable	<u>Variable</u>	
	2	3
1. Newspaper Exposure	.47	.28
2. Radio Exposure	---	.40
3. Film Exposure		---

Exposure to the mass media of communication is probably a crucial factor in promoting innovativeness and economic development in less-developed nations. Lerner (1956), Deutschmann and Fals Borda (1962),

and Frey (1966) all found a strong positive relationship between mass media exposure and innovativeness. Rogers (1966) found that mass media exposure was highly correlated with innovativeness in Bolivia, explaining 67 percent of the variance in innovativeness in one city, and 10 percent of the variance in another. Newspaper, film, and radio exposure in Nigeria is therefore expected to be positively correlated with innovativeness at both the individual and the systems level.

(11) Agricultural Media Exposure. From one viewpoint, this variable overlaps the previous three variables considerably, and is in fact highly correlated with newspaper exposure, radio exposure, and film exposure ($r = .33, .43, .42$, respectively). Its specific function is to measure the exposure to agricultural messages being disseminated by the mass media. It has the additional function, however, of being an indirect measure of contact with extension agents or agricultural workers. Agricultural media exposure is therefore expected to be positively related to agricultural innovativeness at both the individual and the systems level.

(12) Credit Orientation. A favorable attitude toward the use of agricultural credit to finance further investment in agricultural production is a characteristic generally associated with more innovative farmers. In a traditional or subsistence system, decisions for agricultural alternatives are based not on monetary gains but rather on the protection of one's livelihood. A subsistence-level farmer cannot jeopardize his supply of food and his income without some knowledge of



what is involved in such a venture. Thus, innovativeness is expected to be positively related to credit orientation, at both the individual and systems level.

(13) Level of Living. As an indicant of socio-economic status, level of living could be viewed as either a product or an antecedent of innovativeness. Since many of the innovations included in this study require some degree of economic prosperity, it is hypothesized that level of living is positively related with innovativeness. Further, since certain of the 14 innovations are oriented toward community action, level of living at the system level should also be positively related to innovativeness.

(14) Correct Knowledge of Agricultural Innovations. A necessary prerequisite to the successful adoption of agricultural programs, correct knowledge of the innovations is expected to be positively related to innovativeness. As a cognitive correlate of innovativeness, Rogers and Stanfield (1966, p. 24) found that knowledgeability was reported to have a positive relationship in 53 out of 66 research studies dealing with the variable.

(15) Formal Social Participation. Individuals who more actively participate in the activities of their social system are more likely to be innovative. As one index of social participation, group membership is expected to be positively related to innovativeness. Rogers and Stanfield (1966, p.26) found that 123 out of 156 research studies dealing with group participation reported a positive relationship to innovativeness.

Table 3 lists the independent variables utilized in this analysis, with the hypothesized relationship to innovativeness.

Table 3: List of Independent Variables with their Hypothesized Relationship to Innovativeness.

<u>Variable</u>	<u>Relationship^a</u>	
	Individual	System
1. Cosmopolitaness	+	+
2. Education	+	+
3. Familism	-	-
4. Educational Aspiration	+	+
5. Achievement Motivation	+	+
6. Empathy	+	+
7. Knowledge of Agricultural Workers	+	+
8. Economic Aspiration	+	+
9. Literacy	+	+
10. Newspaper Exposure	+	+
11. Radio Exposure	+	+
12. Film Exposure	+	+
13. Agricultural Media Exposure	+	+
14. Credit Orientation	+	+
15. Level of Living	+	+
16. Correct Knowledge of Innovations	+	+
17. Formal Social Participation	+	+

^aSince the relationship of these variables is expected to be interactive for both the individual level and system level, the same direction of relationship is hypothesized for each variable at both the individual and system level.

CHAPTER III

RESEARCH METHODOLOGY

The Diffusion Project

The present study is based on an analysis of a portion of the data gathered in the three-nation Diffusion Project conducted by the Department of Communication, Michigan State University, and sponsored by the United States Agency for International Development. This project was initiated in December, 1964, and terminated in December, 1968. Broadly speaking, the study concentrated on problems associated with the introduction of modern technology among peasants in the nations of Brazil, India, and Nigeria. Only the data gathered from the Nigerian portion of the study were used in the present investigation.

Among the objectives of the Diffusion Project was the specific goal of gathering information useful to change agents in their efforts to introduce innovations. This information included the identification of village innovators and opinion leaders, and their distinctive social and economic characteristics, communication behavior, attitudes, and values; the role and influence of various communication channels such as the mass media, opinion leaders, interpersonal communication, and demonstrations; the response to various communication and economic



incentives which were introduced into the country; and the influence of price incentives, land tenure, credit, marketing practices, the shift from subsistence to commercial agricultural production, and other economic factors.

The Diffusion Project was designed to consist of three data-gathering phases in each of the three nations. The first phase was an analysis of the relative success or failure of various programs of change in agricultural production in some 80 villages in each country. The unit of analysis was the village, and the data were secured from secondary sources and through interviews with village leaders and change agents.

The second phase was an analysis of data obtained mainly through structured personal interviews with villagers living in some 20 villages in each of the three countries. The unit of analysis was the farm family, and respondents were male household heads. The purpose was to trace the diffusion of farm innovations within the villages, and especially to study the role of innovators and opinion leaders in the diffusion process.

In the third phase, certain communication techniques and incentives for the adoption of innovations were introduced into each of the nations. The effectiveness of these incentives and techniques were evaluated through observation and follow-up interviews as part of a controlled field experiment to last over several years.

However, political disturbances and civil strife in Nigeria forced curtailment of the project in this nation,¹ so that Phase

¹ See Preface.

Three had to be cancelled in Nigeria after its initiation. Thus, only the first two phases of the Nigerian Diffusion Project were utilized in the present study.

Conduct of the Study

Phase One

Selection of Villages: A random sample of 30 counties was selected from among the 76 counties in the Ibo- and Ibibio-speaking areas of the Eastern Region of Nigeria. Within each county, at least two villages were chosen for the study. The villages were chosen in pairs: half of them were "success" villages, and half of them were "failure" villages, in terms of their acceptance of Ministry of Agriculture extension programs.

Several criteria were used in selecting the villages. The change agent must have worked in the village for at least nine months. The selection was also based on ratings by the agricultural supervisors and the county supervisors regarding the "most successful" and the "least successful" villages in the counties, as related to innovations sponsored by the Ministry of Agriculture, and on examination of extension records concerning the number of innovations in operation in a given village, the number of farmers participating, and the amount of supplies distributed during the previous years.

After some additions and substitutions necessitated by deficiency in pairings, the list of villages included 34 "success" villages, and 37 "failure" villages. Of the 71 villages, 52 were Ibo-speaking and 19 were Ibibio-speaking.

Two weaknesses in village selection procedures should be mentioned. Extension agents and county supervisors were generally reluctant to designate a village as a "failure" village. Thus the reliability of this designation may be questionable. In addition, the 30 counties chosen in the first stamping step were not ranked on relative success, so that a "success" village in one county may well be a "failure" village in another.

Selection of Respondents: Data were obtained in Phase One from village leaders, change agents, and innovators.

Leaders were chosen through sociometric nominations. Six typologies of leadership were utilized: (1) civic, (2) religious-traditional, (3) religious-modern, (4) administrative-traditional, (5) administrative-modern, and (6) educational. In addition, two informal leadership typologies were utilized: (1) village affairs opinion leadership, and (2) village farming opinion leadership. Leadership nominations were taken first from the village school headmaster and village chiefs, then from those nominated by the headmaster and chiefs, then throughout the village until some ten informants had been interviewed. From 13 to 16 leaders and innovators were selected and interviewed in each village.

Instrument Construction: The interview schedules were translated into Ibo and Ibibio, and reviewed and revised by the research staff. These revised schedules were then back-translated into English, to check for ambiguities. A two-week pretest revealed further weaknesses in the instrument, leading to deletion or revision of certain words or questions.

Interviewer Selection and Training: Criteria used in selecting interviewers included education, cultural origin, age, and experience with rural people. All interviewers were school teachers (or the equivalent) holding the Grade II teaching certificate. All interviewers were at least 25 years old, and spoke the dialect of the village where they worked.

Interviewer training included one week's orientation at research headquarters, Enugu, two week's pretest in the field, and another week at headquarters in revising procedures and discussing problems that were encountered.

Data Collection: Phase One interviewing was conducted between May 15 and August 27, 1966. Altogether, a staff of 11 Nigerian interviewers contacted 947 rural people in 71 villages throughout the Eastern Region. Interviewers averaged three completed interviews per day, with each interview consuming an average of one to one and one-half hours. Each interviewer worked in each village for two weeks, and was visited at least once each week by a supervisor who corrected mistakes and reviewed the interviewer's conduct in the village.

Phase Two

Village Selection: From the total of 71 villages studied in Phase One, the 34 "success" villages were chosen as the basis for the sample population in Phase Two. "Failure" villages were dropped from consideration, since it was desired to study change where it had occurred and "failure" villages were characterized by very low levels of adoption.

After ranking on access to the outside world and institutional development, 18 villages were chosen as the basis for the Phase Two study, with 9 villages used in the pre-test.

Respondent Selection: In Phase Two, the unit of analysis was the individual. The respondents were in each case a male, the head of his household, at least 20 years old, and farming some amount of land. As indicated in Table 4, the general sample was comprised of 1,142 respondents, with the modal selection from each village approximating 65, and the unweighted sampling rate approximating 57 percent of the respondents in each village.

To insure an adequate number of innovators and early adopters in each village for incorporation into the field experimental activities in Phase Three, some 205 innovators and ex-servicemen were added purposively to the sample. In certain descriptive statistics, these 1,142 general sample respondents and 205 innovators and ex-servicemen are considered together, but for all correlational analyses conducted in the present investigation, the general sample of 1,142 respondents was utilized. The population on which the correlational analyses are based are indicated in each table of findings in Chapter IV.

Instrument Construction: The initial interview schedule was constructed, based upon two pilot studies, one in Western Nigeria and one in the Midwest Region. A five-week pretest was conducted in nine villages, and appropriate revisions and deletions were made in the interview schedule. The schedule included structured response items, open-ended response items, and interviewer ratings.

Interviewer Selection and Training: From among the Phase One interviewers, nine "senior" interviewers were selected for Phase Two. In addition, nine "junior" interviewers (with less education and age) were selected. Each interviewing team was comprised of one senior and one junior interviewer.

A total of seven weeks was spent both in the field and at headquarters, learning interviewing techniques, rapport-building, field behavior, etc.

Data Collection: Phase Two interviewing was conducted between November 2, 1966 and February 15, 1967. Altogether, a staff of 18 Nigerian interviewers talked with 1,347 farmers in 18 villages in the Eastern Region. Each team of two interviewers worked in each village for 6 to 7 weeks, and was visited at least once per week by a supervisor. In addition to personal interviews, interviewers made personal observations of the village and respondents' property. Each interview averaged one and one-half hours in length, and two or three interviews were completed each day.

Characteristics of the Sample

All respondents in the study were males. Nearly four-fifths (78 percent) said that farming was their major occupation; i.e., the job at which they spent the most time and/or earned the most money. Of the remaining 22 percent of the sample, all but three respondents said farming was a secondary occupation.

Slightly over half (52 percent) of the respondents were between 30 and 49 years of age; well over half (56 percent) had never attended



Table 4: Village Populations, Sample Sizes, and Sampling Rates for Nigeria, Phase Two.

Village	General Sample or Census	Innovators, or Ex-Service- men	Total Sample	Total Eligible Resp's.	Sampling Rate
Omasi-Agu	65	14	79	162	49%
Obolo-Eke	61	1	62	62	100
Eka Uruk Eshiet	65	16	81	287	28
Nung Ikot-Ikot Udo Offiong	63	16	79	250	32
Utiti Uruan	52	1	53	61	85
Nsukara	66	10	76	152	50
Itu Ezinihite/ Amaova	66	16	82	156	53
Oduma/Amankanu	65	16	81	300	27
Umuduru	80	0	80	83	96
Umuoke/Uga	65	9	74	116	64
Okwudo/Umuoseke	64	16	80	147	54
Ulli/Umuaku	64	16	80	--- ^a	--- ^a
Obigbo	67	15	82	250	33
Umubiakwe	69	12	81	209	39
Uwana	64	16	80	197	41
Owutu	65	17	82	149	55
Ihiala/Umuezeawala	66	14	80	162	49
Obgoji	<u>36</u>	<u>0</u>	<u>36</u>	<u>36</u>	<u>100</u>
Totals	1142	205	1347	^b	^b

^aThe population totals for this village were not available, so no sampling rate can be computed.

