DIFFUSION OF INNOVATIONS IN A DEVELOPMENT SYSTEM: A STUDY OF COLLECTIVE ADOPTION OF INNOVATIONS BY VILLAGE COOPERATIVES IN PAKISTAN

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
SYED A. RAHIM
1968

This is to certify that the

thesis entitled

Diffusion of Innovations in a Development System: A Study of Collective Adoption of Innovations by Village Cooperatives in Pakistan.

presented by

Syed A. Rahim

has been accepted towards fulfillment of the requirements for

Ph. D. degree in Communication

Major Professor

Date May 17, 1968

ABSTRACT

DIFFUSION OF INNOVATIONS IN A DEVELOPMENT SYSTEM:
A STUDY OF COLLECTIVE ADOPTION OF INNOVATIONS
BY VILLAGE COOPERATIVES IN PAKISTAN

by Syed A. Rahim

The present thesis is a study of the diffusion of agricultural innovations among village cooperative societies under a pilot project in rural development in East Pakistan. The main problems investigated are: (1) the relationship between the adoption of innovations at the social system level (Collective Innovativeness), and the adoption of innovations at the individual level (Individual Innovativeness); (2) factors related to the two types of innovativeness; and (3) prediction of innovativeness from a knowledge of antecedent factors.

The units of analysis in the present thesis are village cooperative societies -- a random sample of 80 cooperatives selected from 158 cooperatives at Comilla, East Pakistan. The information on the adoption behaviors and various structural and compositional characteristics of the cooperatives is obtained from official records, interviews, ratings made by judges,

and from key informants. The methods of Factor Analysis, Correlation Analysis and Multiple Regression Analysis are used in examining relationships between the research variables.

The results indicate that the collective innovativeness and the individual innovativeness are interrelated, but conceptually different. The factors related to collective innovativeness are (1) the degree to which the cooperative is socially related to other components in the development system (Integration); the collective capacity of the cooperative members for interaction, communication, decision making and action (Organizational Health); and (3) the modernity of the leaders of the cooperative society. The factors related to individual innovativeness are (1) integration and (2) the modernity of the members of the cooperative society.

It is possible to explain a significant amount of variation in innovativeness by a relatively small number of independent variables. The variables which are important predictors of innovativeness are identified. Also, the necessary statistics for combining the predictor variables into a linear equation are computed.

A number of unexpected findings in the present study are discussed at length. The absence of a relationship between innovativeness and individual

modernity of the members of the cooperative is explained in terms of the members' interest and involvement in agriculture.

Finally, a number of conclusions are drawn and some suggestions for future research are offered.

DIFFUSION OF INNOVATIONS IN A DEVELOPMENT SYSTEM: A STUDY OF COLLECTIVE ADOPTION OF INNOVATIONS BY VILLAGE COOPERATIVES IN PAKISTAN

By

Syed A. Rahim

A THESIS

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

DOCTOR OF PHILOSOPHY

Department of Communication

1968

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: _____, Chairman

_____

_____

_____

ACKNOWLEDGMENTS

I am indebted to Professor Everett M. Rogers, who accepted chairmanship of my guidance committee in September, 1965, and has since remained a constant friend and stimulating guide. I am grateful to the other members of my doctoral committee - Professor Hideya Kumata, Professor Eugene Jacobson, Professor F.B. Waisanen and Professor Paul Hiniker - for their valuable advice and assistance.

I am indebted to the Pakistan Academy for Rural Development, Comilla, East Pakistan, for granting me leave of absence from the Academy to study for a higher degree Michigan State University. I own a great deal to the Pakistan Project, Michigan State University and to the Ford Foundation for financial support.

Dr. Akhter Hameed Khan, Director, Pakistan Academy for Rural Development, and Mr. Richard O. Niehoff, Assistant Dean, International Programs, Michigan State University, did everything possible to help and encourage me in finishing my study program. I am grateful to them. Dr. Khan and his colleagues at the Academy extended all possible cooperation during the field-work for the present

thesis.

Joseph Ascroft helped me with Computer Programming. Mrs. Marianna Choldin made editorial corrections in the draft manuscript of this thesis. I am indebted to both of them.

Finally, I wish to express my deep appreciation for the patience and daily sacrifices of my wife Majeda Rahim, who accompanied me to the United States of America.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The introduction of technological innovations in traditional agriculture is one of the basic elements of all rural development programs in developing nations. Scientists, politicians, planners and administrators are aware of the need for deliberate efforts to persuade farmers to adopt new ideas and practices. The conscious and organized attempt to influence farmers in making decisions that lead to acceptance and use of new ideas, methods and products is characteristic of all rural and community development programs. The diffusion of innovations is often initiated, directed and to some extent controlled by the change agency and intermediate organizations linking the change agency to the farming community.

Rural development programs in a number of developing nations provide an opportunity for the study of diffusion of innovations in partially controlled field situations (Niehoff, 1966). These settings are attractive because they are located in developing nations where organized efforts are being made to introduce selected innovations in specific communities, and some records of

the operations of the change agents and the responses of the farmers are often maintained. Different approaches in different programs also provide opportunities for comparative studies. These settings are deliberately organized development systems within the larger social system of a nation, where the change agencies are linked to farming communities through various channels of communication.

The study reported in the present thesis is an attempt to understand the process of the diffusion of innovations in a development system at Comilla, East Pakistan. This development system is a pilot project on rural development launched in 1960 by the Pakistan Academy for Rural Development at Comilla, East Pakistan. The innovating units of this system are village level cooperative societies of farmers. There is a central organization which promotes agricultural innovations and provides information, training, services and supplies to the village cooperative societies. The nature of some of the innovations promoted at Comilla are such that their adoption is possible only when the members of a cooperative society take collective decisions to practice them jointly. An example of such an innovation is the deep tube-well for irrigation. The installation of a deep well operated by a power pump requires a substantial amount of investment. At least fifty acres of land must be brought under irrigation to run a power pump economically.

An average farm in Comilla is too small (about two acres in size) to support a deep tube-well set-up. However, if thirty farmers agree to work jointly in sharing the expenditure, running the pump, and arranging distribution of water to the individual plots of the fields, a tube well can become a practical solution to the problem of irrigation for winter cultivation.

The cooperative societies in Comilla are set up to overcome the technical problem of the small scale of farming in modernizing agriculture in East Pakistan. The Comilla system is a good example of working with groups rather than individual farmers in introducing innovations. It is a good case for the study of innovation at the group or organizational level.

Setting of the Study

It is necessary to describe the Comilla Project before stating the specific problems investigated in the present study.

In 1959, the government of Pakistan founded two Academies for Rural Development, one at Peshwar, West Pakistan, and the other at Comilla, East Pakistan. These academies were entrusted with the responsibilities of training government officials in rural development and conducting research and action programs in rural development. Earlier, the faculty members of the Comilla Academy

(a group of social scientists under the dynamic leadership of Dr. Akhtar Hameed Khan, a scholar and administrator) had participated in a development administration seminar organized by Michigan State University at East Lansing, Michigan. They had opportunities to participate in academic exercises in the theory and practices of rural development. As they started organizing the training and research programs at the Academy, it became clear that they also needed to organize pilot projects in rural development to add substance to the theoretical lectures and discussions, and to make the research programs more action-oriented. The Director of the Academy, Dr. Akhtar Hameed Khan, developed a scheme for a pilot rural cooperative project for the agricultural development of Comilla Thana.* This scheme was approved by the provincial government. The Academy was permitted to conduct the pilot project on cooperatives and other needed experiments in Comilla Thana.

In the year 1960, the pilot project on rural cooperatives took a definite shape. Twenty village cooperative societies were organized in Comilla Thana. A central agency was established to take care of the training and extension programs. Later on, it became a

---

*The thana is the smallest administrative unit in East Pakistan, and it is equivalent to the county in the United States. There are 413 thanas in East Pakistan.

central core of several other pilot projects on special cooperative societies, public works, adult education, women's education and training, irrigation, and family planning. The total complex of the rural development projects in Comilla is now known as the Comilla Program. No attempt will be made in this thesis to describe all the projects. Readers interested in details should read various publications of the Academy for Rural Development, Comilla, East Pakistan.* This chapter presents a brief description of the Comilla thana and the pilot project on village agricultural cooperatives.

Comilla Thana

Comilla Thana is located in the Eastern Region of East Pakistan. It is a part of the great alluvial plain of the Bengal Delta. The land is fertile, but flooding is a recurrent problem. The climate is humid and moderately hot. The average rainfall is about 90 inches per year. According to the 1961 Census of Pakistan, Comilla Thana has an area of 107 square miles, inhabited by a population of 217 thousand persons. Thirty-nine percent of the population is literate. The rural population in Comilla Thana is about 158,000. About 20 percent of them are literate. Comilla city, located within the Thana, has a population of 59 thousand persons.

---

*A number of such publications are listed in the list of references at the end of this report.

There are 249 villages in the Thana.* About 25,000 farm families live in these villages.

The conditions of farming in Comilla are not much different from that of other countries in South and South East Asia. A number of students have studied different aspects of village life in Comilla. Fairchild (1961) made a case study of a village and a typical farmer in Comilla. Qadir (1960) studied three generations of man-land ratio in a village at Comilla. Rahim (1960, 1965) examined adoption of innovations and patterns of communication in two villages. In a survey, Farouk and Rahim (1967) studied the economy of Comilla Thana and compared it with the economy of a neighboring thana. Based on these sources the following, rather simplified, picture of a typical farmer in Comilla in 1960 can be drawn.

A typical farmer in Comilla Thana has six members in his family. He owns about two acres of land. His land is distributed over six plots scattered around the village. He is illiterate.

A typical farmer follows the traditional method of cultivation. The source of power is the bullock. The source of water is the monsoon rains. The wooden ploughs,

---

*The definition used in 1961 Census, identified a village with the previous land settlement survey units, called Mouzas. Generally, each mouza has one or more clusters of households. Traditionally, these clusters are identified as villages with distinct names. These names are recorded in the registers of local self government offices. According to these registers, there are over 360 villages in Comilla Thana.

the spades and the sickles are the farm implements. He grows two rice crops in a year. He also grows vegetables in small patches of land around his homestead. Once in every two or three years, his crops suffer extensive damage from flood or insect attack. He can hardly product more than 2,500 lbs. of unhusked rice from an acre of land in a year. In the dry winter season, almost all of the land remains idle. No irrigation facilities are available for winter cultivation. The farmer's average income is about Rs 1500.00 (U.S. Dollars $320.00) per year. He is heavily indebted to local money lenders, who charge exorbitant interest rates (as much as fifty percent per annum). A good portion of his land is likely to be mortgaged against loans received from these money lenders.

Years of struggle with nature, money lenders and middleman traders have made him desperate. He thinks that the conditions of agriculture cannot be improved. He is distrustful of government agents and reluctant to accept their advice and recommendations on improving agriculture. But he pretends to listen to them, because through them come handouts, loans, and relief money. He depends more on his friends and neighbors for information and advice on matters relating to agriculture. He is eager to send his children to school so that they get the education needed for getting jobs in the town. Then he can have some extra sources of cash income. With such cash money he can buy more land.

The Comilla Cooperative Project

The modernization of the traditional, subsistence agriculture of Comilla Thana was a challenge to the Academy for Rural Development at Comilla. The Academy responded to this challenge with a pilot project of rural cooperative societies.

The basic structure of the Comilla pilot cooperative project is a two-tiered cooperative system. At the village level there are small voluntary farmers' cooperative societies. These cooperative societies are federated into a central organization at the thana level. The central organization is a center for training, banking and servicing. It is the change agency*, responsible for the introduction of new ideas and practices.

Through its various sections, the central association performs the following functions:

1. Selecting and locally testing new ideas, practices and products and presenting them before the village cooperative societies.

2. Organizing regular training and education programs for the managers and other representatives of the village cooperative societies.

3. Providing the village cooperative societies with various kinds of credit facilities and guiding and

---

*The change agency is an organization of professional change agents. The main function of a change agent is to influence adoption decisions in a direction that his organization considers desirable.

supervising the utilization of all kinds of loans issued to them.

4. Encouraging the village cooperative societies to build up capital through savings and purchase of shares and providing central banking facilities for those activities.

5. Providing the village cooperative societies with services and supplies of modern agricultural inputs and maintaining a machine station for farm implements and machines.

6. Building storage and processing units to facilitate storage and marketing operations.

The affairs of the central association are managed by a managing committee. This committee is composed of elected representatives of the village cooperative societies and appointed officials of the central association. An appointed director is in charge of the village cooperative societies. He has a staff of deputy directors, chief inspectors and inspectors who take care of training, banking and field supervision activities. The inspectors are village level workers, but they work with village cooperative societies, not with individual farmers.

The village cooperative societies are voluntary association of farmers. The average size of a cooperative is 45 members. The cooperative society operates according to a set of rules outlined in the federal government

cooperative acts. In addition, its membership in the central association requires fulfillment of certain conditions. These conditions include regular weekly meetings of the members at the village, collecting small saving deposits from the members each week, putting the total savings in the savings account of the society in the central bank, and maintaining constant contacts with the central association through the manager and other officebearers of the cooperative society. The manager is required to attend the weekly meetings and training classes at the office of the central association.

The village cooperative societies are democratic organizations at the grass roots. The chairman, manager and other members of the managing committee of the cooperative are directly elected by the members. The officebearers are honorary servants of the cooperative society. All decisions regarding the activities of the cooperative are made collectively by the members. The individual members retain ownership of land, bullocks, implements and labor. Any decision to pool resources in a particular instance is made by the members.

The manager of the cooperative society plays a very important role. He is the main link between the village cooperative society to the central association. Attending weekly meetings of the managers at the central association

is one of his major functions. In these meetings he learns about new ideas and practices and participates in discussions on how to utilize these innovations for improving conditions in the villages. He is expected to understand these messages and relay them regularly to other members in the weekly meetings of the cooperative society. He is the most important formal channel of communication between the change agent and the farmers. He also bears the major share of the responsibility for management of the cooperative society.

The chairman of the cooperative society is the official head of the organization. He conducts the weekly meetings. Usually, he is an older, influential member of the group, responsible for keeping the group together and for legitimizing group decisions. His contact with the central association is less frequent, usually once a month.

Most of the village cooperative societies have a third officebearer called the model farmer. The model farmer is a sort of technical person. He receives training in new agricultural techniques and is expected to demonstrate and teach these techniques to the farmers. He has frequent contacts with the central association.

The managing committee of the village cooperative society is composed of the chairman, the manager, the

model farmer, and two or three additional members. These additional members, usually, are the more influential members of the cooperative society. All the members of the managing committee are elected by the members of the cooperative society.

Innovations Promoted

The agricultural innovations recommended and promoted by the central association include a wide range of new practices and products. Some of these innovations, e.g., seeds, fertilizers, etc., are adopted at the level of the individual farmer. The cooperative society promotes these practices and provides necessary technical information, services and supplies. Joint action is not necessary for the adoption of these practices, although any collective decision* to adopt these practices may add additional support to the individual adoption decisions.

There are other, technically more complex, innovations which are considered as basic to successful modernization of agriculture in the Comilla Thana. The mechanization program and the supervised credit program are the two most important innovations of this kind. The mechanization program consists of the use of tractors

---

*When the members of a social system jointly make a decision to adopt an innovation, the decision is collective.

and other modern implements for cultivation, and the use of power tube wells and lift pumps for irrigation. The supervised credit program is composed of capital formation through small savings and purchase of shares, preparation of joint plans for the utilization of loans, collection and distribution of loan money, and utilization of loan money according to supervised plans. The adoption of these practices requires collective decision and joint action by the members of the cooperative society.

Growth of Comilla Cooperatives

In December, 1960, there were 21 village cooperative societies in Comilla with a total membership of 544 farmers. During the following years there was a steady rise in the number of cooperative societies and in membership size. A comparison of selected indicators of growth for the years 1961-62 and 1965-66 is shown in Table 1.

Table 1 clearly shows that growth of the cooperative pilot project was rapid. The growth of the central association was also very rapid. From a modest beginning, the central association became a large organization with properties and assets valued at Rs 11,290,646 by June, 1966. In the first two years, the central association was largely dependent on grants and loans from the Ford Foundation and the government of Pakistan. From 1963-64, it gradually moved toward self-sufficiency. In 1966,

Table 1. Indicators of Growth of the Cooperative Societies in Comilla Thana.

Indicators of Growth	1961-1962	1965-1966
1. Number of cooperative societies	59	163
2. Number of members	1,860	6,126
3. Cumulative saving deposited in rupees (including shares)	97,456	703,235
4. Total loans taken in the year (Rs.)	235,664	795,983
5. Amount of loan repaid in the year (Rs.)	60,162	659,541
6. Total area under tractor cultivation (acres)	434	1,583
7. Total number of tube-wells for irrigation	2	30
8. Total area under tube-well irrigation (acres)	36	1,141
9. Total area under improved methods of cultivation (acres)	948	6,477

Source: Khan (1966).

capital and revenue grants constituted only 10 percent of the total assets of the central association.

Problems and Difficulties

The growth and development of the cooperative pilot project was rapid and in some respects spectacular. However, many problems and difficulties arose; many questions required serious study and research. In reviewing the status of the project, Dr. Akhtar Hameed Khan (1963) made the following comments:

> There have been many adjustments to make, some of them quite unexpected. We see growing pains on all sides. On all sides, too, we see traditional values remaining strong. We find the growth of membership loyalty slow. We know our educational efforts must be refined and strengthened. We need to understand the villager better, and somehow find organizational approaches that elicit deeper response from them.
>
> We know, too, we must be strict to maintain discipline. Beyond all else, we know we must continue to study, to explore, to experiment,--for we are yet learners in how best to do this thing to which we have laid our hands.

The magnitude of these problems continued to grow as the program expanded during the following years. The efforts to understand the intricate nature of the problems and devise solutions became more and more difficult because of absence of relevant research findings.

A Preliminary Investigation

In February, 1966, the Director of the Academy, Dr. Akhtar Hameed Khan, appointed a research team to study the operations of the village cooperative societies. The Committee was supposed to find out why some village cooperatives were performing better than others, and why some were performing very poorly; what the ordinary members thought about their cooperatives and the programs advocated by the central association.

The research team selected 45 cooperative societies. These were purposely selected in order to represent 'good' and 'bad' cooperatives, 'old' and 'new' cooperatives and to cover all regions of the Thana. The performance rating of the cooperatives was based on their classification into categories of "poor", "medium" and "good" made by other senior officers of the central association. The members of the research team visited the selected cooperatives and interviewed the officials, members and non-members in the villages. They examined the records maintained by the cooperative societies. A general guideline was used for interviewing in all the selected villages.

The findings of this study, reported by Hussain (1967), indicated that the most common factors associated with poorly performing cooperatives were misappropriation of the funds of the cooperative, presence of factions, lack

of interest on the part of the members and the manager, replacement of the manager without a proper substitute, and autocratic and coterie rules. In a good society, the members attend the meetings regularly, take interest in the programs, and make joint decisions in the weekly meetings. Group solidarity is high. The accounts and other records are properly maintained. The managing committee shares responsibilities and encourages joint activities. The manager is hard-working and honest, and he maintains a good working relationship with the central association.

The 1966 study was weak methodologically. The criterion variable was not specifically defined in terms of innovation adoption. However, it was found that the regularity of saving, repayment of loans, intensity of extension program and use of agricultural machines were factors that distinguished a good cooperative from a poor cooperative society. The findings were simple and descriptive. No hypotheses nor statistical tests were applied in the study. However, the investigation did provide information suggesting the crucial importance of organizational and social system variables related to innovation adoption. A number of recent studies on innovation diffusion have provided similar evidence. Some of these studies will be discussed in the following section.

A Review of Relevant Literature

Past research on the diffusion of technological innovations in agriculture implicitly emphasized an optional adoption process, where adoption of an innovation is conceptualized as a purely individual decision (Rogers, 1962). As a result, attempts were primarily directed toward identifying individual characteristics related to innovation adoption.* Studies conducted in different countries show consistently positive associations between early adoption of innovations and the farmers' education, level of living, cosmopoliteness, mass media use, membership in organizations, and contacts with change agents.

In a small number of studies on innovation in agriculture, communities were used as units of analysis. Community or village level variables were used to explain variation in the rate of diffusion over time or the level of adoption at a given point of time. On the other hand, in most of the research on innovation in education, schools were taken as units of analysis. Adoption of innovations by the school was related to other characteristics of the

*It is interesting to note that during the last twenty-five years, social psychologists have shown great interest in understanding group processes and the influence of group factors on individual and group behavior. In the same period, rural sociologists largely studying innovation diffusion neglected group and social system variables as factors related to individual and group innovativeness.

school. Similarly, a few studies on industrial innovation examined the relation between innovation adoption (by firms) and other characteristics of the firms.

In compiling some generalizations on innovation in education, Miles (1964) noted that the characteristics of the school system, of the innovating persons or groups, and of other relevant outside (the school) groups were important factors influencing innovation in the schools. A favorable environment, progressive community norms, availability of resources, and innovative administrators, facilitated innovation in the schools. Sheer size and the growth of a school system forced adaptive changes and increasing concern for innovation.

David (1966) examined the relationship between some personal and organization variables and adoption of innovations in two liberal arts colleges. The colleges did not differ in their awareness of innovations. In the more innovative college, the faculty members perceived the organizational norms as "permitted" and "recommended." In the less innovative college norms were perceived as "obligatory" and "prohibitive". But, the norm concerning faculty participation in decision-making was perceived as more obligatory in the more innovative college. Faculty cohesiveness in the less innovative college was higher than faculty cohesion in the more innovative college. Davis explained that in the less innovative college, there

was a conflict between the president and the faculty, which probably led to more cohesiveness among the faculty. Since most innovations were viewed as proposed by the president, the resistence to change may be accounted for, in part, because it was the president who proposed them.

Queely and Street (1965) compared two elementary schools; one adopted a new system of grading earlier than the other school. The first school had wider participation of the staff in school decisions, higher pupil achievement, more adequate consequences of innovation and greater teacher interest in the students.

In a study of innovation in industrial firms, Carter and Williams (1959) found that the technical progressiveness of the firm was positively related to good training policy, quantitative investment decisions, scientists in top managerial posts, enough intermediate managerial personnel, good chief executors of programs and absence of secretiveness. In another study, Mansfield (1963) found innovativeness positively related to the size of the firm. The growth rate, profitability, liquidity of the firm and age of the president of the firm were not related to innovativeness.

In agricultural diffusion, a number of students (Marsh and Coleman, 1956; Young and Coleman, 1959; van den Ban, 1960; Coughenour, 1964; Qadir, 1966) demonstrated the importance of group or social system variables in explaining

innovation adoption in farming communities. They found that the rates of diffusion and the level of adoption at a given point in time varied from community to community depending on the community norms toward innovation. Similarly, Rogers and Burdge (1962) and Flinn (1963) found that a significant part of the variation in innovativeness of individual farmers could be explained by variation in community norms concerning innovation.