^bSince only incomplete data are available, accurate totals cannot be computed. However, of the villages where data are given, the mean population is approximately 164 people, and the unweighted sampling rate is approximately

school, and another third had not completed their primary education.

Thus, the typical respondent in the study was a male farmer, the head of his household, who was between 30 and 49 years of age, and who had little or no formal education (Table 5).

Knowledge of Agricultural Innovations

Respondents were read a list of the 14 agricultural innovations studied in Phase Two of the project, and asked what information they had concerning each innovation. The interviewers then scored respondents as to whether the information was correct. All interviewers were carefully trained and tested in the technical aspects of each innovation, and specific points of information about each innovation were printed on the interview schedules to assist the interviewer in his rating.

Only 3 percent of the respondents had no correct information about any of the 14 innovations. At the other extreme, 9 percent of the respondents had correct information about 11 to 14 of the innovations. Over one-third (35 percent) knew something about four innovations, and another third (33 percent) knew about seven innovations. Table 6 shows the number of innovations about which respondents knew at least one correct item of information.

From 70 to 80 percent of the respondents had correct information about the four best-known agricultural innovations: poultry (79 percent), fertilizer (79 percent), oil palm rehabilitation (74 percent), and NS-1 maize (70 percent). However, between these four best-known innovations and the fifth best-known innovation, a sharp decrease in information appeared. Only 40 percent of the respondents had correct information

 Table 5: Personal Characteristics of the Respondents (N = 1,347).

<u>Characteristics</u>	<u>Percentages^a</u>
Occupation:	
Farmer	78
Non-farmer	22
Age Group:	
20 to 29 years	15
30 to 39 years	24
40 to 49 years	28
50 to 59 years	18
60 to 69 years	10
70 and older	5
Formal Education:	
Never attended school	56
Primary, incomplete	33
Primary, complete	8
Secondary, incomplete	1
Secondary, complete	2
University, incomplete	0
University, complete	-- ^b

^aIn order to include every respondent interviewed in Phase Two, these percentages are based on N = 1,347, which includes 205 innovators and ex-servicemen purposively selected for the sample.

^bLess than 1 percent.



Table 6: Number of Innovations Respondents Knew Correctly.

<u>Innovations</u>	<u>Percentage^a</u>
None	3
One	7
Two	6
Three	10
Four	12
Five	12
Six	11
Seven	10
Eight	7
Nine	6
Ten	7
Eleven to fourteen	9
	100

^aThese percentages are based on an N of 1,347 (see footnote, Table 5).

Table 7: Respondents' Correct Information
About Agricultural Programs.

<u>Innovations Known Correctly</u>	<u>Percentage^a</u>
Poultry	79
Fertilizer	79
Oil Palm Rehabilitation	74
NS-1 Maize	70
Citrus	40
Aldrin Dust	38
Improved Cassava	35
Rubber Planting Scheme	33
Community Plantations	33
Cocoa Planting Scheme	32
Rice Development Scheme	25
Vegetable Seeds	17
FAID Credit Program	12
Cashew	11

^aPercentages, which are based on N = 1,347, sum to more than 100 percent because many respondents knew about more than one innovation (see footnote, Table 5).

regarding the citrus innovation. At the lowest level of correct information, 12 percent of the respondents had correct information about the FAID credit program, and 11 percent knew about the cashew innovation.

Adoption of Agricultural Innovations

Respondents were asked if they had ever (planted, joined, used, or bought) each of the 14 innovations studied. Somewhat less than two-fifths (37 percent) of the respondents had never used any of the innovations, less than one-fifth (19 percent) had tried one, and smaller percentages had at some time used two (14 percent) or three (10 percent) of the innovations. Only 1 percent had used nine or more of the innovations. Eighty percent had used three or less (including none) of the innovations (see Table 8).

Considerable differences were found in the percentage of respondents adopting each of the innovations. As indicated in Table 9, almost two-fifths of the respondents had adopted fertilizer (39 percent), almost a third had adopted NS-1 maize (32 percent), almost a fourth had adopted Aldrin dust (23 percent), and almost a fifth had adopted poultry (19 percent). Below these first four innovations, the percentage of adoption declined rapidly. Less than 10 percent of the respondents had adopted either rice (8 percent), improved cassava (7 percent), vegetable seeds (7 percent), cocoa (5 percent), rubber (4 percent), or cashew (3 percent). Only two percent of the respondents had adopted the use of FAID credit.

Thus, the adoption rate was quite low for most of the innovations, with certain innovations being adopted by hardly anyone. In general,



the highly divisible innovations¹ (fertilizer, NS-1 maize, Aldrin dust, and citrus) had the highest rate of adoption, with those innovations requiring a substantial commitment of land (such as cocoa, cassava, oil palm, rubber, community plantations) being adopted by fewer respondents. Almost two-fifths (37 percent) of all respondents had adopted no innovations at all (see Table 8). As indicated in Table 1, similar percentages of respondents adopting the innovations were found in both Phase One and Phase Two of the study, with one or two notable exceptions.

Table 8: Percentage of Respondents Adopting
Agricultural Innovations.

<u>Number of Innovations Adopted</u>	<u>Percentage of Respondents</u> ^a
0	37
1	19
2	14
3	10
4	7
5	5
6	3
7	2
8	2
9 or more	1
	100

^aPercentages based on N = 1,347 (see footnote, Table 5).

¹See Chapter II for the definition of divisible innovations.



Table 9: Percentage of Respondents Adopting Each of the
14 Agricultural Innovations (Phase Two).

<u>Innovation</u>	<u>Percentage Adopting^a</u>
Fertilizer	39
NS-1 Maize	32
Aldrin Dust	23
Poultry	19
Oil Palm Rehabilitation	17
Community Plantations	13
Citrus	10
Rice	8
Improved Cassava	7
Vegetable Seeds	7
Cocoa Planting Scheme	5
Rubber Planting Scheme	4
Cashew	3
FAID Credit Program	2

^aPercentages, which are based on N = 1,347, sum to more than 100 percent, since many respondents adopted more than one innovation (see footnote, Table 5).

Analysis of Data

Three statistical methods were utilized in the analysis of data in this study:

- (1) Zero-order correlation.
- (2) Higher-order partial correlation.
- (3) Multiple correlation.

First, zero-order correlations were computed between innovativeness and all other independent variables (both individual and system). Then, higher-order partial correlations between innovativeness and each of the independent variables were computed, holding constant all other independent variables. To specifically determine the contribution of the system variables, partial correlations were computed for the system level independent variables, with the individual level effects held constant.

After submitting the system variables outlined previously to both zero-order and higher-order partial correlational analysis, we selected the best predictors of innovativeness for inclusion in a multiple correlation analysis. Similarly, the best predictors from the zero-order and partial correlation analysis of the individual level variables were included in this further analysis. Thus, the best predictors from the system variables analysis, and the best predictors from the individual level analysis, were submitted to multiple correlation analysis, using the multiple regression least squares delete computer program, to formulate a paradigm of variables that predict innovativeness and possess significant explanatory power.

Operationalization of Variables

Dependent Variables

In recent years, attempts have been made to devise indices of innovativeness which will accurately measure respondents' behavior concerning the adoption of recommended innovations.¹

In operationalizing the index of innovativeness utilized in the present study, a measure was chosen which indicated the total number of innovations (out of 14) adopted by the respondents, weighted by the year it was first used. Each respondent was asked: "When did you first (plant) (join) (use) (buy) the oil palm rehabilitation scheme...the agricultural cocoa scheme...the agricultural rubber scheme... etc." The answers were originally coded as:

¹Dasgupta (1968) compared and evaluated five indices of adoption of recommended farm practices in terms of their ability to predict adoption behavior of farmers. The five indices represent a continuum from a relatively simple index to a methodologically sophisticated one. They included:

Percent of Applicable Practices Adopted. The practices adopted by the farmer were first added and then divided by the number of practices which were applicable on his farm. The figure so obtained was then multiplied by 100. The farmers were then classified into five categories according to their adoption scores.

Years of Use of Adopted Applicable Practices. An adoption score was derived for each farmer by adding the number of years he had used each of the applicable practices. The figure so obtained was then divided by the number of practices applicable to his farm. The farmers were then classified into groups according to their adoption scores (Bose and Dasgupta, 1962, p. 14).

Innovativeness Scale. The mean and the standard deviation of the distribution of adoption over time are used to divide the distributions into five areas, labelled as innovators, early adopters, early majority, late majority, and laggards (Rogers, 1958).

Adoption Scale (Trace Line Analysis). Through the examination of trace lines on a two-dimensional line graph, attempts were made to select a number of recommended farm practices which were consistently related to the latent variable continuum of adoption behavior for the

00 = never used
 nn = last two digits of year first used
 99 = not applicable, has not heard of innovations.

In order to give higher ratings to earlier adopters, these answers were subsequently recoded, according to the following pattern:

1967 = 00
 66 = 01
 65 = 02
 64 = 03
 63 = 04
 62 = 05
 61 = 06
 60 = 07

The new codes therefore may be interpreted as follows:

00 = never used any innovation.
 01 = one adopted in 1966.
 91 = all 14 adopted in 1960 or before.

purpose of constructing an adoption scale. Farmers were given scores on the basis of the number of these six practices each of them had adopted.

Adoption Scale (Guttman Scalogram Analysis). The seven practices examined by trace line analysis were also submitted to Guttman scalogram analysis. After eliminating two practices which did not scale well, a minimally satisfactory scale was produced, with a coefficient of reproducibility of .90, the errors being randomly distributed.

Of the five indices examined by Dasgupta, none were found to be far superior to others, although two--years of use of applicable practices, and the adoption scale constructed with the aid of trace line analysis and subsequently tested by Guttman scalogram analysis--were of more value in predictive ability.

Independent Variables

The following operationalizations were utilized to measure the 17 independent variables included in this study:

(1) Cosmopolitaness was operationalized as a total score ranging from 0 to 40 for number of visits outside the village. These visits included towns within the Eastern Region, cities within the Eastern Region, cities outside the Eastern Region, other towns outside Eastern Region, and places outside Nigeria. Each category was weighted from 1 to 4, based on distance from the respondents' village, to yield a total possible score of 40.

(2) Education was operationalized as the respondents' score on a scale running from 0 to 6, indicating he had never attended school, attended primary (incomplete), attended primary (complete), attended secondary (incomplete), attended secondary (complete), attended university (incomplete), or attended university (complete).

(3) Familism was operationalized as the respondents' score on a scale running from 0 to 4, indicating loyalty and orientation toward members of his family. Respondents were asked two questions: "If you had enough money to start a trade, but a land dispute arose between your family and another, what would you do with the money?" and, "If you had saved enough money to build a zinc house but a brilliant relative needed money for schooling, what would you do?" Respondent's answers were coded so as to give higher scores for the latter alternative in each question, to indicate a higher degree of familism.

(4) Educational aspiration was operationalized as respondents' answer to a question regarding what level of education they would want to reach, if they could be young again. Possible answers included none, primary, secondary, or university, coded 0, 1, 2, or 3, respectively, so that a higher score indicated higher aspiration.

(5) Achievement motivation was operationalized as respondents' score for a series of three questions designed to measure the degree to which occupational and economic success were valued. The questions were: "Do you think that work should come first, even if it implies lack of rest?" "Do you think the best way to judge a man is by his success in his occupation?" and, "Do you think the most important qualities of a real man are determination and driving ambition?" Scores ranged from 0 to 6, with a high score indicating high achievement motivation.

(6) Empathy was operationalized as the respondents' score on a scale ranging from 0 to 9, indicating answers to the following three questions: "How could the newspaper help farmers in this village to progress?" "If electricity were brought to this village, how would your life change?" and, "How could the cinema be used to make this village more civilized?" Specific scores for each question were assigned, ranging from 0 to 3, depending on whether response was (0) don't know, or no response, (1) vague or unrealistic, (2) specific relationship but no direct improvement, and (3) specific relationship plus direct improvement.

(7) Knowledge of Agricultural Change Agents was operationalized as respondent's score on a question indicating whether he knew any

agricultural workers who come to his village. Possible responses were: No, or incorrect, and Yes, coded 0 or 1, respectively.

(8) Economic Aspiration was operationalized as respondent's score on a scale ranging from 0 to 9, indicating various responses to the question: "If you had all the money you needed, what would you do with it?" Answers were coded in the 9 categories according to the degree of desire for economic improvement exemplified, with higher scores indicating higher degrees of economic aspiration.

(9) Literacy was operationalized as respondent's score on a functional reading test. Respondent was asked to read a card containing 35 English words: "He who cannot read is like a blind person who is being led lest he goes astray. He is dependent upon others. The book which he cannot read mocks him as a slave to ignorance." The number of incorrect words was recorded, and respondent was scored from 00 to 35, according to the number of words known. A higher score indicated a higher degree of literacy.

(10) Newspaper Exposure was operationalized as respondent's score on an index ranging from 00 to nn, indicating the actual number of papers read, or read to him, during the previous four weeks.

(11) Radio Exposure was operationalized as respondent's score on an index ranging from 00 to 14, indicating the number of days he had listened to the radio during the previous two weeks. The score represented the actual number of days, with 14 as the maximum.

(12) Film Exposure was operationalized as respondent's score on an index ranging from 0 to 9, indicating the number of films he had seen

during 1966. Answers were coded as follows: 0 = none; 1 to 8 = actual number; and 9 = nine or more films seen. Thus a higher score indicated higher film exposure.

(13) Agricultural Media Exposure was operationalized as respondents' score, based on a total number of exposures to various types of agricultural media messages during 1966. Possible scores ranged from 00 to 12, with answers coded as follows: 0 = No, 1 = don't know, 2 = Yes. Six types of agricultural messages included: Read agriculture newsletter or pamphlet, saw an agricultural demonstration, heard an agricultural radio program, saw an agricultural film, attended an agricultural lecture, talked with an agricultural officer. Thus, a higher score indicated higher exposure to agricultural media.

(14) Credit Orientation was operationalized as respondent's score on an index ranging from 0 to 9 indicating the source of credit he would contact to raise money to improve the farm. Answers were coded so as to give higher scores for individuals who indicated greater orientation to sources external to the family and close friends.

(15) Level of Living was operationalized as respondents' score on an index, based on the total number of selected personal possessions the respondents owned. Answers were coded 0 for No, and 1 for Yes, indicating if they owned a radio, a wristwatch, cushioned chairs, laced shoes, a cupboard, an iron bed, a clock, a bicycle, framed photographs, and a 1966 calendar. Scores ranged from 0 to 9, indicating the actual number of these possessions.

(16) Correct Agricultural Knowledge was operationalized as respondents' score on an index ranging from 00 to 28, indicating whether respondents had correct information about each of the 14 innovations. Respondents were asked, "Do you know anything about..." and interviewers judged the correctness of the response by comparing against a checklist carried to the interview. Respondents were scored as either 0 for no correct information, or 2 for correct information. A previous index had recorded the simple fact of knowledge or lack of knowledge about the programs.

(17) Formal Social Participation was operationalized as respondent's score on an index indicating the number of groups in the village in which the respondent held memberships. A list of eight categories of village groups, plus "others" was used as the basis for the classification, and scores ranged from 00 to nn, indicating the actual number of groups belonged to.

In each of the foregoing questions, and all others asked during the interview, confidentiality and a friendly and courteous manner were used by the interviewer. In addition, the interviewers were instructed to seek specific answers for each question, to indicate by appropriate coding whether the respondent was qualified to answer the question, and to record every answer given.

Construction of Variables

As outlined earlier, two levels of modernization characteristics were included in the present analysis as independent variables:

(1) Individual level variables, constructed from each respondent's score on each of the 17 variables on which data were obtained.

(2) System level variables, constructed from the mean value of each of the 17 variables within the villages included in the study. Each of the 18 villages in the study thus had 17 different scores, representing the mean value for each of the 17 independent variables. Each respondent in each village was assigned a score based on the mean level of each of the 17 independent variables in his village, for inclusion in the correlational analyses as a system variable. For example, each individual's innovativeness was correlated with his own individual level of achievement motivation, as well as with the mean level of achievement motivation in his village.

CHAPTER IV

RESEARCH FINDINGS

Correlates of Innovativeness

The research design of the present study calls for the selection of certain modernization characteristics of individuals, to be submitted to zero-order, partial, and multiple correlation analyses, with a view to developing a paradigm of variables that best predict innovativeness.

As outlined in the guiding hypotheses (Chapter II), three basic propositions are examined:

(1) That selected individual modernization characteristics of the respondents are positively related to innovativeness.

(2) That the distribution of these individual characteristics throughout the social system (herein called system level variables) are positively related to innovativeness.

(3) That the interaction of these two levels of independent variables is positively related to innovativeness, and the consideration of both levels of variables simultaneously explains more variance in farmers' innovativeness than do the individual level variables alone.

Let us now examine each of these propositions in the light of various data analyses conducted in order to examine them.

Individual Characteristics and Innovativeness

Zero-Order Correlations. As indicated in Table 10, 15 of the 17 individual level variables included in the analysis had zero-order



correlations which were statistically significant from zero at the .05 level of probability. Of the 15 statistically significant correlations, correct agricultural knowledge had the highest zero-order correlations with innovativeness (.53), followed closely by agricultural media exposure (.52). The individual respondent's education (.35), level of living (.38), social participation (.35), knowledge of agricultural workers (.34), literacy (.34), and newspaper and radio exposure (.32 and .31, respectively) were all highly correlated with innovativeness.

The individual level of cosmopoliteness (.26), educational aspiration (.23), empathy (.29), economic aspiration (.12), and film exposure (.24) were also significantly correlated with innovativeness. Familism was negatively related to innovativeness, as expected, but the correlation barely reached significance at the .05 level of probability (-.06). Neither achievement motivation nor credit orientation were significantly related to innovativeness at the individual level.

Partial Correlations. Partial correlational analysis is a technique whereby the correlation between a dependent variable and an independent variable can be determined, while holding constant one or more other independent variables. Such a technique statistically eliminates the intercorrelation between the independent variables, and results in a "cleaner" measure of the relationship between the dependent and the independent variables.

Two types of partial correlation were computed in the present analysis:

Table 10: Zero-Order Correlations between Individual Level Variables, System Level Variables, and Innovativeness (N = 1,142).

Variable	Zero-Order Correlation with Innovativeness		Correlation of Individual Variable with System Variable
	Individual Level of Independent Variable	System Level of Independent Variable	
Cosmopolitaness	.26 ^a	.03 ^b	.33
Education	.35 ^a	.14 ^{ab}	.31
Familism	-.06 ^a	-.18 ^{ab}	.39
Educational Aspiration	.23 ^a	.09 ^{ab}	.29
Achievement Motivation	.03	.06 ^a	.22
Empathy	.29 ^a	.16 ^{ab}	.31
Knowledge of Agricultural Workers	.34 ^a	.11 ^{ab}	.43
Economic Aspiration	.12 ^a	.11 ^a	.14
Literacy	.34 ^a	.13 ^{ab}	.23
Newspaper Exposure	.32 ^a	.11 ^{ab}	.21
Radio Exposure	.31 ^a	.08 ^{ab}	.20
Film Exposure	.24 ^a	.17 ^{ab}	.27
Agricultural Media Exposure	.52 ^a	.22 ^{ab}	.33
Credit Orientation	-.02	-.05	.31
Level of Living	.38 ^a	.13 ^{ab}	.33
Correct Agricultural Knowledge	.53 ^a	.28 ^{ab}	.52
Formal Social Participation	.35 ^a	.18 ^{ab}	.58

^a

Significantly different from zero at the .05 level of probability.

^bSignificantly different from individual level variables at .05 level of probability.

(1) First-order partial correlation, in which the correlation between innovativeness and individual characteristics was computed, while holding constant (partialling out) the system characteristics. This was computed for each variable.

(2) Sixteenth-order partial correlations, in which the correlations between innovativeness and a given independent variable was computed, while holding constant (partialling out) the other independent variables included in the analysis. This also was computed for each variable.

Let us look first at the first-order partial correlations. As indicated in Table 11, all but three of the 17 individual variables were significant at the .05 level of probability, when system variables were partialled out. The three non-significant correlations were for familism (.01), achievement motivation (.02), and credit orientation (-.01). Among the significant correlations, the correlations for agricultural media exposure (.49) and correct agricultural knowledge (.47) were markedly higher than all others. Level of living (.36), education (.33), knowledge of agricultural workers (.33), literacy (.32), and social participation (.31) had correlations with innovativeness above .30. Cosmopolitaness (.27), empathy (.26), educational aspiration (.22), film exposure (.20) had correlations with innovativeness above .20, and economic aspiration was correlated with innovativeness at .11.

Sixteenth-order partial correlations with innovativeness were also computed for the individual level variables, and the results are shown in Table 12. In this analysis, the correlation between each of the individual level variables and innovativeness was computed, while

Table 11: First Order Partial Correlations between Individual Level Variables, System Level Variables, and Innovativeness (N = 1,142).

<u>Variable</u>	<u>Individual Variable and Innovativeness, Holding System Variables Constant</u>	<u>System Variable and Innovativeness, Holding Individual Variables Constant</u>
Cosmopoliteness	.27 ^a	-.06 ^a
Education	.33 ^a	.04
Familism	.01	-.17 ^a
Educational Aspiration	.22 ^a	.03
Achievement Motivation	.02	.05
Empathy	.26 ^a	.08 ^a
Knowledge of Agricultural Workers	.33 ^a	-.04
Economic Aspiration	.11 ^a	.09 ^a
Literacy	.32 ^a	.06 ^a
Newspaper Exposure	.31 ^a	.05
Radio Exposure	.30 ^a	.02
Film Exposure	.20 ^a	.11 ^a
Agricultural Media Exposure	.49 ^a	.06 ^a
Credit Orientation	-.01	-.05
Level of Living	.36 ^a	.01
Correct Agricultural Knowledge	.47 ^a	.01
Formal Social Participation	.31 ^a	-.03

^asignificantly different from zero at the .05 level of probability.

holding constant all other individual level variables. As indicated in Table 12, only six of the individual level variables were significantly correlated with innovativeness when their intercorrelations with all other individual variables was mathematically removed. As was true with first-order partial correlation analysis (see Table 11), correct agricultural knowledge (.26) and agricultural media exposure (.22) were most highly correlated with innovativeness. Formal social participation (.17) and newspaper exposure (.14) were both rather highly correlated with innovativeness, while education (.06) barely reached significance at the .05 level of probability. Contrary to expectations, credit orientation (-.10) was negatively correlated with innovativeness.

Multiple Correlation. Multiple correlational analysis is a technique whereby the contribution to the prediction of the dependent variable by a number of independent variables when considered together is computed. In this particular case, we computed the contribution made by all individual level variables to innovativeness. After deleting 11 variables which did not reach the minimum significance criterion, six variables taken together produced a multiple correlation coefficient of .62 (Table 12), accounting for 38 percent of the variance in innovativeness.

System Characteristics and Innovativeness

As discussed in Chapter III, the mean level of each of the independent variables was taken as an indicator of the distribution of the selected modernization characteristics throughout the social

100
100

Table 12: Sixteenth-Order Partial Correlations of Six Individual Level Variables with Innovativeness, after Deletion of 11 Variables Not Reaching Minimum Significance^a (N = 1,142).

Variable	Partial Correlation Coefficients (16th-Order)
Education	.06
Newspaper Exposure	.14
Agricultural Media Exposure	.22
Credit Orientation	-.10
Correct Agricultural Knowledge	.26
Formal Social Participation	.17
Multiple Correlation Coefficient = .62	
Coefficient of Determination (R ²) = .38	

^aSignificance criterion established at .05 level of probability.

system. Let us now examine the relationship of these system variables to innovativeness.

Zero-order Correlations. As indicated in Table 10, all of the zero-order correlations for the system variables and innovativeness were statistically significant, except two. Cosmopoliteness (.03) was not significantly correlated with innovativeness at the system level, nor was credit orientation (-.05).