Participation in group discussions and decisions was another variable that was found to be positively associated with innovation adoption. This point was demonstrated in the social psychological research of Lewin and others (1947) and Coch and French (1948). In field experiments on the effects of mass media, Neurath (1962) in India and Waisanen and Durlak (1968) in Costa Rica, found participation in radio forums significantly correlated to innovation adoption.

There have been few studies in agricultural diffusion research focussing on social systems as units of analysis. Recently, however, three studies have been added to this category. Yadav (1967) studied the relationship of the elements of communication structure and technological diffusion in Indian villages. The two villages were very different in respect to the rate of diffusion of technological innovations and the average level of adoption of innovations. The innovations considered were fertilizers, ,

insecticides, seeds, new crops and implements. A number of hypotheses on the nature of the communication structure in the two villages were tested. The communication structure was examined in terms of opinion leadership, patterns of homophily in dyadic communication and communication integration. The two villages differed significantly in respect to some characteristics of opinion leadership (e.g. media exposure, change agent contacts) and various measures of communication integration (e.g. integration in information seeking, contacts between subgroups).

The other two studies on villages as units of analysis were completed under the first phase of the research project entitled "Diffusion of Innovations in Rural Societies", directed by Everett M. Rogers at Michigan State University. In the India study (Fliegel and others, 1967), a measure of the success of change programs in 108 Indian villages was related to other characteristics of the villages. The measure of success of the change programs was based on the degree to which leaders had adopted six practices, cultivators had adopted six innovations, and the village had adopted four collective ideas. The innovations were new seeds, fertilizers, insecticides, implements and improved cattle breeding practices. Some variables found to be related to the success of change program in villages were: the extent of

contacts with change agents, urban centers and mass media; level of living; availability of certain resources; presence of modern organizations; and caste position and socio-economic status of the leaders.

In the comparative study in Brazil, Whiting and others (1968) measured the success of change programs in 76 villages in terms of the leaders' adoption of innovations. The six innovations included new seeds, new crops, dairy, and family nutrition. Some of the variables related to innovation adoption were the number of formally-organized groups (connected with the major institutions), concensus between community and county leaders on problems, cohesiveness of the community, literacy of the community leaders, frequency and thoroughness of visits by the change agents, and dependence of the village on the change agency for loans.

The diffusion studies using social systems (villages, communities, schools, firms) as units of analysis have one aspect in common. Each study sought correlates of adoption among social structural and cosmopositional variables. The structural variables included variables measuring the relationship between components within the system, and the relationship between the system and other systems in the environment. The compositional variables included average characteristics of the components within the system or characteristics of some important components in the system.

But in one respect, the agricultural innovation studies differed from the other studies. In education and industry, the innovations were adopted by the systems (schools or firms). Although exact information is not available, it appears that the innovation adoption decisions were made by the authorities or collectively by the members in the systems. In the agricultural studies, the systems were villages or communities. The level of adoption in the systems were derived or aggregated from the extent of adoption by individual members in the system. In one study (Fliegel and others, 1967) items measuring adoption by the leaders, adoption by the cultivators and adoption by the village were combined to obtain a single composite measure of innovation adoption for the village. A general weakness in all these studies was that no discrimination was made between possible kinds of innovation adoption decisions. An individual making an adoption decision purely by himself is one type of phenomena. A group of individuals making a collective decision to adopt an innovation that requires joint activities is another matter. It is desirable to seek antecedents of these two kinds of innovation adoption separately and examine their interrelationship. It may also be noted that none of the agricultural studies, reviewed previously, specifically examined the collective adoption decision and its antecedents.

As pointed out earlier, the rural development pilot project at Comilla provides an opportunity to study these neglected aspects of diffusion problems. In a present thesis an attempt has been made to investigate some of these problems.

The Problem

The successful planning and execution of a program for the introduction of innovations in traditional farming communities depends on many factors. A knowledge of these factors--what they are and how they function--is essential for the development of any useful theory of innovation diffusion. What kind of people adopt innovations relatively early? What kinds of innovations are adopted quickly? What communication strategy maximized innovation diffusion? What organizational arrangements work best? These are some of the questions commonly asked by change agents. Again, these are the questions in which theoreticians are interested.

In dealing with these questions, one can work at the individual level or at the social system level, or one can move between the two levels of analysis. The unique nature of the program at Comilla provides an opportunity to study adoption behavior at a system level. This is the main concern of the present thesis. The study of adoption behavior at the individual level and its re-

lationship to system-level innovation can also be conducted at Comilla. This is the second concern of the present thesis.

Once a set of factors related to innovation adoption behavior has been identified, the question of fitting them into a model becomes next. At the simplest level, a linear model for prediction of innovative behavior from a set of independent variables has considerable practical significance. The third concern of this thesis is to develop such a model for predicting innovation adoption by village cooperative societies at Comilla.

The study of the adoption of complex, divisible innovations at the social system level raises a methodological problem. Is it desirable to include both (1) the earliness of adoption, and (2) the intensity of practice of the innovations, in a measure of innovativeness of a social system? How can this be done? One solution to this problem is attempted in the present thesis.

The village agricultural cooperative societies at Comilla are engaged in what may be called the collective adoption of innovations.* The collective adoption of an innovation is where the decision to adopt is made jointly by the system's members and the actual use of the innovation involves joint efforts by the members of the

---

*The formal definitions of various kinds of adoption decisions are presented in Chapter II.

system. It has been observed that the village cooperative societies at Comilla vary considerably in collective adoption in innovations, although they are under the same change program. It is natural to assume that the collective adoption behavior of the cooperatives is related to factors such as structural and compositional variables and the relationship of cooperatives to each other and to the change agency. What are some of these factors? What are their relative importance with regard to association with innovative behavior of the cooperative societies?

The influence of the cooperative society on the innovative behavior of its members (optional adoption decisions) is an interesting problem. The present author previously completed an analysis of data on adoption of innovations by the members of 18 village cooperative societies at Comilla (Rahim, 1966). He found that the variation in innovativeness scores between the cooperative societies was nine times larger than the variation in innovativeness scores within the cooperative societies. It appears that the cooperative societies exert considerable influence on the member's innovative behavior. Given this fact, what structural and compositional factors of the cooperative societies are related to the innovative behavior of the members?

The two problems presented previously deal with collective adoption behavior and individual adoption behavior. What is the relationship between these two kinds of adoption behavior? To what extent is the collective adoption behavior of the cooperatives related to the individual adoption behavior of the members of the cooperatives?

Finally, the problem of building a simple predictive model can be stated. What linear combination of the relevant variables should be made in order to obtain a reliable prediction of innovative behavior of the cooperative societies?

CHAPTER II

THEORETICAL FRAMEWORK

This investigation of collective adoption of innovations in the Comilla Rural Development Project Area is exploratory in nature. It was not specifically designed for the testing of formal hypotheses derived from a theory of diffusion of innovations. However, the design of the study was developed in a broad theoretical framework. The terms and concepts used, and the theoretical justifications for variables chosen, are presented in this chapter.

Development System

A development system is a system 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 condition for innovation diffusion and development. The major components of a development system 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 source by channels of communication. This description of the basic elements of a development system is similar to the description of the crucial elements in the analysis of diffusion of innovations given by Katz (1961) and Rogers (1962). It immediately suggests what classes of variables should be considered in explaining the planned diffusion of innovations. For example, we should expect that the policy and action of the change agency, the nature of the innovations, the characteristics of the adopter population and the nature of communication, are important determinants of innovation diffusion in a development system.

Diffusion Process

Diffusion in a development system is the process of adoption, over time, of innovations by the components or the units of adoption in the receiver system. Diffusion begins when an innovation moves from the source system to the receiver system. The process continues until all relevant units in the receiver system adopt (or reject) the innovation.

The study of the process of diffusion of innovations is a major research topic. In empirical research, one usual technique of examining the diffusion process is to

study the diffusion curve obtained by plotting the number of proportion of adopter units at various points in time. A common finding is that the distribution is S-shaped, which closely resembles the cumulative normal curve (Rogers, 1962). A number of students (Dodd, 1955; De Fleur, 1958; Hagerstrand, 1965) developed mathematical models for the diffusion process. Coleman (1964) suggested a number of simple models for diffusion in a population of limited size. In his "constant source" model, information from a single source flows at a constant rate. The rate of diffusion at any given point in time is proportional to the number of non-adopters in the adopter population. The resulting curve is exponential in form. In the "interpersonal propagation" model, information from each adopter flows to non-adopters. The rate of adoption is a function of the number of adopters and the number of non-adopters. The resulting curve is logistic in form. In the models proposed by Hagerstrand, the geographical distance between the source and the receiver regulating the flow of interpersonal communication is the primary determinant of diffusion.

These models represent ideal situations where the flow of information is constant over time and reception of information follows adoption. In a development system, such ideal conditions are not likely to exist.

The change agency is likely to regulate communication and to accelerate or retard the rate of diffusion as the situation demands.

Types of Adoption Behavior

Important distinctions can be made between different kinds of adoption behavior on the basis of the level of the decision-making unit, the level of the unit implementing the decision, and the degree to which an individual is involved in the processes of decision-making and implementation. Rogers and Shoemaker (1968) suggested four kinds of adoption behavior: (1) optional, (2) contingent, (3) authority, and (4) collective. The present typology is a modified form of the typology used by Rogers and Shoemaker.

1. An individual adoption is defined as the case where an individual makes a decision for himself and implements the decision by the use of the innovation. In this process, the individual adopter is likely to be influenced by the other members of his social system. But the final responsibility of the decision-making and acting is his own. The adoption of a new fertilizer by a farmer, or a new kitchen gadget by a housewife are examples of individual adoption.

2. A social system adoption is defined as the case where the decision to adopt an innovation is made by a

decision-making subsystem of the social system. This subsystem may consist of all the members of the social system or may consist of one or more members authorized to make decisions for the social system. The implementation of the decision may depend on action taken by the members individually or action taken by the members collectively. The adoption of a new grading system in a school, the adoption of new techniques of production in a factory, the adoption of a rice-combine by a farmers'-cooperative society, are examples of social system adoption.

(a) Contingent adoption is defined as a social system adoption in which the individual members have the option to adopt or not to adopt the innovation, after a prior adoption decision by the system. An example of a contingent adoption is the adoption by a teachers of audio-visual aids in teaching, after the school authority has adopted the audio-visual equipment in the school.

(b) Collective adoption is defined as a social system adoption in which the individual members are involved in the decision-making. The individual members are obliged to act jointly to adopt the innovation. An example of a collective adoption is the adoption of a deep well for irrigation by a farmer's cooperative society. The adoption decision is made jointly by the farmers. The use of the deep well for irrigation involves joint action by the farmers.

(c) Authority adoption is defined as a social system adoption in which the individual members are not involved in the decision-making. The individual members must, individually or jointly, adopt or reject the innovation. An example of an authority adoption is the adoption of a new technological process by the management of a factory. The individual members are bound to use the new process.

In any study of innovative behavior the individual is the proper unit of analysis when adoption is an individual decision. In a study of an authority adoption or a contingent adoption or a collective adoption, the innovative behavior of an individual adopter cannot be satisfactorily explained if analysis is made only at the individual level. Since the decision is made at the social system level, analysis at that level is necessary.

The classification of adoption behavior into the four types is summarized in Table 2.

Adoption Process

The adoption of an innovation is a process over time. In past research, this process was conceptualized as consisting of the stages of awareness, interest, evaluation, trial and adoption (Rogers, 1962). Recently, Rogers and Shoemaker (1968) reconceptualized the adoption process in terms of four sub-processes: knowledge, persuasion, decision and confirmation. This reconceptualization was

Table 2. Four Types of Innovation Adoption

	Types of Innovation Adoption			
	Individual	Contingent	Collective	Authority
1. Level of decision making	Individual	Social system and individual	Social system	Authority in the social system
2. Level of implementation	Individual	Individual	Social system	Social system or individual
3. Role of individual in decision-making	Optional	May or may not be involved at the social system level. Optional at the individual level	Obligatory	Not involved
4. Role of individual in implementation	Optional	Optional	Obligatory	Compulsory

considered necessary as accumulated research evidence (Mason, 1962; Lionberger, 1960; Deutschmann and Fals Borda, 1962) showed variation in decision-making behavior, depending on various situational factors.

In the present paper, the adoption process is conceptualized as consisting of four sub-processes: (1) communication, (2) persuasion, (3) decision, and (4) action (or implementation). These sub-processes are not distinct phases. They extend over time with a certain degree of overlapping and telescoping. This is a general framework that can be used for the study of any type of adoption behavior. However, the following description is specifically designed to describe the collective adoption process, where social systems are the units of adoption.

1. Communication

Communication is the process of transmission of innovation-related information in a development system. It is a vital process. The nature and flow of information in a development system determine the availability of information necessary to make adoption decisions. To the extent that relevant communication channels link various parts of a development system, and to the extent that relevant information flows through such channels, the adoption process is accelerated or retarded. Formally organized channels of communications are the essential structure of a development system. These channels are

mass media programs, training, demonstrations, meetings and visits and other encounters between agents and clients. In addition, there are informal interpersonal channels that link various parts of a development system.

The communication structure in a development system can be seen as consisting of three component structures: (1) communication between change agency and units of adoption, (2) communication among units of adoption, and (3) communication within units of adoption. Each of these components can be further examined with reference to the direction of the flow of information.

2. Persuasion

Persuasion is the process of influencing the behavior of the potential units of adoption toward adoption of innovations.

Through communication and other means, persuasion forces are generated in a development system. These forces are basic in the sense that they act as "pressures to innovate" on the potential adopters. The communication structure in a development system contains strategic elements where different channels of communication tend to converge. These elements receive and relay more information than other elements in the system. The elements (e.g., group leaders) which link the change agency to the adopter population (group members) are strategic elements. The forces which generate "pressures to

innovate" are more likely to be directed toward these elements. Consequently, they are likely to be more sensitive in perceiving the strength of forces operating from the following sources: (1) the change agency, (2) other adopter units in the system, and (3) components within the adopter unit. The process of adoption can be examined in terms of how the pressure to innovate from these sources leads to adoption decisions and subsequent implementation of the decisions.

3. Decision

Decision is the process by which a potential adopter unit accepts an innovation as relevant, useful, and desirable or rejects the innovation. The final outcome of this process is a state of willingness to act.

The decision process involves sharing of information by individuals making decisions, use of information stored in records and memory (past experience), and feedback from previous actions. Some organized procedures ensure participation of individuals in the decision-making process. The degree to which pressures to innovate are operating on a decision-making body is likely to influence the nature of decision and the speed with which decisions are made.

4. Action

Action is the process by which an adoption decision is implemented into the actual use of the innovation. This

process involves the mobilization of resources and the management and coordination of various activities. This process continues until the full-scale use of the innovation becomes a part of normal behavior.

Factors Related to Innovativeness

Innovativeness is defined as the relative degree to which an individual or a social system responds to new ideas and practices. The response is reflected in the innovation-adoption behavior. The degree of response is relative to other units of adoption in the total social system.

The innovativeness of an individual is reflected in the individual adoption behavior. When the adoption behavior is contingent, it reflects both the individual's and the social system's innovativeness. The collective adoption behavior reflects the innovativeness of the total social system. In authority adoption, the innovativeness of the decision-making authority of the social system is reflected.

The innovativeness of an individual or a social system can be measured in a number of different ways, using one or more criteria. In past research, the time of adoption and the number of innovations adopted at a given point in time, were the two criteria widely used. The method used in the present study is a modified method

where the intensity or the scale of use of an innovation is considered along with time of adoption. It will be discussed in the following chapter on methodology.

In selecting the variables for the present investigation a number of factors were considered. First, the theoretical framework immediately suggested that variable such as communication structure, participation, pressure to innovate, group solidarity, resources, etc., should be included. Second, the review of past research indicated that these variables were considered in the past and found to be significant correlates of innovativeness. Third, a limited amount of time and other resources available excluded any possibility of an intensive survey at the level of individual farmers.

Finally, the experimental nature of the pilot project at Comilla suggested that certain assumptions on the constancy of some conditions throughout the cooperative societies could be made. An explanation of this last point is now in order.

In the Comilla pilot project for Rural Development, a number of conditions are deliberately controlled. Certain other conditions do not show much variation from village to village because the area is small, and it has a uniform type of rice-producing, monsoon agriculture.

The village agricultural societies are somewhat insulated from the various external sources of influence.

For example, the differential intensity of the various government extension programs in different parts of the thana could create variation in the response of the farmers. But this is unlikely, because all activities of the representatives of the nation-building departments of the government are channeled through the programs of the central association. The program of the central association constitute one complex treatment. This is equally applied to all the cooperative societies through the formal channels of communication. Each of the cooperative societies is exposed to the same kind of information. Each of the cooperatives has equal access to the services and the resources offered by the central association. The major innovations promoted by the central association are carefully designed so as to make them equally applicable and equally profitable to all the cooperative societies.

These factors, then, are likely to contribute very little to the variation in the innovativeness of the cooperative societies. They are the factors controlled by the design of the pilot project. The control factors are as follows:

1. The nature and availability of basic information about the innovations, through formal channels of communication.

2. The nature and availability of the services and supplies needed for the adoption of the innovations.
3. The influence of all other government extension programs.
4. The applicability and the profitability of an innovation to the cooperative societies.
5. The type of agriculture.

The paradigm presented in Figure 1 and the list in Table 3 show the variables and their expected relationships. The variables on the left-hand side are considered as independent variables. The main criterion variable is innovativeness of the cooperative societies. This is measured in terms of collective adoption behavior. The expected direction of the relationship between an independent and the criterion variable is indicated by a positive (+) or a negative (-) sign.

The variable of "the average level of individual innovativeness in a cooperative society" is first treated as an independent variable. Then, in a second stage of analysis, it is treated as a criterion or dependent variable. It is related to the same set of independent variables.

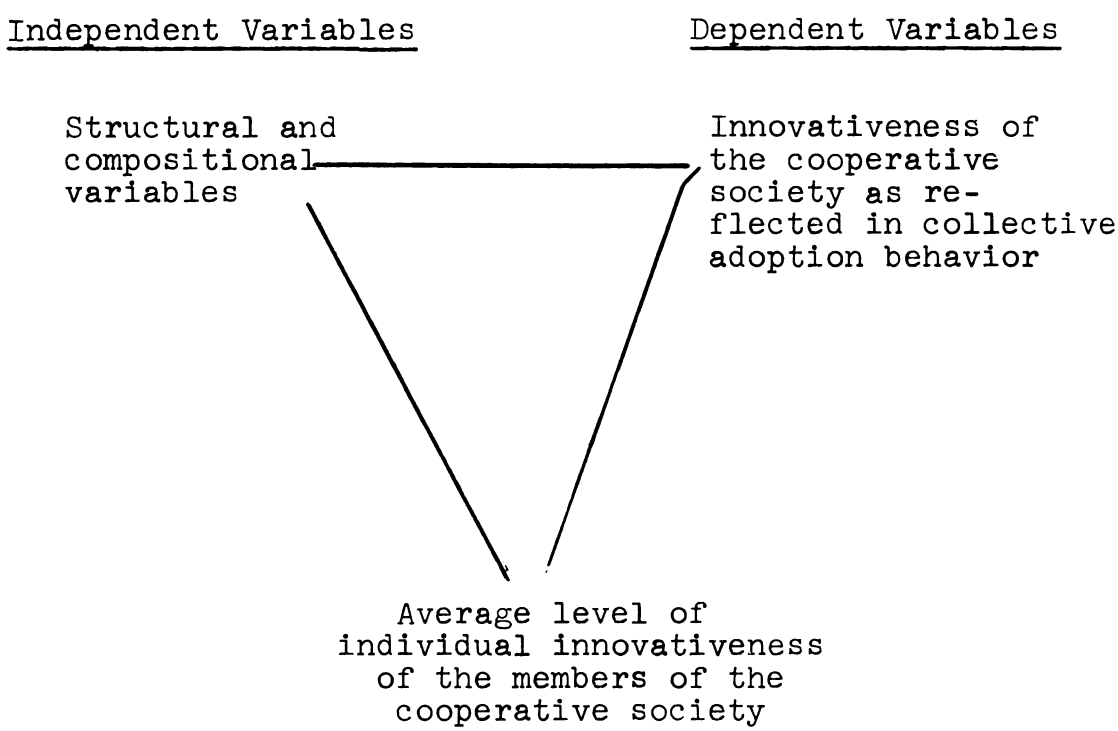

Figure 1. Paradigm Showing the Relationship Between Innovativeness and Other Variables

Table 3. List of Independent Variables

Structural Variables

1. Interpersonal Communication (+)

   (a) The degree of external communication of the leaders of the cooperative society (+)

   (b) The degree of internal communication of the leaders of the cooperative society (+)

   (c) Opinion leadership of the leaders of the cooperative society (+)

2. The extent to which the village influentials are the formal channels of communication between the change agency and the cooperative society (+)

3. The frequency of visits of the change agents to the village cooperative society (+)

4. The degree of participation of the members of the cooperative in decision-making (+)

5. The intensity of the training and educational activities within the cooperative society (+)

6. The effectiveness of the management of the cooperative society (+)

7. The centralization of the power structure in the cooperative society (+)

8. The degree to which oligarchy is present in the cooperative society (-)

9. The degree of pressures to innovate (+)

   (a) From the change agents on the leaders of the cooperative (+)

   (b) From the leaders on the members of the cooperative (+)

   (c) From the members on the leaders of the cooperative (+)

Table 3--continued

10. Resources (+)

    (a) The total amount of loans received from the central association (+)

    (b) Number of persons trained in various skills at the central association (+)

    (c) Time spent by the managers and the chairmen in cooperatives' work (+)

11. Group solidarity: the degree to which the members are attracted to the cooperative society (+)

12. The degree of inequality of the distribution of the resources possessed by the members of the cooperative (-)

    (a) Land owned (-)

    (b) Loans received (-)

13. Size of the membership (+)

    (a) Membership size at the time of the survey (+)

    (b) Increase in membership size over the past years (+)

14. Accessibility of the cooperative from the office of the central association.

    (a) Distance (-)

    (b) Physical accessibility (+)

Compositional Variables*

1. Age of the leaders (-)

2. Education of the leaders (+)

3. The leaders' affiliation with organizations (+)

4. Economic status of the leaders (+)

5. Mass media exposure of the leaders (+)

6. Education of the members (+)

Table 3--continued

7. Economic status of the members (+)

8. Occupational diversity of the members (+)

9. Mass media exposure of the members (+)

10. Members' contacts with the town (+)

---

*The compositional variables are aggregate measures of individual characteristics of the members of the cooperative society. Thus, these variables measure the degree to which certain individual characteristics are present or absent in the social system (cooperative society).

CHAPTER III

METHODOLOGY

Design of the Study

The objective of the present study is to examine and explain variation in innovative behavior of a set of cooperative societies in a rural development program. Therefore, a design facilitating selection of units with a wide range of variation in innovative behavior was appropriate. This was accomplished by using a stratified random sampling procedure.