Most highly correlated with innovativeness were correct agricultural knowledge (.28) agricultural media exposure (.22). Familism, as expected, was negatively and significantly correlated with innovativeness (-.18), and social participation (.18), film exposure (.17), empathy (.16), education (.14), literacy (.13), and level of living (.13) were all positively and significantly correlated with innovativeness at the system level. Knowledge of agricultural workers, economic aspiration, and newspaper exposure were all significantly correlated (.11) with innovativeness at the system level. Educational aspiration (.09), radio exposure (.08), and achievement motivation (.06) were also correlated positively with innovativeness.

Partial Correlations. Both first-order partial correlations and higher-order partial correlations were computed for the system level variables in the analysis. Let us consider first-order partial correlations first in our discussion.

As indicated in Table 11, when system variables were correlated with innovativeness, holding individual level variables constant, seven of the 17 variables were statistically significant at the .05 level.

Familism (-.17), empathy (.08), economic aspiration (.09), literacy (.06), film exposure (.11), and agricultural media exposure (.06) were statistically significant at the .05 level of probability, and in the expected direction. Cosmopolitaness (-.06), however, was negatively correlated with innovativeness, contrary to expectation, and was statistically significant.

Although film exposure and agricultural media exposure were both significantly correlated with innovativeness at the system level, newspaper exposure (.05), radio exposure (.02), and knowledge of agricultural workers (-.04) were not significantly correlated with innovativeness, contrary to expectations.

With the exception of familism (-.17) and film exposure (.11), all the first-order partial correlation coefficients for the system level variables were quite low.

As indicated in Table 13, 33rd-order partial correlations were computed for the system variables, and the individual variables. Twenty of these higher-order partial correlations were significantly correlated with innovativeness at the .05 level, but seven were negatively correlated with innovativeness. Because of the large number of independent variables (34) utilized in the analysis, and the high degree of inter-correlation between them, these negative higher order partial correlation coefficients are difficult to interpret with confidence.

Comparison of Individual and System Variables

When one examines the zero-order correlations of both the individual and system variables (see Table 10), it is seen that 15 of the 17

Table 13: Thirty-Third-Order Partial Correlations of 34 Independent Variables with Innovativeness (N = 1,142).

<u>Variable</u>	<u>Partial Correlation Coefficient</u>	
	<u>Individual Level</u>	<u>System Level</u>
Cosmopolitaness	.00	-.19 ^a
Education	.05	-.19 ^a
Familism	.00	.18 ^a
Educational Aspiration	.03	-.03
Achievement Motivation	-.04	.09 ^a
Empathy	-.08 ^a	-.19 ^a
Knowledge of Agricultural Workers	.06 ^a	.03
Economic Aspiration	.04	-.20 ^a
Literacy	.04	.18 ^a
Newspaper Exposure	.11 ^a	-.04
Radio Exposure	-.02	.20 ^a
Film Exposure	-.02	.12 ^a
Agricultural Media Exposure	.22 ^a	-.02
Credit Orientation	-.06 ^a	.21 ^a
Level of Living	.02	.20 ^a
Correct Agricultural Knowledge	.20 ^a	.17 ^a
Formal Social Participation	.17 ^a	-.19 ^a

^aSignificantly different from zero at the .05 level of probability.

variables at each level were significantly correlated with innovativeness. However, they were not the same variables in both cases.

Cosmopolitaness' correlation with innovativeness was .26 at the individual level, and .03 at the system level, and was not statistically significant at the system level. On the other hand, the correlation of achievement motivation with innovativeness increased from .03 at the individual level to .06 at the system level, and was barely significant at the system level. Credit orientation, which was not significant at the individual level, was also not significant at the system level. With four exceptions, all zero-order correlations with innovativeness were significantly lower at the system level than at the individual level.

Sixteen of the zero-order correlations between the individual and system variables and innovativeness were significantly higher than the partial correlations with the individual and system level effects partialled out (see Table 13). This was to be expected, if in fact the system level variables exerted any influence upon the individual's innovativeness, as hypothesized. For example, the zero-order correlation between the individual level of film exposure and innovativeness was .24, whereas the partial correlation between film exposure and innovativeness, with the system level of literacy held constant, was .20, indicating perhaps that the system level of this variable was contributing somewhat to the zero-order correlation at the individual level. A similar result was observed for formal social participation (.35 for zero-order correlation at the individual level versus .31 with the system level partialled out), and correct agricultural knowledge (.53 versus .47).

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Table 14: Comparison of Zero-Order and First-Order Partial Correlations for Both Individual and System Variables and Innovativeness (N = 1,142).

Variable	Zero-Order Correlation With Innovativeness		First-Order Partial Correlation With Innovativeness	
	Individual Level	System Level	Individual Level	System Level
Cosmopolitaness	.26	.03	.27	-.06 ^a
Education	.35	.14	.33	.04 ^a
Familism	-.06	-.18	.01	-.17
Educational Aspiration	.23	.09	.22	.03 ^a
Achievement Motivation	.03	.06	.02	.05
Empathy	.29	.16	.26	.08 ^a
Knowledge of Agricultural Workers	.34	.11	.33	-.04 ^a
Economic Aspiration	.12	.11	.11	.09
Literacy	.34	.13	.32	.06 ^a
Newspaper Exposure	.32	.11	.31	.05 ^a
Radio Exposure	.31	.17	.30	.02 ^a
Film Exposure	.24	.17	.20 ^a	.11 ^a
Agricultural Media Exposure	.52	.22	.49	.06 ^a
Credit Orientation	-.02	-.05	-.01	-.05
Level of Living	.38	.13	.36	.01 ^a
Correct Agricultural Knowledge	.53	.28	.47 ^a	.01
Formal Social Participation	.35	.18	.31 ^a	-.03 ^a

^aSignificantly different from zero-order correlations at .05 level of probability, as indicated by t test for significance of difference between two correlation coefficients, with 1139 degrees of freedom. For this test of significance, the first-order partial correlation coefficients were treated as zero order correlation coefficients. An alternative method of comparison is to randomly divide the sample into two groups, and compute the zero-order correlations from one group and the first order partial correlation from the other. For large samples, however, (N greater than 300), the difference between the two methods is negligible.

Although system level film exposure and system level agricultural media exposure were both significantly correlated with innovativeness when individual level variables were partialled out (Table 11), system level newspaper exposure and system level radio exposure were not significantly correlated with innovativeness. All four of these variables were highly related to innovativeness at the individual level, however, suggesting that the primary relation of these variables with innovativeness is at the individual level, not at the system level.

Variables which were statistically significant at the individual level, but not at the system level, when first order partial correlations were computed (see Table 11), were education (.33 at the individual level versus .04 at the system level), educational aspiration (.22 versus .03), newspaper exposure (.31 versus .05), radio exposure (.32 versus .02), knowledge of agricultural workers (.33 versus -.04), level of living (.36 versus .01), correct agricultural knowledge (.47 versus .01), and social participation (.31 versus -.03). Fourteen variables were significantly correlated with innovativeness at the individual level when system level variables were held constant, but only seven variables were significantly correlated with innovativeness at the system level when individual level variables were held constant. In general, then, system level variables were less highly correlated with innovativeness than were individual level variables.

Joint Influences of Individual and System Variables

In order to determine the joint influence of individual and system variables to innovativeness, two types of analysis were performed:

(1) A comparison of zero-order and first-order partial correlations for both individual and system variables and innovativeness.

(2) First-order multiple correlations of individual level and system level of each variable, and higher-order multiple correlations of all individual and system variables which met the minimum significance criterion of .05 level of probability.

Let us consider the first type of analysis. As indicated in Table 14, the first-order partial correlations of each variable with innovativeness were all lower than the zero-order correlations of each variable with innovativeness. The only exception to this generalization was the correlation of cosmopolitaness with innovativeness, which was higher in correlation with innovativeness when first-order partial correlation was computed than when zero-order correlation was computed. As indicated in Table 11, cosmopolitaness was negatively correlated with innovativeness at the system level when the individual level of cosmopolitaness was held constant.

If indeed the individual and system level of each variable interact to increase the correlation of that variable with innovativeness, the partialling out of either the individual level or the system level of that variable should decrease the correlation with innovativeness. With the exception of cosmopolitaness, this was the case for each of

the 17 variables. However, the zero-order correlations of the individual variables with innovativeness was decreased less by partialling out the system variables, than the zero-order correlations of the system variables were decreased by partialling out the individual variables, indicating that the system variables explained less of the variance of innovativeness than did the individual characteristics of the respondents.

Let us now consider the first-order multiple correlations. As indicated in Table 15, multiple correlational analysis was performed for each variable, taking both the individual level and system level of that variable into account. Only seven of the 17 variables had higher first-order multiple correlation coefficients than zero-order correlation coefficients at the individual level; moreover, the increase was quite small in almost every case. The first-order multiple correlations, therefore, did not clearly indicate an interaction effect between the individual level and system level variables.

The results of higher-order multiple correlation analysis were, however, somewhat more marked and easier to interpret. In describing how the higher-order multiple correlation coefficient was determined, consideration must be given to the role of highest-order partial correlation coefficients, and the least squares delete computer program.

Highest-order partial correlation is a special type of partial correlation in which the correlation between the dependent variable and the independent variable under consideration are determined, while holding constant all other variables in the analysis. In the present

Table 15: First-Order Multiple Correlations for Each Variable, When Both Individual Level and System Level for Each Variable Are Taken into Account, in Predicting Innovativeness (N = 1,142).

Variable	Zero-Order Correlation with Innovativeness		Multiple Correlations with Innovativeness
	Individual Level of Independent Variable	System Level of Independent Variable	
Cosmopoliteness	.26	.03	.27 ^a
Education	.35	.14	.35
Familism	-.06	-.18	.18 ^a
Educational Aspiration	.23	.09	.23
Achievement Motivation	.03	.06	.06 ^a
Empathy	.29	.16	.30 ^a
Knowledge of Agricultural Workers	.34	.11	.34
Economic Aspiration	.12	.11	.15 ^a
Literacy	.34	.13	.34
Newspaper Exposure	.32	.11	.32
Radio Exposure	.31	.08	.31
Film Exposure	.24	.17	.26 ^a
Agricultural Media Exposure	.52	.22	.52

Table 15--Continued.

Variable	Zero-Order Correlation with Innovativeness		Multiple Correlations with Innovativeness
	Individual Level of Independent Variable	System Level of Independent Variable	
Credit Orientation	-.02	-.05	.05 ^a
Level of Living	.38	.13	.38
Correct Agri- cultural Know- ledge	.53	.28	.53
Formal Social Participation	.35	.18	.35

^aVariables in which multiple correlation for both the individual level and system level shows some increase over the zero-order individual level.

analysis, a total of 34 variables were used in the analysis, so that the partial correlation was of the 33rd order.

Two types of highest-order partial correlation were utilized in the analysis of the data:

(1) Highest-order partial correlations for all 34 variables.

Such correlations include both significant and non-significant variables, and are not of primary interest in the present study. Results of this analysis are shown in Table 13.

(2) Highest-order partial correlations for the 23 variables remaining in the analysis, after 11 variables had been deleted because they did not reach the minimum statistical significance criterion. Results of this analysis are shown in Table 16.

Deletion of the non-significant variables from the analysis occurred in the following manner. The data were submitted to the computer for analysis by the "least squares delete" computer program, with the stipulation that all variables that did not reach a minimum significance level of .05 should be deleted from the analysis. Of the 34 variables submitted to computer analysis (including both individual and system level variables), 11 were deleted. The 11 variables in the order deleted included:

1. Cosmopolitaness
2. Familism
3. System level agricultural media exposure
4. Radio exposure
5. Level of living
6. Film exposure
7. Literacy
8. System level educational aspiration
9. Educational aspiration
10. Achievement motivation
11. Economic aspiration.

Thus, a total of 23 variables were retained in the analysis as statistically significant after the highest-order partial correlation analysis, and were combined into a multiple correlational analysis. The multiple correlation coefficient for these 23 variables was .68, with a coefficient of determination of .47 (see Table 17).

In order to determine how much additional variance could be explained by taking both individual level and system level variables into account, a multiple correlation coefficient was computed for individual level variables only. After deleting the individual level variables which did not meet the minimum significance criterion of .05, six variables (see Table 12) were retained in the analysis, producing a multiple correlation coefficient of .62, and a coefficient of determination of .38.