The population was composed of 154 village cooperative societies, registered on or before December, 1966. These cooperatives were classified into four strata. The two criteria used for stratification were (1) the length of time a cooperative was in operation, and (2) current performance of the cooperative in various activities and programs. The performance scores were obtained from ratings made by the chief inspectors of the cooperative societies on a six-item scale. The details of the sampling design are presented in Table 4.

Table 4. Distribution of the Total Sample over Four Strata

Stratum		Stratum Size	Sampling Fraction	Sample Size
I.	Older and low performance	44	.52	23
II.	Younger and low performance cooperatives	36	.52	19
III.	Older and high performance cooperatives	42	.52	22
IV.	Younger and high performance cooperatives	32	.52	16
	Total	154	.52	80

The information obtained from the selected samples referred to current states and conditions and past states and conditions of the cooperative societies. Thus, a logitudinal dimension was added to the design. A second stage of sampling was used in selecting ten members from each cooperative society. A simple random sampling method was used at that stage. Information on individual members were obtained from records and through key informants.

Organization of Field Work

The organization of data-gathering field work was started in August, 1967. The author spent 15 days visiting village cooperative societies and various sections of

the central association. During this period, a number of officials of the central association and chairmen and managers of village cooperative societies were interviewed. The purpose of this initial investigation was to ascertain the nature and scope of information available from various official records, and to pretest schedules and questionnaires.

Training of Investigators

Four full-time and three part-time field investigators were recruited from local villages. These persons had 8 to 10 years of formal schooling. They each had experience in working in a number of survey-research projects organized by the Comilla Academy for Rural development.

The field investigators received training for 20 days. They were sent to village cooperatives (outside the sample) to study various records and interview the officers of the cooperatives. They reported to headquarters (the Academy) every third day to have their work examined and to participate in training discussions. The author directly supervised the field investigators.

Three research assistants were recruited to assist the author in interviewing, compiling and coding. One of the research assistants held an M.A. degree in Sociology, another held an M.A. degree in Education, and the third assistant possessed a B.A. degree in Business Management.

A fourth assistant was borrowed from the research section of the Academy when interviewing began. All these research assistants received training in computation, coding and interviewing methods.

Methods of Data-Collection

Three methods were used in the collection of data: (1) administering rating questionnaires to selected officials of the central association, (2) filling out forms with data compiled from various records and documents of the central association and village cooperatives, and (3) interviewing the managers and chairmen of the sample cooperatives. In addition, key informants were used in obtaining certain information about the members of the cooperatives chosen in the sample.

The following instruments were used in the collection of data.*

(1) Performance rating questionnaire

This questionnaire has six items. The chief inspectors rated each of the 154 cooperative societies on ten-point scales. These ratings were used in the stratification procedures for sample selection.

(2) Visit questionnaire

This questionnaire was administered to selected

*See Appendix A at the end of this thesis.

officers of the central association. The extent to which these officers visited different cooperative societies in the sample was rated (by them) on a three point scale.

(3) Questionnaire on rating cooperatives on selected characteristics

This questionnaire contained 24 statements. Each statement referred to a characteristic or a condition of a cooperative society. The questionnaire was administered to 21 inspectors of the cooperative societies. Each inspector rated the cooperatives under his supervision. He indicated, on a three point scale, the degree to which each statement was applicable to a particular cooperative society.

(4) Schedule used by field investigators

This schedule was used for collecting information from the records and the officers of the cooperative societies. The information obtained pertained to the cooperatives and ten members from each cooperative society.

(5) Schedule for interviewing the managers and chairmen of the sample cooperatives

This schedule contained structured and open-ended questions. Most of the questions referred to the respondent. Some questions referred to the cooperative society to which the respondent belonged. It was used in the personal interviews with the managers and chairmen.

(6) Other schedules and forms

These were simple schedules and forms used in recording information compiled from various records and documents of the central association. Information on loans, savings, tractors, irrigation-wells, etc., were recorded on these schedules and forms.

The field work was conducted in three overlapping phases. In September, 1967, the field investigators visited the cooperative societies with schedule # 4. Each of them completed work on two or three cooperatives in three to four days and returned to the head office. The completed schedules were checked immediately. When incomplete or improper entries were found, the field investigator was sent back to obtain the missing data. Then a second installment of work was assigned. In this way, the field work was finally completed in the middle of November, 1967.

The author and the research assistants made frequent visits to the various sections of the central association during October and November, 1967. In this period, various records and documents were examined, relevant information was compiled and the schedules and forms (#5) were filled out. This part of the work involved a considerable amount of compilation and simple computation, because the official records did not present the data in the same form as were required for the present study. In the same period,

questionnaire # 2 was administered to five senior and eight intermediate level officers of the central association. Questionnaire # 3 was administered to 21 inspectors in three groups.

The last phase of the field work was started in the middle of November, 1967. The managers and the chairmen of the sample cooperative societies were interviewed by the author and three other interviewers.

From previous test interviews, it was found to be extremely difficult to interview a manager or a chairman privately in the village. Invariably, a group of villagers gathered and started participating in the interview process. The managers and chairmen found it difficult to answer some of the questions frankly when other members were present. Moreover, considerable time was spent in travelling. So it was decided to interview the managers and the chairmen at the survey headquarters located on the Academy campus.

The proposal for data-gathering was presented in a meeting of the managers of the cooperative societies. It was agreed that each interviewee would be paid an amount of Rs. 5.00 (U.S. $1.05) as a travelling allowance. The managers agreed to this proposal. Printed letters of invitation were sent to each of the managers and chairmen of the 80 sample cooperatives.

The interviews were conducted by four interviewers. The average time spent on an interview was two hours. The general impression of the interviewers was that the interviewees were cooperative and frank in answering questions.

Compilation and Coding

The data compilation and coding were designed to reduce the total volume of information into a form suitable for computer analysis. First, averages, percentages and scores were obtained by simple arithmetic operations. Rates of change were estimated from the slopes of regression lines drawn on graphs. These graphs presented time-series data, e.g., per member savings in different years. Similarly, Gini indices were computed graphically.* As a result of these operations, the total volume of data was reduced to a data matrix of 244 items (columns) and 80 cooperatives (rows) or 19,520 cells. Some of the items in this matrix were pre-coded. The values in the other items were transformed into codes. This was done by constructing frequency distribution tables and then assigning suitable

---

*The Gini index is a measure of concentration. For example, Gini index for concentration of land holdings was obtained in the following manner. The percentages of the total land owned by 10,20, ... 100 percent of the total members were plotted in a graph. The area under the graph, expressed as proportion of the total area, was a measure of concentration of land for the cooperative society.

codes to each of the class intervals in the frequency distribution tables.

A codebook explaining each of the codes in terms of original values of the data accompanied the data matrix.

The resultant data matrix (in coded form) was used in the final analysis, which involved factor analysis and correlation analysis. The process of coding resulted in some loss of information in the variability of the variables. The effect of this loss would be some reduction in the correlation coefficients. It was decided to accept this loss for the sake of the advantage gained in the data-handling process.

Non-response and Estimation of Missing Data

All items in the rating questionnaires were completed and there were no data missing from the records (the non-response rate was zero). But one manager and nine chairmen could not be interviewed for various reasons. Two of them refused to be interviewed. The rest were either ill or said they were too busy. They could not be interviewed, although several attempts were made to contact them. Due to this lack of response, about three percent of the 19,520 cells in the final data matrix were blank. These blanks were filled by a simple method of estimation of missing data; a missing cell was filled by the median of the distribution of the values in the other cells of the column.

Reliability of Information

About 38 percent of the total information was collected from official records, about 42 percent from the interviews with managers and chairmen, and about 14 percent from rating questionnaires.

The official records at the central association are carefully maintained and regularly audited by qualified auditors. The village records are also audited regularly. There is little reason to question the reliability of the information obtained from these records. A number of independent checks were made on some of the items of information. These checks supported the previous contentions.

The reliability of the information obtained through the rating questionnaires (#3) was checked in the following manner. A number of cooperatives were independently rated by the chief inspectors. Some cooperatives were rated by more than one inspector. These operations yielded 30 pairs of comparative ratings. For example, cooperative A was rated on 24 items by rater M, and the same cooperative was rated on the same items by rater N. This was one of the thirty pairs of comparisons.

An index of agreement was computed by expressing the number of items on which the two raters gave the same score as a percentage of the total number of items. The index of agreement obtained for the 30 comparisons varied

from 38 percent to 80 percent. Eighty-three percent of these indices were above 50. It can be shown that the probability of getting an agreement index of 50 or more by chance is only 0.05. Therefore, the reliability of the ratings by the inspectors can be taken as rather high.

The reliability of the information collected through schedule # 5 was checked by comparing the responses of the managers and chairmen on some factual items. The correlation between the responses of the chairman and the manager was moderately high on some items. These were the items on the questionnaire where the respondent was asked to give some specific information about the cooperative society. For example, how many members were trained in various skills? Is there an effective system of fines for defaulting members? The correlation was low for items such as whether there is a faction in the village, or how many members feel strongly in favor of the cooperative.*

However, most of the items in schedule # 5 were about the respondents themselves -- their education, age, communication behavior, etc. A few independent checks on these items showed a high degree of reliability.

---

*This experience supports previous findings that attitudinal data is often less reliable than more factual, objective data.

Operationalization of Variables and Index Construction

The items in the questionnaires and schedules were designed as operational forms of the variables listed in the previous chapter. These items were selected on the basis of their theoretical relevance and face validity. Some of the variables were operationalized by a single item. For example, the education of a manager was operationalized by the manager's response to the question: How many years did you attend school? In a few cases, more complex variables were operationalized in terms of a single item. For example, three alternative forms of power structure in a cooperative were provided. The inspector (rater) was asked to choose the one that most accurately described the power structure of the cooperative rated by him.

However, most of the complex variables were operationalized in terms of more than one item. It was not possible to decide a priori which items would measure these variables best, or what possible independent dimensions those variables might have. Therefore, as many items as possible were chosen. The idea was to use factor analysis later in selecting suitable items.*

*Factor analysis is a statistical method of data-reduction. It can be used for determining the number and nature of underlying variables among a large number of measures. If the measures are related to a single underlying variable,

All the operational items of a variable was put into a factor analysis solution. The principal axis solution and the varimax rotations were obtained. These were carefully examined. The composition of the different factors and the items were then examined. A factor was taken as a separate variable when (1) it explained a sizable portion of the total variance, (2) it contained items with both high and clean loading,* (3) when it was logical to treat the factor as one dimension of the main variable.

In selecting the best items from a particular factor, the following criteria were used: (1) the item explains a high proportion of the common factor variance or high communality (.40 or above); (2) the item has a high factor loading (.50 or above); (3) the item is clean; (4) the item appears consistently in the same factor as the rank of the factor solution is changed; and (5) the selection of the item as a measure of the underlying variable is logically sound.

---

factor analysis tests unidimensionality and identifies the "best" measures of the variable. If the variable has more than one independent underlying dimension (or factor), factor analysis can sort out the measures between the dimension or factors and identify the best measures for each of the factors.

*The factor loading on an item indicates the degree of correlation between the item and the factor. An item is considered "clean" if it loads highly on one factor and low on all the other factors.

The factor analysis produced a set of items for each of the variables. Some of these sets contained items measured in the same unit. When this was the case, the arithmetic mean of the items in the set was taken as an index measuring the variable. When the items in a set were in different units, a technique known as "sten-scoring" (Rogers and others, 1962) was used to transform them into a common unit.* Then the arithmetic mean was computed.

The factor analysis and the index construction reduced the total items to 51 variables. These variables, with their operational forms, are listed in Appendix B.

Construction of the Innovativeness Index

Innovativeness at the individual level can be operationalized in terms of relative time of adoption of innovations (Rogers, 1962). If person A adopts an innovation at time t_1, and another person B from the same social system adopts the same innovation at time t_2, then, t_1 and t_2 are measures of the innovativeness of A and B, respectively. When such time scores for a number of innovations are available, they can be combined

---

*Sten scores are calculated by forcing an observed distribution into a normal distribution and then assigning scores 0, 1, 2, ... 9 to subjects falling into 10 different parts of the distribution. The distribution is divided into 10 parts with .50 as class interval.

to form an innovativeness index. This procedure can also be used in measuring social system innovativeness. The type of adoption behavior will determine the units to which adoption time should be related.

There are two general problems. Often, research studies are conducted before innovations are fully diffused in the social system. Then some non-adopters are found. The non-adopters can be assigned an innovativeness score of zero. But, if person A is a non-adopter of an innovation adopted by 90 percent of the population, and person B is a non-adopter of an innovation adopted by only 10 percent of the population, both will receive a zero score. This seems inappropriate. When, at a later point in time, the second innovation is adopted by 90 percent of the population, B is less likely to be in the remaining 10 percent of non-adopters. Therefore, less error will be made if B is given a score higher than A. One approach is to give B the average score of all the non-adopters. If it is assumed that the distribution of adopters is a normal distribution, the average score can be obtained by forcing the distribution of adopters into a standard normal distribution.*

---

*This procedure has been described in detail by Rogers and others (1962).

The second problem can be stated as follows. The time of adoption measures only one aspect of adoption behavior: the degree to which one person is relatively earlier than another person in adopting innovations. One can think of other aspects of innovative behavior; for example, the intensity of use, the continuity of use, and the speed at which full-scale use of the innovation is reached. If these measures correlate highly with time of adoption, they can be used along with time measures. If they do not correlate highly, one must search for additional dimensions of innovative behavior. Obviously, inclusion of these items will greatly increase the scope of item selection for construction of the innovativeness scale.

By definition, time of adoption refers to the time of full-scale use of an innovation. When an innovation is divisible (i.e., when it can be used on a small scale at first with a subsequent-gradual incerase in the scale of use), the scale or the intensity of use can be seen as a function of time. But time is a measure of innovativeness. Therefore, the scale of use or the intensity of use should measure innovativeness.

Consider a case where full-use has not been reached. Usually, the time-measure in such a case refers to the time of first use. This measure is a partial measure.

Sometimes it can lead to gross errors. An example will make this point clearer.

This example is taken from Comilla. The figures in Table 5 show the time of first use and intensity or scale of use of deep-well irrigation by two cooperative societies in Comilla. Dhanpur Cooperative started to use well irrigation one year earlier than Shrreballaupur Cooperative. Therefore, one can say that Dhanpur is more innovative than Shrreballaupur. But, Shrreballaupur was faster in increasing the scale of use than Dhanpur.

Assuming that 60 acres under irrigation is the standard of full-scale use in both the cooperatives, Shrreballaupur would reach the stage of full-scale use in 1967. But Dhanapur would reach full scale use in, say, 1970. Now, using standard measures, Shreeballaupur is more innovative than Dhanpur.

It can be noted that, under certain assumptions, the time of full-use can be estimated from a knowledge of the time of first use, the scale of use at two points in time and the rate of change in the scale of use.

The implication of the point discussed previously is clear. An innovativeness scale using time of first use of idvisible innovations should include items that measure the scale of use and rate of change in the scale of use of innovations.

Table 5. Use of Deep Well Irrigation by Two Cooperative Societies at Comilla.

Year	Dhanpur Cooperative	Shreeballapur Cooperative
	acres irrigated	acres irrigated
1963-64	22	--
1964-65	21	10
1965-66	24	34
1966-67	34	57

The innovativeness scale used in the present study was constructed in the following manner. A total of 37 items were available. These items included measures of the time of first use, scale of use at two different points of time and the rate of change in the scale of use over a period of time. For example, the following items were related to deep well adoption: (1) date of installation of the deep well; (2) acres of land irrigated in the year of installation; (3) acres of land irrigated in 1966-67; and (4) the average rate of change in acres irrigated during the intervening period. This rate was estimated from the slope of the best-fit line drawn over

points showing acres irrigated in different years.*

The 37 items were factor analyzed. Two clear factors emerged. Most of the items on mechanization, and two items on the date of establishment and the date of registration of cooperatives, loaded highly on one factor. Most of the items on the credit program loaded highly on a second factor. This result leads to a conceptualization of two independent dimensions of collective innovativeness of the cooperative societies. The first factor was taken as a variable measuring collective adoption of mechanization. It was named "CINOM." The second factor, named "CINOC," was taken as a variable measuring collective adoption of a new credit program. It may be noted that the time measure and the intensity measures on an innovation fell into the same factor. But innovations of different kinds fell into two different factors.

Eight items from the first factor (CINOM) and five items from the second factor (CINOC) were finally selected for the construction of the index. The criteria of item-

---

*Two additional rates of change were obtained by breaking the total period into two sections: (1) from the year of installation to 1964-65, and from 1964-65 to 1966-67. This was found to be necessary because the year 1965 was a crisis year, when, for various reasons, acreage under irrigation was very low for most of the cooperatives.

selection described earlier were used.

The items of CINOM and CINOC were in different units of measurement. Also, there were zero frequencies because some of the cooperatives did not use tractors and deep wells. The item scores were transformed into sten scores. To obtain the index values, the arithmatic mean of the sten scores were computed.

In addition to the two indices of collective innovativeness, a third index was constructed. This index measured the average level of individual innovativeness of the members of the cooperative society. This index was named ALINO.*

Information was obtained on individual adoption of innovations by ten members of each cooperative society. A member was rated on a three point scale (high, medium, low) on the basis of the number of innovations (fertilizers, seeds, etc.) adopted. The manager and the chairman of the cooperative society rated each member. The average of the rating scores of the ten members was taken as a measure of the ALINO of the cooperative society.

---

*The initials are used for convenience. ALINO is for "average level of individual innovativeness." Similarly, CINOM is for "collective innovativeness on mechanization", and CINOC is for "collective innovativeness on credit program."

CHAPTER IV

DEPENDENT VARIABLES: INNOVATIVENESS

The dependent variables in the present study are certain measures of innovativeness. The choice of innovativeness as the dependent variable is dictated by the main objective of the present study, which is to identify factors related to innovativeness of the cooperative societies at Comilla, Pakistan.

Measures of Innovativeness

Different types of adoption behavior were conceptualized in Chapter II. Accordingly, different measures of innovativeness were computed. Collective innovativeness was measured in terms of the collective adoption behavior of the cooperative societies at Comilla. A number of items measuring the time and intensity of adoption were used in the construction of innovativeness indices. Two major innovations were considered: (1) an agricultural mechanization program, and (2) a program of supervised credit. It was found that the scale items related to these two innovations measured two independent dimensions of collective innovativeness.

In addition, the average level of individual adoption of innovations by the members of the cooperative

societies was measured by an index. Now, yet another measure of innovativeness will be introduced.

It was stated in Chapter III, that the chief inspectors of the cooperative societies rated the cooperatives on a six-item scale. The items in this scale were related to various innovations adopted collectively or individually by the members of the cooperative societies. Each rating was made as to the current status of adoption of innovations by the cooperative. The total score for each cooperative society on this scale was used in the process of selecting the stratified sample for the present study. However, the same score can also be used as a composite measure of innovativeness. This measure will be called "COMINO," a composite measure of innovativeness of each cooperative society in our study.

So four different measures of innovativeness are available:

(1) CINOM - an index measuring the collective adoption of the mechanization program.

(2) CINOC - an index measuring the collective adoption of the credit program.

(3) ALINO - an index measuring the average level of individual innovativeness of the members of the cooperative societies.

(4) COMINO - a composite index, based on subjective ratings by cooperative inspectors, measuring both the collective innovativeness and the average level of individual innovativeness.

Relationship Between Different Measures of Innovativeness

The relationship between the four measures of innovativeness is shown in Table 6.

Table 6. Correlation Coefficients Between Four Measures of Innovativeness of the Cooperative Societies at Comilla (Zero-order Product-Moment Correlation Coefficients).

Measures of Innovativeness	Measures of Innovativeness			
	CINOM	CINOC	ALINO	COMINO
CINOM	-	.02	.28**	.36**
CINOC	-	-	.18	.48**
ALINO	-	-	-	.33**

*Significant at 5 percent level of probability; the critical value of r is .183 when N = 80.

**Significant at 1 percent level of probability; the critical value of r is .256 when N = 80.

Collective Innovativeness

The correlation between CINOM and CINOC is close to zero (.02). This is expected, because, these indicies are two independent dimensions of collective innovative-

ness of cooperative societies. These dimensions were identified after the measures of innovativeness were factor analysed.

This finding indicates that the adoption of the mechanization program is not related to the adoption of the credit program. It seems that one cannot talk about innovativeness, of the cooperatives at Comilla, as a general tendency to adopt innovations. A cooperative society might adopt one kind of innovation promptly, but, at the same time, might remain indifferent to a different kind of innovation.

A closer look at the interrelationship between the items of the two measures of collective innovativeness reveals some insight. The item "amount of savings per member in 1966-67" is negatively correlated (r =-.27) with the item "months ago the cooperative was formed". The item "average rate of change in loans taken" is negatively correlated (r = -.28) with the item "acres of land irrigated by tube-wells in 1966-67." The item "amount of loans per member taken in 1966-67" is negatively correlated (-.17) with the item "months ago tractors were first used." These correlation indicates that the adoption of mechanization is usually followed by less intensive savings and borrowings. But this relationship is not reflected in the correlation between indices of innovativeness (CINOM and CINOC).

The previous analysis points to a methodological problem. The analysis of relationships in terms of composite indices can mask intricate relationship between the adoption of different types of innovations. This problem can become serious when two innovations are interdependent in such a manner that a more intensive practice of one of the innovations leads to a less intensive practice of the other innovation.*

Collective and Individual Innovativeness

The correlation coefficient between CINOM and ALINO is highly significant, while the correlation between CINOC and ALINO is just below the 5 percent level of significance. In both cases the correlation is in the positive direction. It seems that the collective innovativeness of cooperative societies and the average level of individual innovativeness of the cooperatives, are correlated (although the degree of correlation is rather low). Innovativeness for individual members of the cooperative societies explains only a small amount of variation in the collective adoption behavior of the cooperative societies. A collectivity of innovative farmers doesn't necessarily constitute a highly innovative

---

*The issues raised in this section is discussed in Chapter VII of the present thesis.

cooperative society. It is likely that individual innovativeness is one of the many factors that make a cooperative adopt innovations collectively, but it does not insure such occurrence.

A closer examination of the relationships between the various measures of collective innovativeness and individual innovativeness shows that there is a tendency for the measures of time of adoption to correlate more strongly with individual innovativeness than the measures of intensity of collective adoption. It seems that a high level of individual innovativeness induces an early action towards collective adoption. But the intensity of collective adoption depends more on other factors than individual innovativeness.

Composite Measure of Innovativeness

The COMINO index is a composite measure of collective and individual innovativeness. It is a measure based on ratings of the cooperatives by judges. This is a simply measure that is convenient for practical purposes.

CIMINO is highly correlated with CINOM, CINOC and ALINO. The multiple correlation coefficient between COMINO and the other three measures is .60. About 60 percent of the variation in the ratings made by the inspectors can be accounted for the variation in the

collective and individual innovativeness of the cooperative societies. One can conclude that the inspectors are rather accurate judges and that the rating scale is a dependent instrument for constructing a composite index of innovativeness of the cooperative societies.