When the multiple correlation coefficient for the individual level plus system level variables is compared with the multiple correlation coefficient for the individual level only, it is seen that the former was somewhat higher (.68 as compared with .62). Thus, taking both individual level variables and system level variables into account in the analysis produced a multiple correlation coefficient which accounts for 47 percent of the variance in innovativeness, whereas the coefficient for the individual level variables only explained 38 percent of the variance in innovativeness (Table 17).

Confirmation of Hypotheses

Although this analysis was not designed to rigorously test hypotheses, three rather general guiding hypotheses were set forth

Table 16: Twenty-Second Order Partial Correlations of 23 Independent Variables with Innovativeness, After Deletion of 11 Variables by Least Squares Delete Program.^a
(N = 1,142).

<u>Variable</u>	<u>Partial Correlation Coefficients</u>
I. Individual Level	
Education	.09
Empathy	-.07
Knowledge of Agricultural Workers	.07
Newspaper Exposure	.12
Agricultural Media Exposure	.24
Credit Orientation	-.07
Correct Agricultural Knowledge	.20
Formal Social Participation	.17
II. System Level	
Cosmopolitaness	-.24
Education	-.21
Familism	.22
Achievement Motivation	.22
Empathy	-.22
Knowledge of Agricultural Workers	.13
Economic Aspiration	-.23
Literacy	.19
Newspaper Exposure	-.09
Radio Exposure	.23
Film Exposure	.19
Credit Orientation	.21
Level of Living	.24
Correct Agricultural Knowledge	.23
Formal Social Participation	-.23

^aSignificance criterion established at .05 level of probability.
Thus, all of these variables are statistically significant.

Table 17: Comparison of Multiple Correlation Coefficients and Coefficients of Determination of Individual Level Variables Only, System Level Variables and Individual Level and System Level Variables Considered Simultaneously (N = 1,142).

<u>Level of Variable Considered</u>	<u>Multiple Correlation Coefficient</u>	<u>Coefficient of Determination</u>
Individual Level Only	.62	.38
System Level Only	.40	.16
Individual and System Level Considered Simultaneously	.68 ^a	.47

^aSignificantly different from either individual level only or system level only at .05 level of probability, as indicated by t test for significance of difference between two correlation coefficients, with 1139 degrees of freedom.

in Chapter II. Perhaps a consideration of these hypotheses in relation to the analytical results can bring the goals and conclusions of this study into sharper focus.

- H₁ The individual level of innovativeness for Nigerian villagers is positively related to the individual level of selected modernization characteristics.

As described earlier in this chapter, three analytical techniques were utilized to test this hypothesis:

- (1) Zero-order correlations
- (2) First-order and highest-order partial correlations
- (3) Multiple correlation

With the exception of two variables (achievement motivation and credit orientation), the zero-order correlations of the selected individual level variables to innovativeness were positive and significant. All but three of the individual level variables (achievement motivation, credit orientation, and familism) were positively and significantly related to innovativeness when first-order partial correlations were computed, but only six variables were significant when highest-order partial correlations were computed, probably because of the high intercorrelations between the independent variables. The multiple correlation coefficient for the six significant individual level variables was .62.

With the minor exceptions here noted, the first guiding hypothesis was generally confirmed.

- H₂ The individual level of innovativeness for Nigerian villagers is positively related to the system level of selected modernization characteristics within each village.



As described earlier in this chapter, two analytical techniques were utilized to test this hypothesis:

- (1) Zero-order correlations
- (2) First-order and highest-order partial correlations.

All the system level variables were somewhat lower in zero-order correlation with innovativeness, than the individual level variables. Fifteen of the system level variables were statistically significantly correlated with innovativeness, however, and all but one were in the hypothesized direction. When first-order partial correlations were computed, seven of the 17 system variables were significantly correlated with innovativeness. When higher-order partial correlations were computed for the system variables, seven were statistically significant but in a negative direction. The high level of intercorrelations among the independent variables, and the large number included in the present analysis, make the results of partial correlations analysis somewhat difficult to interpret.

We conclude, therefore, that the second guiding hypothesis was only partially confirmed.

- H₃ The individual level of innovativeness for Nigerian villagers is positively related to the joint influence of the individual level and the system level of selected modernization characteristics within each village.

The primary analytic technique utilized in testing this hypothesis was multiple correlation. First-order multiple correlations were computed, utilizing individual and system levels for each variable, but the results were not clear-cut. Including the 23 individual and system level variables



which were statistically significant in highest-order partial analysis into a multiple correlation, however, increased the correlation coefficient to .68, accounting for 47 percent of the variance in innovativeness. This is compared with a multiple correlation for individual variables of .62, accounting for 38 percent of the variance in innovativeness.

We conclude, therefore, that the third guiding hypothesis is generally confirmed, although the additional amount of variance in innovativeness explained by taking system level variables into account as well as individual level variables was not very great.

Analysis for Isolating System Effects

As set forth in Chapter II, the present study was designed to make the following determinations for system effects:

(1) To investigate whether system level variables contribute significantly to the amount of variance explained in the innovativeness of Nigerian farmers.

(2) To investigate whether the individual level variables describing individual characteristics of Nigerian farmers are mediated by the system level variables in their influence on innovativeness.

Both of these research questions were answered in the affirmative, with certain reservations and exceptions. Generally, the following two statistical techniques gave strongest support for these two conclusions:

(1) Partial correlations, in which the correlation between system level variables and innovativeness was computed, while holding constant the individual level variables. Of the 17 pairs of variables for which



this partial correlation was computed, seven were significantly correlated with innovativeness at the .05 level. Of these seven significant variables, six were correlated in the hypothesized direction, as follows:

Familism	Negative
Empathy	Positive
Economic Aspiration	Positive
Literacy	Positive
Film Exposure	Positive
Agricultural Media Exposure	Positive

Cosmopolitaness, however, with a correlation of $-.06$, was significantly but negatively related to innovativeness at the system level.

(2) Multiple correlations, in which the amount of variance explained by utilizing both individual and system level variables was compared with the amount of variance explained by utilizing individual level variables only. The consideration of both levels of variables simultaneously increased the amount of variance explained in innovativeness by 9 percent (from 38% to 47%).

The system level variables seem to exert mediational influence upon the individual level variables in three different ways:

(1) Augmenting their correlation with innovativeness, as indicated by:

(a) The increase over zero-order correlation obtained by computing a multiple correlation coefficient incorporating both individual and system variables, for each variable.

(b) The increase in the amount of variance explained in innovativeness by incorporating both individual and system level

variables, for all variables in the analysis, in a multiple correlation coefficient, when compared with the amount of variance explained by incorporating only individual level variables in a multiple correlation coefficient.

(c) The decrease in correlation between innovativeness and individual level variables, when system level variables were partialled out.

(2) Decreasing their correlation with innovativeness, as indicated by the increase in correlation of individual level cosmopolitanism with innovativeness, when system level cosmopolitanism was partialled out. As indicated earlier, the partial correlation (first-order) for system level cosmopolitanism and innovativeness, with individual level cosmopolitanism held constant, was $-.06$. To interpret this negative correlation verbally, the higher the mean level of cosmopolitanism in an individual's village, the lower will his individual innovativeness be. Thus, system level cosmopolitanism exerted a depressing influence upon the individual farmer's innovativeness.

(3) Serving as an alternative to individual correlates of innovativeness. In the case of familism, for example, the correlation of individual level familism when system level familism was held constant, was practically nil ($.01$). The system level correlation of familism, however, with individual familism held constant, was highly significant ($-.17$). Further, the multiple correlation coefficient obtained by taking both individual and system level familism into account was $.18$,

as contrasted with $-.06$ for individual level familism only. This would seem to indicate that an individual farmer's familism matters little in predicting innovativeness, so long as his village is low in familism. Thus, system level familism serves as an alternative to individual level familism, in predicting innovativeness, in some instances.

SECTION 10

LINE

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The present study was designed to explore the relations between individual modernizing characteristics of Nigerian farmers, the corresponding system characteristics, computed as the average level of those characteristics in each of the villages where the respondents lived, and the individuals' innovativeness. Of primary concern was the interaction between the two levels of modernizing characteristics in explaining greater amounts of variance in innovativeness.

A portion of the data gathered in the three-nation Diffusion Project conducted by the Department of Communication, Michigan State University, and sponsored by the United States Agency for International Development, were analyzed. The Diffusion Project was conducted in three phases: Phase One was an analysis of the relative success or failure of various programs of change in agricultural production in some 80 villages in each country. The unit of analysis was the village, and data were secured primarily from interviews with village leaders and change agents. Phase Two was based on data obtained through personal interviews with individuals living in some 20 villages in each of the three countries. Respondents were male household

heads. Phase Three was designed as a field experiment using selected communication techniques and economic incentives. However, Phase Three was curtailed in Eastern Nigeria after its initiation because of civil strife and political disturbances in the country. Thus, the first two phases of the Nigerian Diffusion Project were utilized in the present study, with the major portion of the data coming from Phase Two.

From the 71 villages studied in Phase One, 18 villages were chosen as the basis for the Phase Two study. The sample was comprised of 1,142 respondents, who were in each case a male, the head of his household, at least 20 years old, and farming some amount of land. The sampling rate within each village was approximately 57 percent.

Fourteen agricultural innovations were selected for inclusion as innovations in the study. They included: fertilizer, NS-1 maize, Aldrin dust, poultry, oil palm rehabilitation, community plantations, citrus, rice, improved cassava, vegetable seeds, cocoa planting schemes, rubber planting scheme, cashew, and FAID agricultural credit. Both knowledge and adoption of these innovations were generally quite low, with 50 percent of the respondents knowing five innovations or less, and 37 percent of the respondents adopting no innovations at all.

Seventeen cognitive, attitudinal, and overt behavioral characteristics of individuals were utilized as independent variables, including cosmopolitanism, education, familism, educational aspiration, empathy, knowledge of agricultural workers, economic aspiration, literacy, newspaper exposure, radio exposure, film exposure, agricultural media exposure, credit orientation, level of living, correct

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agricultural knowledge, formal social participation, and achievement motivation. Each of these 17 variables was aggregated through a measure of central tendency (mean) and utilized as an independent variable at the system level.

Three guiding hypotheses were selected as the focus of the analysis: (1) that the individual level of innovativeness for the respondents is positively related to the individual level of selected modernization characteristics, (2) that the individual level of innovativeness is positively related to the system level of selected modernization characteristics, and (3) that the individual level of innovativeness is positively related to the joint influence of the individual and system levels of selected modernization characteristics.

Three statistical methods were utilized in the analysis of the data: (1) zero-order correlation, (2) first-order and higher-order partial correlations, and (3) multiple correlation.

First, zero-order correlations were computed between innovativeness and each independent variable, both individual and system. Then, higher-order partial correlations between innovativeness and each of the independent variables were computed, holding constant all other independent variables. To specifically determine the contribution of the system variables, partial correlations were computed for each of the system variables, with the individual level variables held constant.

After submitting the independent variables to both zero-order and higher-order partial correlation analysis, the best predictors of innovativeness (the variables most highly correlated with innovativeness) were submitted to a multiple correlation analysis. Both individual level and system level variables were included in the multiple correlation analysis. Thus, the best predictors from the system variables and the best predictors from the individual variables were included in the multiple correlation analysis, using the multiple regression least squares delete computer program, to formulate a paradigm of variables that predict innovativeness, and have significant explanatory power.

When zero-order correlations were computed between the independent variables and innovativeness, 15 of the 17 individual level variables were significantly correlated with innovativeness. These 15 variables were cosmopoliteness, education, familism, educational aspiration, empathy, knowledge of agricultural workers, economic aspiration, literacy, newspaper exposure, radio exposure, film exposure, agricultural media exposure, level of living, correct agricultural knowledge, and formal social participation. Also, 15 of the 17 (not the same 15) system level variables were significantly correlated with innovativeness when zero-order correlations were computed. These 15 variables were education, familism, educational aspiration, achievement motivation, empathy, knowledge of agricultural workers, economic aspiration, literacy, newspaper exposure, level of living, correct agricultural knowledge, and formal social participation.

Most highly correlated with innovativeness at the individual level were correct agricultural knowledge (.53) and agricultural media exposure (.52). Most highly correlated with innovativeness among the system level variables were correct agricultural knowledge (.28) and agricultural media exposure (.22). In general, individual level variables were more highly correlated with innovativeness than system level variables.