CHAPTER V

INDEPENDENT VARIABLES: CORRELATES OF INNOVATIVENESS

A large number of variables were selected as possible correlates of innovativeness of the cooperative societies at Comilla. These variables are related to various structural and compositional characteristics of the cooperative societies, which constitute the independent variables in the present study. The relationship between the independent variables and the dependent variables will be examined in this chapter.

Zero Order Correlations

The correlation coefficients between 47 independent variables and four dependent variables are presented in Table 7. These coefficients are Peasonian zero-order correlation coefficients. The square of a correlation coefficient (between two variables) can be interpreted as the proportion of variance in one of the variables explained by the other variable. For example, the correaltion between "change agents' visits" and "CINOM" is .72. One can say that about 52 percent (.72 x .72 x 100) of the variation in CINOM is due to variation in change agents' visits.

The correlation coefficients are measures of association. It is possible to test whether an observed

Table 7. Correlates of Innovativeness of Cooperative Societies at Comilla, East Pakistan.

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
1. Change Agents' Activities				
(a) Change agents' visits to the cooperative (VISIT)	.72**	.09	.27**	.20*
(b) Demonstration of innovations in the cooperative villages (DEMO)	.32**	-.13	.14	.11
2. Leaders' External Informal Communication				
(a) The manager's communication with the change agents and the leaders of other cooperatives (MNEXCOM)	.44**	-.03	.13	.15
(b) The chairman's communication with the change agents and the leaders of other cooperatives (CEXCOM)	.35**	.19*	.08	.23*
3. Leaders' Internal Informal Communication				
(a) The manager's communication with the other leaders and the members in the cooperative (MNICOM)	.14	.17	.02	.12
(b) The chairman's communication with the other leaders and members in the cooperative (CICOM)	-.10	.03	-.02	-.01

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
4. Influentials as Communication Channels				
(a) The degree to which the village influentials are the channels of communication between the cooperative and the central association (INFCOM)	-.10	.03	-.02	-.01
5. Opinion Leadership				
(a) The manager's opinion leadership among other managers and chairmen (MNOPLD)	.32**	.18	.18	.36**
(b) The chairman's opinion leadership among other managers and chairmen (COPLD)	.33**	.05	.05	.04
(c) The leaders opinion leadership among the members of the cooperative (LOPLD)	.30**	.16	.08	.30**
6. Pressure to Innovate				
(a) The leaders perception of pressure on them from the central association and pressure from them on the members (PSRI)	.21*	.05	.03	.18

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
(b) The leaders perception of pressure on them from the members (PSRII)	.22*	.12	.05	.19*
7. Management				
(a) Routine operations, disciplines (MANGI)	.11	.09	-.03	.13
(b) Planning, coordination and supervision (MANGII)	.05	.22*	.02	.32*
(c) Poor initiative - dependence on external guidance and supervision (ESUP)	-.23*	-.19*	-.05	-.36**
(d) Change in officers - number of different persons held the offices of the manager and the chairman (CIO)	.25*	-.04	.12	-.02
(e) Time spent by the manager and the chairman in cooperative's work (TSPNT)	.22*	.28**	.15	.21*
8. Participation				
(a) The members participation in the discussion in the weekly meetings (PARTI)	.10	.31**	.09	.43**
(b) The members attendence in the weekly meetings (PARTII)	.02	.12	.08	.12

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
9. Training Program - Member-training program within the cooperative (TRNG)	.13	.30**	.21*	.37**
10. Power and Influence				
(a) Oligarchy - the Cooperative is ruled by a few members (OLGAR)	.20*	-.41**	.02	-.35**
(b) Centralization of influence - presence of one, a few or several influentials (CINFLU)	.18	.20*	.01	.15
11. Group Solidarity: degree to which the members have strong attraction for the cooperative (GRSOLD)	-.12	.24*	-.06	.06
12. Resources Received from the Central Association				
(a) The total amount of loans received (LOAN)	.45**	.41**	.23*	.41**
(b) Number of persons trained in various skills at the central association (SKILL)	.41**	.01	.21*	.22*

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
13. Size				
(a) Present membership size (SIZE)	.22*	.20*	.08	.49**
(b) Change in membership size since the date of registration of the cooperative (CNGSIZEI)	.09	.29**	-.03	.44**
(c) Change in membership size since the date of formation of the cooperative (CNGSIZEII)	-.08	.17	.06	.27**
14. Inequalities in the Distribution of Resources				
(a) Gini index of the distribution of loans received by the members (GNLN)	-.15	-.01	.12	.19*
(b) Gini index of the distribution of land owned by the members (GNLD)	-.08	-.06	-.04	-.08
15. Spatial Factors				
(a) Distance of the cooperative from the town (DISTWN)	-.07	.06	-.14	-.17
(b) Physical accessibility of the cooperative from the town (ACESS)	.03	.08	.17	.06

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
16. Characteristics of the Leaders				
(a) Age of the Manager (MAGE)	.02	.04	-.01	.01
(b) Age of the Chairman (CAGE)	.04	-.22*	.13	-.20*
(c) Education of the Manager (MEDU)	-.02	.03	.24*	-.08
(d) Education of the chairman (CEDU)	-.09	.17	.13	.10
(e) Economic status of the Manager (MECO)	.03	-.03	.09	-.04
(f) Economic Status of the Chairman (CECO)	.01	.26**	-.07	.18
(g) Manager's membership in organization (MORG)	.20*	.01	.06	.07
(h) Chairman's membership in organizations (CORG)	.26**	.18	.22*	.21*
(i) Manager's exposure to mass media (MNMSCOM)	.01	.02	.05	.12
(j) Chairman's exposure to mass media (CMSCOM)	.02	.07	-.07	-.02
17. Characteristics of the Members				
(a) Average level of education (MEMEDU)	-.01	.06	.45**	.13
(b) Average land holding (MEMLAND)	.10	.06	.27**	-.02
(c) Percentage of the members having one or more secondary occupation (MEMOCU)	.01	.01	.04	.09

Table 7. continued

Independent Variables	Correlation With Innovativeness			
	CINOM	CINOC	ALINO	COMINO
(d) Average level of mass media exposure (MEMSCOM)	-.03	-.17	.27**	.03
(e) Average level of contacts with the town (MEMTWN)	-.12	.02	.32**	.04

*Significant at 5 percent level of probability; the critical value of r is .183, when N = 80.

**Significant at the 1 percent level of probability; the critical value of r is .253, when N = 80.

correlation is different from zero (that is, no association) or not. In Table 7, the correlation coefficients significantly different from zero are marked with astericks. Eighteen (of the 47 independent) variables are significantly correlated with CINOM, fourteen variables are significantly correlated with CINOS, nine variables are significantly correlated with ALINO, and nineteen variables are significantly correlated with COMINO.

Correlates of CINOM

The variables measuring the change agents' activities, leaders informal communication with other components in the development system, leaders opinion leadership on matters related to innovations, resources received from the central association, and the chairman's membership in organizations are highly correlated with collective adoption of the mechanization program. CINOM is moderately correlated with pressure to innovate, change in officers, time spent by leaders in cooperative's work, membership size, and manager's membership in organizations. The correlation between CINOM and dependence on outside guidance and supervision is moderate and negative. Oligarchy is positively (but only moderately) correlated with CINOM.

A general pattern in the correlates of CINOM can be noted. Most of the significant correlates of CINOM

are measures of the cooperatives' external relationship with the other components in the development system. The variables measuring internal structural and compositional characteristics are scarce among the set of significant correlates of CINOM.

Correlates of CINOC

The variables measuring members' participation in weekly meetings, intensity of member-training program, amount of time spent by the leaders in cooperative's work, loans received from the central association, change in membership size since the date of registration of the cooperative and the economic status of the chairman are highly correlated with CINOC. Oligarchy is highly correlated with CINOC, but the relationship is negative. CINOM is moderately correlated with the chairman's external communication, planning and coordination in internal management, concentration of influence, group solidarity and membership size. The relationship between CINOM and dependence on external supervision, and, CINOM and the chairman's age, are moderate and negative.

The correlates of CINOC show a pattern different than the pattern reflected by the correlates of CINOM. Here, the internal structural variables are more represented than the variables measuring external contacts

and compositional characteristics of the cooperative society.

Correlates of ALINO

The measure of the average level of individual innovativeness of the members of a cooperative society is highly correlated with change agents' visits, members average level of education, average land holding, average level of mass media consumption and average level of contacts with the town. ALINO is moderately correlated with member-training program, total amount of loans received by the cooperative, number of persons trained in various skills, the manager's education and the chairman's membership in organizations.

The correlates of ALINO show a distinct pattern where the compositional variables are predominant factors. The variables related to the internal organization of the cooperative society, are not significantly correlated with ALINO. A few variables measuring the cooperative's contacts with the central association are represented among the correlates of ALINO.

Correlates of COMINO

COMINO, the composite measure of innovativeness, is highly correlated with opinion leadership, participation, member-training, total amount of loans received

and size. The correlations with oligarchy and dependence on external supervision are high and negative. Change agents' visits, chairmen's external communication, leader's perception of pressure from members, coordination in management, time spent by leaders in cooperative's work, skill-training, the Gini index of the distribution of loans and the chairman's membership in organizations are moderately correlated with COMINO.

The pattern of relationships in this case are a mixture of the patterns reported in the previous sections. COMINO is correlated with both measures of external contact, and internal organization of the cooperative. A few compositional factors are represented among the correlates of COMINO.

Factor Analysis of the Independent Variables

About one-fourth of the total number of correlations between all possible pairs of 47 independent variables are significantly different from zero at the 5 percent level of probability. This is not an unexpected result. It is implied, in the arrangement of the variables under various headings in Table 7, that certain variables are closely related to each other, and possibly measure the same underlying dimension. In order to test this notion, the independent variables are factor analyzed.

Five theoretically relevant factors are identified in the factor solution. Each factor contains several variables with high and clear loadings. It is possible to take the variable with the highest loading as an operational definition of the factor (underlying variable or construct). But, a more meaningful procedure is to select several variables with high and clean loadings. This procedure reduces errors due to sampling and provides protection against faulty judgment in operationalization.

The five factors and the variables loading highly on them are as follows.

1. Integration

Integration is defined as the degree to which a cooperative society is socially related to other components of the development system.* Integration is reflected in the intensity of communication and other transactions. The following variables are measures of integration, and load highly on the integration factor.

(a) The change agents' visits to the cooperative society

(b) The manager's informal communication with the change agents and the leaders of

*Coleman (1966) has used a similar concept in a study of medical innovations.

other cooperative societies.

(c) Pressure to innovate from the members

(d) Number of persons trained to various skills at the central association.

(2) Organizational Health

The organizational health of a cooperative society can be defined as an internal state or condition that generates collective capacity of the members for interaction, communication, decision making and action.*

The following variables are chosen as measures of organizational health.

(a) Planning, coordination and supervision of activities with the cooperative society.

(b) The members' participation in decision making at the weekly meetings.

(c) Having an effective member-training program in the cooperative.

(d) Time spent by the leaders in the cooperative's work.

3. Growth

Growth is defined as increase in the membership of a cooperative society.

---

*This definition is based on Likert (1967, p. 29).

The specific variables measuring growth are as follows:

(a) Present size of membership.

(b) Change in membership size since the date of establishment of the cooperative.

(c) Change in membership size since the date of registration of the cooperative.

4. Modernity of the Leaders

Modernization is defined as a process by which individuals change from a traditional way of life to a more complex, urban, technologically oriented and participant style of life.* Modernity is the state of an individual at any given point of time in the process of modernization.

The following variables are measures of modernity of the leaders of the cooperative society.