First-order partial correlations were computed separately for individual level and system level variables with innovativeness. First, individual variables were correlated with innovativeness, with system variables held constant. All but three of the individual level variables were significantly correlated with innovativeness, with correlations ranging from .49 for agricultural media exposure to .11 for economic aspiration (the lowest significant correlation). Next, system level variables were correlated with innovativeness, with individual level variables held constant. Only 7 of the 17 system variables reached statistical significance in this analysis. Thus, fewer system level variables were significantly correlated with innovativeness, when individual level variables were held constant, and correlations were generally considerably lower for system level variables than for individual level variables.

Highest-order partial correlations were then computed, to select variables from both individual and system levels most highly correlated with innovativeness, to be included in a multiple correlation analysis. Of the 34 independent variables submitted to the

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least squares delete computer program, 11 were deleted when they did not reach the minimum statistical significance criterion of .05 level of probability. Thus, a total of 23 variables were retained in the analysis as statistically significant after the highest-order partial correlation analysis, and these were combined in a multiple correlation analysis. The multiple correlation coefficient for these 23 variables was .68, with a coefficient of determination of .47.

When the individual level variables only were submitted to highest order partial correlation analysis, only six were retained as statistically significant. When entered into a multiple correlation analysis, these six individual level variables produced a multiple correlation coefficient of .62, and a coefficient of determination of .38.

Conclusions

On the basis of the present analysis, several conclusions regarding the relation to innovativeness of individual modernizing characteristics, system modernizing characteristics, and their interaction, seem to be possible.

1. The individual modernization characteristics selected for inclusion as independent variables in this study were generally highly correlated with the individual Nigerian farmer's innovativeness. As suggested by the paradigm (Figure 1) in Chapter II, individual characteristics of respondents have been frequently investigated for relationships to innovativeness, and to a considerable extent

the findings reported herein agree with many previous studies utilizing many of these same individual level variables.

Worthy of note, however, are three variables included in the present study which were not significantly correlated with innovativeness at the individual level: familism, achievement motivation, and credit orientation. Possibly these modernizing characteristics were not relevant individual variables in the Nigerian context, or, as discussed later in this chapter, the failure of these variables to be significantly correlated with innovativeness in this study may have been due to measurement error.

2. The system level modernizing characteristics selected for inclusion as independent variables in this study were related to some degree to the innovativeness of the individual Nigerian farmers. In general, however, they were not nearly so strongly related to innovativeness as the individual level variables.

Familism, which was not significantly correlated with innovativeness at the individual level, was significantly correlated with innovativeness at the system level, indicating that an individual farmer may be highly innovative if the general level of familism in his social system is low, even if his individual level of familism is quite low.

System level cosmopolitanism, which was not significantly correlated with innovativeness in the zero-order correlation analysis, and negatively and significantly correlated with innovativeness in the partial correlation analyses, is of considerable interest. Since



this characteristic is strongly related to innovativeness at the individual level, and either non-significant or negatively correlated at the system level, one might conclude that an individual farmer is likely to be innovative when he is individually highly cosmopolite, but not likely to be highly innovative when the social system in which he lives is highly cosmopolite. Perhaps the relation of cosmopoliteness to innovativeness is curvilinear, so that after some undetermined point of inflection on the curve, further increments of cosmopoliteness act as a suppressant to individual innovativeness.¹

Credit orientation, which was not significantly correlated with innovativeness at the individual level, was not significantly correlated with innovativeness at the system level either. Apparently, this characteristic was a poor predictor of innovativeness in the Nigerian context.

3. Taking both individual level variables and system level variables into account in a multiple correlational analysis increases the amount of variance explained in innovativeness, so that some interaction effects occur between individual level and system level independent variables. However, the amount of variance explained by individual level variables only was far greater than the amount of variance explained by system level variables only. The increase in amount of variance explained by taking both levels of independent variables into account amounts only to 9 percent.

¹ See Appendix A for analysis of curvilinearity.

Therefore, taking both levels of independent variables into account can increase the ability to predict individual innovativeness, but not greatly.

Limitations of the Study

Although several comments regarding weaknesses in sampling procedure, measurement error, etc., appear in earlier chapters of this dissertation, several limitations of the present investigation need specific mention.

1. The usual problems of field research (sampling, interviewer selection and training, biased responses, lack of information regarding conditions preceding introduction of innovations, problems of causality inference, etc.) are considerably magnified when the site of the study is in a less developed country such as Eastern Nigeria. Language difficulties, low homophily between researchers and respondents, danger of bias because of economic, philosophic, or political considerations, etc., were all present during the conduct of this study. Consequently, even though special efforts were made to overcome or counteract these difficulties in conducting the study, less than perfect confidence exists regarding the degree of success achieved in this effort.

2. Caution should be exercised in generalizing the results of this investigation to populations other than that included in the study. Although Eastern Nigeria farmers share many problems and characteristics with farmers in other nations of the world,

several factors make the subjects of this investigation somewhat unique, including the extremely low state of modernization existing generally in the country, the peculiar clique and kinship ties existing within the social systems, and the tension and anxiety characterizing the nation because of extremely unsettled civil and political conditions at the time of the investigation.

3. A most important limitation of the present study concerns the rather narrow focus on a very small portion of the total social system and its environment. In looking for correlates of innovativeness within the individual farmer himself and his environment, we chose only a very few of the many social, psychological, and overt behavioral characteristics that could be examined in relationship to innovativeness. A myriad of influences--political, economic, philosophical, etc.--surround the individual farmer, even in an extremely underdeveloped nation such as Nigeria, which relate either negatively or positively to his innovativeness. As explained in Chapter II, this present analysis was not designed as an investigation of the total social system, in all its hundreds of facets, but we chose instead to focus specifically on a relatively small number of attitudinal, cognitive, and behavioral characteristics which have been found to be related to innovativeness at the individual level in previous investigations. We attempted to determine the relation of these variables to individual innovativeness at both the individual and system level, and to determine if their interaction explains any



more variance in innovativeness than either taken alone. Such an approach is highly specific, and the results should not be generalized beyond the implications of these research findings.

4. A clear weakness of the present study is that no direct measurements were taken of the interpersonal communication processes within the villages, although several of the independent variables included in the analyses clearly exert their influence through the interpersonal communication network. Intuitively, one would expect the mean level of the independent variables within the villages (herein called system variables) to affect the individual farmers through the interaction among the individuals who live within the village. Yet, no direct measurements were taken of these interpersonal communication activities, but they were merely assumed. In future studies of a similar nature, more useful results could probably be obtained by directly measuring these dyadic relationships within the social system, and including them as another variable for consideration.

5. In the preliminary discussions regarding the present study, several variables from Phase One of the Diffusion Project were considered for inclusion. These variables included number of visits to the village by the agricultural extension agent, concentration of opinion leadership within the village, consensus among the change agents regarding the most important problems facing the village at the time of the survey, and other theoretically promising variables. However, logistical problems connected with

including these variables in the analysis were prohibitive, so they were dropped from consideration. The problems included differences in number of respondents in the two phases, difference in systems of coding used in the two phases, difference in the form submitted to the computer center for analysis, etc. We can only regret that it was not possible to include these variables, since the present results would probably have been more rewarding by their inclusion.

6. An analysis for curvilinearity computed for the relationship of each of the 34 independent variables to innovativeness indicated that many of the relationships were highly curvilinear. Since a product-moment correlation computed between variables in which the relationship is actually curvilinear will always be less than the true relationship, the findings of the present study represent an under-measurement of the actual relationship between these independent variables and innovativeness. Thus, higher zero-order correlations could have been obtained had the analyses been based on the correlation ratio, instead of the product-moment correlation coefficient.

Implications for Change Agent Strategy

What implications does the present investigation have for change agencies seeking to introduce innovations and modernizing technology into a less developed country such as Nigeria? Several suggestions seem to be warranted.

1. Although the evidence for system effects and interaction effects is not overwhelmingly powerful in the present investigation,

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the findings do suggest that an individual farmer's innovativeness is influenced by something more than individual characteristics alone. A change agency desirous of introducing an innovation into a given social system may therefore expect to find the adoption of that innovation affected by characteristics of the social system as well as of the individual receiver. The system characteristics should therefore be taken into account in the mapping of a strategy for change.

2. One of the concepts used by development theorists is "climate for development," usually defined as a concentration of social and psychological conditions within a social system which are conducive to modernization and development. The system effects found in the present study would seem to corroborate the value of taking such a concept into account in strategy planning. If the change agency desires to introduce innovations into a target social system, the system effects within that social system can reinforce and augment the process of modernization initiated by the individual modernization characteristic of the individuals. Since the mean level of a given modernization characteristics within a social system is a function of the number of individuals within that social system who possess that characteristic, the system variables which are positively related to innovativeness can serve as a "multiplier" for social change.

Implications for Future Research

The present form of analysis could well be expanded into other fruitful areas of research.

(1) One such area that might be investigated would be the determination of the relation between some selected characteristic of an individual (.e.g, innovativeness) and the level of selected independent variables within some type of social system other than a village. Human beings interact with, and are members of, various social systems, including the family group, the larger kinship group, cliques within the village or community, and perhaps special interest groups or reference groups. One might hypothesize, for instance, that individuals are influenced to adopt or not adopt various innovations by their interaction with members of the clique of which they are members. What happens in such situations when the clique members have belief or attitudes which are antagonistic to the norms of the larger social system? Would an individual be more innovative if he were a member of a special interest group in his community if that special interest group were more innovative than the average member of the larger social system? Such questions might reveal previously unstudied relationships between sub-systems and the larger social system, as well as between individuals within the sub-system itself.

(2) The amount of variance in innovativeness explained in the present study might have been increased by selection of a more promising set of independent variables. The variables utilized in the present investigation were chosen because of the conceptual relevance to innovativeness, as indicated by previous research. However, the list of possible independent variables was by no means exhaustive. If this study should be repeated, higher correlations with individual



innovativeness might be produced by such system variables as:

- The presence or absence of institutions in the village
- The number of social cliques in the village
- The population of the village
- The geographical dispersion of the village population
- The presence or absence of communications media
- An index of usage of communications media
- Distance from nearest urban center
- An index of accessibility (paved roads, remoteness, etc.)
- An index of commercial development

One advantage of including system variables such as these, in addition to or in place of aggregated individual level variables, is that such non-aggregated variables are more easily manipulable. Aggregated individual level variables are by definition a function of the level of these variables on the part of individuals, so that little can be done, at least in the short run, to alter the level of these variables at the system level. On the other hand, a variable such as the presence or absence of an educational institution can be manipulated, since such a facility could be physically erected, so that its impact upon the village or other social system could be measured with some rigor.

(3) The relationship of many of the independent variables in the present analysis to the communication process has been implied, rather than operationalized and measured. The correct knowledge of agricultural innovations within the system, for example, undoubtedly has impact upon individual innovativeness because of the communication process in operation within the system. However, no measure of such

interpersonal communication processes was included in the present analysis. If system variables have influence upon an individual's innovativeness, as the present study indicates, then a fruitful opportunity for future research lies in tapping the communication networks between individuals within the system, to determine how the system variables exert their influence. What are the communication processes that bring an individual into contact with system level achievement motivation, for instance? Or again, what are the communication linkages between the deviant and other members of the social system (e.g., a low innovative individual in a high innovative social system, or a high innovative individual in a low innovative social system)? Such questions were not considered in the present analysis, and offer an opportunity for productive future research.

(4) The present investigation hopefully will encourage other investigations utilizing system variables in addition to individual variables in their analyses. Although the investigation of the influence of individual characteristics is not nearly completed, perhaps equally or even more fruitful results could be obtained by expanding the scope of diffusion research to include more system analyses, at least to some extent. One of the notable lacunae in previous diffusion research has been an extremely narrow focus upon the individual and his characteristics, with hardly any attention to the individual's relationship to the social system of which he is a part. Both reason and research, however, indicate

that the individual is markedly influenced by his environment. The present study investigated individual and aggregated social, psychological, and behavioral characteristics in analyzing innovativeness. Perhaps even more enlightenment could be gained by including variables chosen from the economic, religious, political, philosophical, or other realms.

(5) A clear opportunity exists for further investigation of the joint influence of individual and system level variables upon innovativeness, using an even larger number of villages or social systems as the locus of the study. Added generalizability could be gained by conducting corroborative or similar research under similar research conditions, but in different social settings (perhaps another less developed country). Are the findings of the present study confined only to less developed countries, or do they hold true for more developed countries as well? Could more reliable and precise results be obtained by including a larger number of social systems in the analysis?

Perhaps partial answers to the question regarding the generalizability of the findings of the present study are already being compiled. In a contemporary study conducted by Saxena (1968) in the Department of Communication, Michigan State University, of the influence of system variables upon agricultural innovativeness in India, results very similar to those of the present study were obtained. Saxena investigated the relation of 15 individual and aggregated modernization characteristics to the individual innovativeness of residents of

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eight Indian villages, and found that the amount of variance in innovativeness explained by taking both individual and system level variables into account was 14 percent greater than including individual level variables only.

Saxena also extended the analysis of system variables by investigating the relevance of Newcomb's theory than an individual will tend to maintain minimal discrepancy between his own attitude toward an innovation and that of the system of which he is a part, depending upon the valence that is jointly attributed to change by the individual and by the system.

Such an investigation represents one extension of the present analysis. Others dealing with balance theories (i.e., cognitive dissonance, congruity, etc.) are possible, and offer opportunities for potentially rewarding research.

Thus, with this initial entry of system variables into diffusion research, perhaps the analytical techniques described by Durkheim a century ago in sociological investigations can increase our understanding of the relevance of system effects and produce even more imposing results than those already compiled.



BIBLIOGRAPHY

- Aurabac, Herbert A. (1955) "A Guttman Scale for Measuring Isolation." Rural Sociology, 20, pp. 142-45.
- Becker, Selwyn A. and Frank Stafford (1967), "Some Determinants of Organizational Success," Journal of Business, 40, pp. 511-18.
- Becker, Selwyn A. and Thomas A. Whisler (1967), "The Innovative Organization: A Selective View of Current Theory and Research." Journal of Business, 40, pp. 462-69.
- Berelson, Bernard, Paul F. Lazarsfeld, and W.N. McPhee (1954), Voting: A Study of Opinion Formation in a Presidential Campaign. Chicago, Illinois: University of Chicago Press.
- Blalock, Hubert M., Jr. Causal Inferences in Non-Experimental Research. Chapel Hill, N.C.: University of North Carolina Press, 1961.
- Blau, Peter M. (1957), "Formal Organization: Dimensions of Analysis." American Journal of Sociology, 63, p. 64.
- Blau, Peter M. (1960), "Structural Effects." American Sociological Review, 25, No. 2, pp. 178-93.
- Bose, Santi Pryia and Dasgupta, Satadal (1962), The Adoption Process. Calcutta, West Bengal Department of Agriculture, Socio-Agro-Economic Research Organization, Extension Bulletin No. 1.
- Campbell, Ernest Q. and C. Normal Alexander (1965), "Structural Effects and Interpersonal Relationships." American Journal of Sociology, 71, pp. 284-89.
- Carroll, Jean (1967), "A Note on Departmental Autonomy and Innovation in Medical Schools." Journal of Business, 40, pp. 431-34.
- Cattell, R.B. (1951), "Types of Group Characteristics," in Harold Guetzkow (ed.), Groups, Leadership, and Men. Pittsburgh: Carnegie Press. pp. 16-52.
- Coleman, James S. (1964) Introduction of Mathematical Sociology. Glencoe, Illinois: The Free Press.

- Coughenour, C. Milton (1964), "The Rate of Technological Diffusion Among Locality Groups." American Journal of Sociology, 69, pp. 325-39.
- Dasgupta, Satadal, (1968), "Relative Predictability of Five Indices of Adoption of Recommended Farm Practices." Sociologia Ruralis, 8: 1-22.
- Davis, James A., Joe L. Spaeth, and Carolyn Huson (1961), "A Technique for Analyzing the Effects of Group Composition." American Sociological Review, 26, No. 2, pp. 215-25.
- Deutschmann, Paul J. and Fals Borda, Orlando (1962). Communication and Adoption Patterns in an Andean Village. San Jose, Costa Rica, Programma Interamericano de Information Popular.
- Duncan, James A. and Burton W. Kreitlow (1954), "Selected Cultural Characteristics and the Acceptance of Educational Programs and Practices." Rural Sociology, 19, pp. 349-57.
- Durkheim, Emile (1897), Suicide. (Translated by James A. Spaulding and George Simpson, 1951), Glencoe, Illinois: The Free Press.
- Durkheim, Emile, The Rules of Sociological Method. (Translated by George Simpson, 1950), Glencoe, Illinois: The Free Press.
- Economic Development Institute (1967), Phase I: Preliminary Report of Selected Descriptive Findings for Leaders and Progressive Farmers in 71 Eastern Nigerian Villages. USAID/MSU Diffusion of Innovations Research Report, University of Nigeria, Enugu Campus (Mimeo).
- Economic Development Institute (1967), Phase II: Preliminary Report of Selected Descriptive Findings for 1347 Rural Farmers and Innovators in 18 Eastern Nigerian Villages. USAID/MSU Diffusion of Innovations Research Report No. 72, University of Nigeria, Enugu Campus (Mimeo).
- Evans, William A. and Guy N. Black, (1967), "Innovation in Business Organizations: Some Factors Associated with Success or Failure of Staff Proposals." The Journal of Business, 40, pp. 519-30.
- Faris, R.E.L. and H.W. Dunham (1939), Mental Disorders in Urban Areas. Chicago, Illinois: The University of Chicago Press, pp. 101-23.
- Fliegel, Frederick C. (1957), "Farm Income and Adoption of Farm Practices." Rural Sociology, 22, pp. 159-62.



- Forde, D. and G.I. Jones (1950), The Ibo and Ibibio-Speaking Peoples of Southeastern Nigeria. London: International African Institute.
- Frey, Frederick W. (1963), "Surveying Peasant Attitudes in Turkey." Public Opinion Quarterly, Vol. 27: 335-355.
- Garrett, Henry E. (1964), Statistics in Psychology and Education. New York: David McKay Company, Inc.
- Goldsen, Rose K. and Ralis, Max (1957), Factors Related to Acceptance of Innovations in Bang Chan, Thailand. Ithaca, N.Y.: Cornell University, Southeast Asia Program Data Paper 25.
- Green, M.M. (1947), Ibo Village Affairs. London: Sidgwick and Jackson, Ltd.
- Groves, Ernest R. and William F. Ogburn (1928), American Marriage and Family Relationships. New York: Henry Holt and Co., pp. 193-205.
- Gusfield, Joseph R. (1967), "Tradition and Modernity: Misplaced Polarities in the Study of Social Change," American Journal of Sociology, 72, pp. 351-362.
- Keith, Robert F. (1968), An Investigation of Information and Modernization Among Eastern Nigerian Farmers. East Lansing, Michigan: Department of Communication, Michigan State University, Technical Report No. 4.
- Kendall, Patricia and Paul F. Lazarsfeld (1950), "Problems of Survey Analysis," in Robert K. Merton and Paul F. Lazarsfeld, editors, Continuities in Social Research: Studies in the Scope and Method of 'The American Soldier'. Glencoe, Illinois: The Free Press, pp. 195-96.
- Lazarsfeld, Paul F. and Herbert Menzel (1961), "On the Relation Between Individual and Collective Properties," in A. Etzinol (ed.) Complex Organizations. New York: Holt, Rinehart, and Winston, p. 425.
- Lipset, S.M., M.A. Trow, and J.S. Coleman (1956) Union Democracy, Glencoe, Illinois: The Free Press, pp. 163-171.
- Loomis, Charles P. and J. Allan Beegle, (1964) Rural Sociology, The Strategy of Change. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

- McClelland, David C. (1961), The Achieving Society. New York: The Free Press.
- McNemar, Quinn, (1965), Psychological Statistics. New York: John Wiley and Sons, Inc.
- Marsh, C. Paul and A. Lee Coleman (1954), "The Relation of the Neighborhood of Residence to Adoption of Recommended Farm Practices." Rural Sociology, 19, pp. 385-90.
- Merton, Robert K. (1957), Social Theory and Social Structure. New York: The Free Press.
- Neill, Ralph E. and Rogers, Everett M. (1963), "Measuring Achievement Motivation Among Farmers," Columbus, Ohio: Agricultural Experiment Station Departmental Series AE 346.
- Niehoff, Arthur H. (1966), A Casebook of Social Change. Chicago: Aldine Publishing Company.
- North Central Rural Sociology Subcommittee for the Study of the Diffusion of Farm Practices (1961), Adopters of New Farm Ideas: Characteristics and Communicative Behavior. East Lansing, Michigan: Michigan State University, North Central Regional Extension Bulletin No. 13.
- Ottenberg, Simon. ds (1959), "Ibo Receptivity to Change," in M. Herskovits and W. Bascom, Continuity and Change in African Culture. Chicago: University of Chicago Press, pp. 130-43.
- Qadir, Syed Abdul (1966), Adoption of Technological Change in the Rural Philippines--An Analysis of Compositional Effects. Ph.D. Thesis, Cornell University. Published by University Microfilm, Inc., Ann Arbor, Michigan.
- Rahim, S.A. (1961), The Diffusion and Adoption of Agricultural Practices: A Study in a Village in East Pakistan. Comilla, Pakistan Academy for Village Development.
- Riley, Matilda White (1963), Sociological Research: I. A Case Approach. New York: Harcourt, Brace, and World, Inc.
- Robinson, W.S. (1950), "Ecological Correlations and Behavior of Individuals," American Sociological Review, 15, pp. 351-57.
- Rogers, Everett M. (1962), The Diffusion of Innovations, New York: The Free Press.

- Rogers, Everett M. (1965), Revised Operational Plan for Research Project on Diffusion of Innovations in Rural Societies. East Lansing, Michigan: Michigan State University, Department of Communication (Mimeo).
- Rogers, Everett M. (1966), Mass Media Exposure and Modernization Among Colombian Peasants." Public Opinion Quarterly, 29:614-625.
- Rogers, Everett M. (1967), Bibliography on the Diffusion of Innovations, East Lansing, Michigan: Michigan State University, Department of Communication (Mimeo).
- Rogers, Everett M. and Rabel J. Burdge, (1961), Community Norms, Opinion Leadership, and Innovativeness Among Truck Growers, Wooster, Ohio: The Agricultural Experiment Station Research Bulletin No. 912.
- Rogers, Everett M. with F. Floyd Shoemaker (forthcoming) The Diffusion of Innovations: A Cross-Cultural and Communication Approach. Glencoe, N.Y.: The Free Press.
- Rogers, Everett M. and David Stanfield (1966), "Adoption and Diffusion of New Products: Emerging Generalizations and Hypotheses." Department of Communication, Michigan State University, Mimeographed Departmental Publication.
- Ryan, Bryce and Neal C. Gross, (1943), "The Diffusion of Hybrid Seed Corn in Two Iowa Communities," Rural Sociology, 8:15-24.
- Sapolsky, Harvey M. (1967), "Organizational Structure and Innovation," Journal of Business, 40, pp. 297-510.
- Saxena, Anant, (1968), System Variables and Individual Innovativeness in Indian Villages. Unpublished Ph.D. Dissertation, Department of Communication, Michigan State University.
- Scheuch, Erwin, (1965), "Cross-National Comparisons Using Aggregate Data: Some Substantive and Methodological Problems," R. Merrit and S. Rokkan (editors), in Comparing Nations. New Haven: Yale University Press, pp. 143-167.
- Schramm, Wilbur (1965), quoted in Tom Carroll and R. Vincent Farace, System Analysis, Computer Simulation, and Survey Research: Applications to Social Research in Developing Countries, Computer Institute for Social Science Research, Michigan State University.
- Selvin, Hanan C. (1958), "Durkheim's Suicide and Problems of Empirical Research," American Journal of Sociology, 63, pp. 607-19.

- Selvin, Hanan C. and W.O. Hagstrom (1963), "The Empirical Classification of Formal Group." American Sociological Review, 28, pp. 399-411.
- Shepard, Herbert A. (1967), "Innovation-Resisting and Innovation-Producing Organizations." Journal of Business, 40, pp. 470-77.
- Sills, David L. (1961), "Three Climate of Opinion Studies," Public Opinion Quarterly, 25, pp. 571-73.
- Steiner, G.A (ed.) (1965), The Creative Organization. Chicago: The University of Chicago Press.
- Stouffer, S.A., et al. (1949), Studies in Social Psychology in World War II, Vol. 1. The American Soldier During Army Life, Princeton, New Jersey: Princeton University Press.
- Tannenbaum, Arnold S. and Jerald G. Bachman (1964), "Structural Vs. Individual Effects," American Journal of Sociology, 69, pp. 585-95.
- Uchendu, Victor C. (1965), The Igbo of Southeastern Nigeria, New York: Holt, Rinehart and Winston.
- Valkonen, Tapani (1966), Individual and Structural Effects in Ecological Research," Paper prepared for the Symposium on Quantitative Ecological Analysis in the Social Sciences, Evian France.
- Van den Ban, Anne Willem (1960), "Locality Group Differences in the Adoption of New Farm Practices." Rural Sociology, 25, pp. 308-320.
- _____. Webster's New Collegiate Dictionary, (1958), Springfield, Massachusetts: G.C. Merriam Co.
- Yeracaris, C.A. (), "Social Factors Associated with Acceptance of Medical Innovations: A Pilot Study." Unpublished Paper, New York: University of Buffalo.
- Young, Frank W. and Ruth C. Young (1962), "The Sequence and Direction of Community Growth: A Cross Cultural Generalization." Rural Sociology, 27, pp. 374-386.
- Young, James N. and A. Lee Coleman (1959), "Neighborhood Norms and the Adoption of Farm Practices." Rural Sociology, 24, pp. 372-83.



APPENDICES

APPENDIX A

Correcting Multiple R for Inflation

A multiple correlation coefficient, R , computed from a sample always tends to be somewhat "inflated" with respect to the population R , owing to the accumulation of chance errors which tend to pile up since R is always taken as positive. The inflation of a multiple R is most pronounced when N is small and the number of variables in the problem quite large.

The multiple correlation coefficients obtained in the present analysis are not likely highly inflated for the following reasons:

(1) The sampling rate within each of the villages studied was quite high, ranging from 27 percent of the total eligible respondents to a complete census (100 percent sample) in two of the villages (see Table 4).

(2) The sample size used in the computation of the multiple correlation coefficient was quite large ($N = 1,142$).

(3) Although a total of 34 independent variables was utilized in one analysis, 23 in another, and 16 in another, the number of independent variables was only a small proportion of the sample population, in each analysis.

Formula for correcting an inflated multiple R : An obtained multiple correlation coefficient can be corrected or "shrunken" to give a better measure of the population R by the use of the following formula:

$$R_c^2 = 1 - k^2 \frac{(N - 1)}{(N - m)}$$

where:

N = size of the sample

m = number of variables in the problem

(N - m) = degrees of freedom

$$k^2 = (1 - R^2)$$

In the findings of the present investigation, $R = .68$, in the analysis computed for 23 significant individual and system level variables, $N = 1,142$, and $m = 23$ (not including 11 variables not reaching the minimum significance criterion of .05); $k^2 = (1 - .68^2)$ or .53. Substituting these values into the formula, we have:

$$R_c^2 = 1 - .53 \frac{(1,141)}{(1,119)}$$

which yields:

$$R_c^2 = .46 \text{ and } R_c = .678$$

and the correction is negligible.

APPENDIX B

Alternative Indices of Innovativeness

During the course of the present investigation, we were concerned with questions regarding the reliability and validity of the index of innovativeness utilized in this study. These questions focused on the "non-unidimensionality" of the index, as indicated by (1) the seeming competitiveness of various innovations in the index with other innovations, (2) various rationales apparently utilized by Nigerian farmers for adopting or not adopting each of the innovations, and (3) the wide disparity between innovations regarding agricultural skill required, amount of investment required, and relative advantage for the farmer.

At least two other indices of innovativeness have recently been utilized in conducting similar analyses of these data: (1) a three-item index, utilizing the most widely adopted innovations in the list: fertilizer, Aldrin dust, and NS-1 maize (Keith, 1968); and (2) a six-item index, including cocoa, rice, cassava, vegetable seeds, poultry, and NS-1 maize, constructed by factor analysis of all fourteen innovations, and selecting the "cleanest" factor which explained the largest amount of variance in innovativeness (Salcedo, 1968).

These two additional indices of innovativeness were included in the present analysis, for information purposes, with the results shown in Table 18.

Table 18: Comparison of Zero-Order Correlations of 34
Individual and System Level Variables with
Three Indices of Innovativeness (N = 1,142)

<u>Variable</u>	<u>Fourteen Item Index^a</u>	<u>Six Item Index</u>	<u>Three Item Index</u>
I. Individual			
Cosmopoliteness	.26	.24	.25
Education	.35	.32	.33
Familism	-.05	-.03	-.09
Educational Aspiration	.23	.18	.26
Empathy	.29	.25	.35
Knowledge of Agricultural Workers	.34	.29	.39
Economic Aspiration	.12	.10	.12
Literacy	.34	.30	.30
Newspaper Exposure	.32	.32	.24
Radio Exposure	.31	.27	.35
Film Exposure	.24	.22	.22
Agricultural Media Exposure	.52	.43	.55
Credit Orientation	-.02	-.02	.04
Correct Agricultural Knowledge	.53	.42	.57
Formal Social Participation	.35	.23	.29
Achievement Motivation	.03	-.03	.06
II. System			
Cosmopoliteness	.03	-.008	-.004
Education	.14	.04	.07
Familism	-.18	-.11	-.27
Educational Aspiration	.09	.08	.19
Achievement Motivation	.06	.04	.06
Empathy	.16	.09	.16
Knowledge of Agricultural Workers	.11	.14	.16
Economic Aspiration	.11	.12	-.02
Literacy	.13	.06	.02
Newspaper Exposure	.11	.04	.02
Radio Exposure	.08	.006	.09
Film Exposure	.17	.15	.06
Agricultural Media Exposure	.22	.16	.21

Table 18--Continued.

<u>Variable</u>	<u>Fourteen Item Index^a</u>	<u>Six Item Index</u>	<u>Three Item Index</u>
Credit Orientation	-.05	-.06	-.05
Level of Living	.13	.02	.05
Correct Agricultural Knowledge	.28	.22	.33
Formal Social Participation	.18	.08	.12

^aThe fourteen-item index of innovativeness is the index utilized in the present analysis.

Several explanatory comments are in order regarding these alternative indices of innovativeness:

(1) As indicated by Table 18, the fourteen-item index of innovativeness and the three-item index of innovativeness yielded very similar zero-order correlations, and the six-item index of innovativeness yielded lower correlation coefficients in almost every instance.

(2) The six-item index of innovativeness was constructed from a factor analysis of all 14 innovations, and was attended by some degree of arbitrariness regarding the number of rotations to be utilized, minimum level of loading to be taken into account in determining communalities, and amount of intercorrelation with items in other factors to be tolerated.

In view of our desire to utilize as realistic an index of innovativeness as possible, our decision was to utilize the 14-item

index of innovativeness, since its wider range of innovations offered several obvious advantages. In our considered opinion, the use of either of the other two indices here described would not have appreciably improved the reliability of the findings, nor significantly improved the coefficient of determination. Although less than perfect, the fourteen-item index is believed to have been the best choice among the three alternatives, from a theoretical, statistical, and practical point of view.

Table 19 shows the intercorrelations between the three alternative indices of innovativeness.

Table 19: Intercorrelations Between 14-Item,
6-Item, and 3-Item Indices of
Innovativeness (N = 1,142).

	<u>6-Item Index</u>	<u>3-Item Index</u>
14-Item Index	.78	.69
6-Item Index	---	.48
3-Item Index	---	---

APPENDIX C

Analysis of Curvilinearity

As outlined in Chapter II, one of the assumptions on which the present analyses rest is linearity of the data. When the means of the arrays of the successive columns and rows in a correlation table follow straight lines (at least approximately), the regression is said to be linear or straight-line. Regression lines which "best fit" the means of the successive columns and rows in the table can be calculated, and used as the basis for prediction of the dependent variable.

When the drift or trend of the means of the arrays (rows or columns) cannot be well described by a straight line, but can be represented by a curve of some kind, the regression is said to be curvilinear, or in general, nonlinear. When the regression is nonlinear, a curve joining the means of successive arrays will fit these mean values more exactly than will a straight line. Hence, should a truly curvilinear relationship be described by a straight line, the scatter or spread of the paired values about the regression line will be greater than the scatter about the better-fitting regression curve. The smaller the spread of the paired scores about the regression line or the regression curve, the higher the relationship between the two variables. For this reason, a zero-order product-moment correlation calculated from a correlation table in which the

relationship is curvilinear will always be less than the true relationship. If the regression is significantly nonlinear, it makes considerable difference whether the correlation ratio (η) or the product-moment correlation (r) is the measure of relationship. But if the correlation is low and the regression is not significantly curvilinear, the product-moment correlation (r) will give as adequate a measure of relationship as the correlation ratio (η).

Examining Table 20, we see that considerable differences exist for every independent variable between the product-moment correlation (r) and the correlation ratio (η), indicating that the relationship of many of these independent variables to innovativeness is highly curvilinear. Since the relationships of these independent variables to innovativeness is curvilinear, the correlations computed on the assumption that the relationships are linear are not a satisfactory basis for predicting innovativeness. The curvilinear relationships also explain the unexpectedly low correlation coefficients we obtained in our analyses, since the zero-order correlations were based on the assumption of linearity.

Table 20: Comparison of Zero-Order Product-Moment Correlation (r) and Coefficient of Non-linear Relationship (n) for 34 Individual and System Level Independent Variables and Innovativeness (N = 1,142).

Variable	Zero-Order Product-Moment Correlation (r)		Correlation of Nonlinear Relationship (eta)	
	Individual Level	System Level	Individual Level	System Level
Cosmopolitaness	.26	.03	.36	.18
Education	.35	.14	.46	.26
Familism	-.06	-.18	.21	.34
Educational Aspiration	.23	.09	.30	.26
Achievement Motivation	.03	.06	.21	.24
Empathy	.29	.16	.38	.21
Knowledge of Agricultural Workers	.34	.11	.43	.28
Economic Aspiration	.12	.11	.24	.23
Literacy	.34	.13	.43	.23
Newspaper Exposure	.32	.11	.51	.22
Radio Exposure	.31	.08	.41	.21
Film Exposure	.24	.17	.38	.26
Agricultural Media Exposure	.52	.22	.59	.33
Credit Orientation	-.02	-.05	.22	.19
Level of Living	.38	.13	.45	.20

Table 20--Continued.

Variable	Zero-Order Product-Moment Correlation (r)		Correlation of Nonlinear Relationship (eta)	
	Individual Level	System Level	Individual Level	System Level
Correct Agricultural Knowledge	.53	.28	.63	.42
Formal Social Participation	.35	.18	.41	.26

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APPENDIX D

Table 21: Mean Values and Standard Deviations for
17 Individual Level, 17 System Level
Variables (N = 1,142).^a

Variable	Individual		System	
	Mean Value	Standard Deviation	Mean Value	Standard Deviation
Cosmopolitaness	3.07	3.57	3.07	1.19
Education	0.55	0.77	0.55	0.24
Familism	0.63	0.96	0.63	0.37
Educational Aspiration	2.33	0.81	2.33	0.24
Empathy	3.98	2.51	3.98	0.77
Knowledge of Agricultural Workers	0.31	0.46	0.31	0.20
Economic Aspiration	2.43	1.48	2.43	0.21
Literacy	6.66	13.01	6.66	2.98
Newspaper Exposure	1.28	4.46	1.28	0.93
Radio Exposure	2.66	4.53	2.66	0.92
Film Exposure	0.76	1.49	0.76	0.40
Agricultural Media Exposure	3.04	3.36	3.04	1.09
Credit Orientation	3.20	2.17	3.20	0.67
Level of Living	2.58	2.75	2.58	0.90
Correct Agricultural Knowledge	11.32	6.39	11.32	3.30
Formal Social Participation	2.65	1.81	2.65	1.05
Achievement Motivation	5.09	1.44	5.09	0.20

^aSee Chapter III for operationalizations of these variables.





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