(a) The chairman's exposure to mass media of communication.

(b) The leader's opinion leadership within the cooperative.

(c) The chairman's economic status.

(d) The chairman's membership in organizations.

---

*This definition is based on Rogers (1968b) and Lerner (1958, pp. 43-75).

5. Modernity of the Members

The following variables are measures of modernity of the members of the cooperative society.

(a) Average level of education of the members.

(b) Average level of the member's exposure to mass media of communication.

(c) Average level of the member's contacts with the town.

The correlation coefficients between each of the five factors (or underlying variables) and the four dependent variables are obtained by using a simple formula.* These correlation coefficients are presented in Table 8.

Table 8 is a more succinct summary of Table 7, in one sense. Here, higher level concepts have been used to pull out the main trends of relationship between the dependent and independent variables. It is possible

---

*If $x_1, x_2, \ldots x_n$ are n parallel measures of an underlying variable X, then the sum of the X's can be taken as a measure of X. The correlation between X and another variable Y is given by

$$r(XY) = \frac{\sum rxy}{\sqrt{n + (n-1)\sum r_{xx}}}$$

For a general expression of this formula, see McNemar (1965, p. 207).

Table 8. Correlation Between Four Measures of Innovativeness and Five Measures of Characteristics of the Cooperative Societies at Comilla.

Characteristics of the Cooperative	Correlations with Measures of Innovativeness			
	CINOM	CINOC	ALINO	COMINO
1. Integration	.52**	.15	.21*	.27**
2. Organizational Health	.17	.37**	.16	.44**
3. Growth	.10	.28**	.06	.51**
4. Leader's Modernity	.21*	.24*	.06	.24*
5. Member's Modernity	-.07	-.03	.42**	.08

*Significant at the 5 percent level of probability; the critical value of r is .183, when N = 80.

**Significant at the 1 percent level of probability; the critical value of r is .256 when N = 80.

to draw the following general conclusions from the results presented in Table 8.

1. Different sets of factors are related to collective and individual innovativeness of the cooperative societies at Comilla. The factors significantly related to adoption of the mechanization program are (1) integration of the cooperative society in the development system, and (2) modernity of the leaders of the cooperative society. The adoption of the credit program is significantly related to (1) organizational health of the cooperative society, (2) growth of the cooperative society and (3) modernity of the leaders of the cooperative society. The factors significantly related to the average level of individual innovativeness of the members are: (1) integration and (2) modernity of the members of the cooperative society. Finally, all the factors, except modernity of the members, are significantly related to the composite measure of innovativeness.

2. The structural factors are more important than compositional factors, as related to the collective adoption of innovations by the cooperative societies. The compositional factors are more important factors in relation to the average level of individual innovativeness of the members of the cooperative societies.

3. The average level of individual innovativeness is related to only those aspects of the social structure which integrate the cooperative society into the development system.

4. The relative importance of the integration and organizational health factors, as related to collective innovativeness, is likely to differ for different kinds of innovations. The difference is probably due to the nature of the innovations. In the present case, the mechanization program was introduced more recently. The village cooperatives depend heavily on the "machine station" maintained by the central association.* Also, the ownership of the tube-wells is retained by the central association. The credit program, involving weekly collection of savings, distribution and realization of loans, maintainance of financial records, etc., require considerable amount of routine organizational activities. The extent to which a cooperative society depends on the central association and its own organization differs considerably for the two innovations. This might explain the difference in the degree of relationship between integration and organizational health, and collective

---

*The central association maintains a pool of tractors and pumps from which these machines are hired out to the cooperatives. Servicing of the machines and coordination of their movements in the villages are managed by the central pool.

innovativeness.

Interaction Effects

When two variables are correlated only in the presence (or absence) of a third variable, an interaction effect is demonstrated. If an interaction effect is present, one cannot talk meaningfully about simple relationship between the two variables. One has to specify the conditions under which the relationship will hold and will not hold.

In the present study, an attempt to detect interaction effects was made. The total sample of the 80 cooperative societies was divided into two sub-samples on the basis of high or low values of a suspected interaction variable.*

Then, correlation coefficients between the dependent and the independent variables were calculated for each of the two sub-samples. The sub-sample correlations and the total correlations were then compared. If an insignificant correlation (for the total sample) appeared significant for either of the two sub-sample, an interaction effect was suspected. The result was then

---

*The cutting point was at the code nearest to the median of the distribution. Due to limitations in the computer program used, it was not possible to divide the sample exactly at the median.

examined for logical and theoretical relevance.*

Table 9 presents the results of interaction analysis. This table presents only those cases where interaction effects was detected and found theoretically relevant. The selection of the independent variables was made on the basis of their insignificant correlation with the dependent variable.

1. When group solidarity in the cooperative is low, CINOM is positively related to the manager's informal communication with other leaders and members. The degree of informal internal communication of the manager contributes positively to the adoption of mechanization when group solidarity is low.

2. CINOM is positively related to member participation in decision-making, when the change agents visit the cooperative frequently. More generally, organizational health is a positive correlate of CINOM, when the cooperative is highly integrated in the development system.

3. The relationship between CINOM and the average level of landholding of the members is negative when the pressure to innovate from the members is low. If the members are not motivated to innovate, then the

---

*This is a crude method for identifying interaction effects. But, this method can be used for a moderate sample size and a simple computer program can be used for computations.

Table 9. Correlation Between the Independent and the Dependent Variables at Different Levels of Selected Interaction Variables. (Figures in parenthesis are sample size.)

Independent Variable	Dependent Variable	Correlation with Dependent Variable at different levels of the Interaction Variable			Interaction Variable
		"High" Sample	"Low" Sample	Total Sample	
Manager's Internal Communication	CINOM	.03 (42)	.52** (38)	.14 (80)	Group Solidarity
Members' Participation	CINOM	.30* (32)	-.05 (48)	.10 (80)	Change Agents Visits
Members' Landholding	CINOM	.08 (27)	-.49** (53)	.06 (80)	Pressure to Innovate From Members
Chairman's Internal Communication	CINOC	-.09 (47)	.46** (33)	.03 (80)	Members' Education
Change Agents' Visits	CINOC	-.18 (47)	.49** (33)	.09 (80)	Members' Education

*Significant at the 5 percent level of probability.

**Significant at the 1 percent level of probability. Also, the correlation is significantly different from the low sample correlation at the 5 percent level of probability.

cooperatives whose members have larger holdings of land are likely to be more resistant to mechanization. The pressure to innovate is a measure of the more general concept of integration. When the degree of integration is low, a cooperative whose members have larger landholdings is likely to respond less to mechanization than a cooperative with smaller landholdings.

4. CINOC is positively correlated to the degree of informal internal communication of the chairman, when the average level of education of the members of the cooperative is low. The chairman's informal communication is an important factor contributing to collective innovativeness (CINOC) when the members have less education.

5. The frequency of the change agents visit to the cooperative is positively related to CINOC when the average level of education of the members is low. Integration is correlated to CINOC when the member's educational level is low.

The results of the interaction analysis would be treated with caution. Perhaps one might obtain a different set of results with a slight change in the cutting points of the distribution of the interaction variables. The method of catagorization of the total sample into halves leads to loss of information. There

are no standard criteria for selection of variables and evaluation of correlation of coefficient. However, the results suggests some interesting hypotheses for future research. The implication of these results seems to be important for the change agents who would like to apply the research findings into concrete action programs.*

*These points are discussed in the section on multivariate analysis in Chapter VII.

CHAPTER VI

PREDICTION OF INNOVATIVENESS: MULTIPLE REGRESSION ANALYSIS

The relationship between a large number of independent variables and the four measures of innovativeness were examined in the last two chapters. The focus of attention was on the relationship between pairs of variables. Now, the results of a more complex analysis will be reported. Two specific questions will be raised: (1) given the present data, how much variation in innovativeness can be explained by a (linear) combination of the independent variables? (2) what minimum number of independent variables can be selected so that their (linear) combination can explain a maximum amount of variations in innovativeness?

Both of these questions are related to the problem of prediction. One is interested in how well innovativeness can be predicted from knowledge of the independent variables, how much variation can be explained, how much error is involved in the prediction, what are the predictors and how can they be ranked in order of importance?

General Regression Analysis

The statistical method of analysis used for this purpose is multiple regression analysis. It is assumed that a dependent variable Y is a linear function of independent variables X_1, X_2 ... X_n, that is:

$$Y = a + b_1 X_1 + b_2 X_2 + \ldots + b_n X_n$$

Using standard computer programs, the least square estimates of the coefficients a, b_1, b_2 ... b_n are obtained.

In order to obtain a small set of independent variables that could explain a high amount of variation in Y, a computer program known as least square delete (LSDEL) is used. This program starts with the general regression equation of all the independent variables. The variable with the highest level of significance of the standardized regression coefficient (beta) is dropped, and a fresh regression equation is obtained. This process continues until only the variables with significant beta coefficients (at the 5 percent level of probability) are retained in the regression equation.

The basic results of the multiple regression analysis are presented in Table 10. The general prediction equations for CINOM contains the 47 independent variable listed in Table 7, plus ALINO. The equations for ALINO and COMINO contain only the 47 independent variables.

Table 10. Results of Multiple Regression Analysis in Terms of the Proportion of Variance Explained in Innovativeness.

	General Solution				LSDEL Solution		
Dependent Variables	No. of Independent Variables Used in Regression	Multiple Regression Coefficient (R)	R^2 = Variance Explained	Significance Level of R	No. of Independent Variables	R*	R^2
1	2	3	4	5	6	7	8
1. CINOM	48	.92	85%	.01	11	.87	75%
2. CINOS	48	.85	74%	.04	8	.71	51%
3. ALINO	47	.83	69%	.09	5	.64	41%
4. COMINO	47	.87	76%	.01	7	.75	56%

*All the multiple regression coefficients are significant at 1 percent level of probability.

Column 4 in Table 10 shows that the prediction equations explain very high proportion of variance in the measures of innovativeness.

The multiple correlation coefficients (Rs) for CINOM and COMINO are significant at the 1 percent level of probability. The significance levels of R for CINOS and ALINO are significant at the 5 percent level, and not significant, respectively.

Least Square Delete Solution

The general prediction equations are powerful prediction instruments, but they are not very useful for practical purposes. They contain too many independent variables. More practical forms of prediction equations are provided by the LSDEL solutions. Column #8 in Table 10 shows that 11 independent variables explain 75 percent of the variation in CINOM, 8 independent variables explain 51 percent variation in CINOC, 5 independent variables explain 41 percent variation in ALINO and 7 independent variables explain 56 percent variation in COMINO. All the multiple regression coefficients are significant at the 1 percent level of probability.*

---

*The variables retained in the LSDEL solutions are sets of independent variables, which explain significant amounts of variation in the dependent variables. However, this

The predictor variables in the LSDEL equations, the standardized regression coefficients (beta weights) and the amount of variation explained by each of the predictor variables are presented in Table 11.

The beta coefficients in Table 11, are standardized regression coefficients.* The beta coefficient for an independent variable measures the amount of change in the dependent variable per unit change in the independent variable when all other independent variables in the system are kept constant. The quantity of variance explained is equal to the product of beta coefficient and the zero-order correlation between the independent and the dependent variable.** This quantity measures the relative importance (in terms of variance explained) of an independent variable.

Rank Order of the Predictors

In terms of variance explained, the predictors

---

does not mean that the variables discarded in the LSDEL solutions are poor predictors. It might be possible to get sets of independent variables, from the discarded variables, which might explain significant amounts of variation in the dependent variables. For this reason, the results of the LSDEL solutions should be interpreted carefully.

*The beta coefficients are regression coefficients when the variables in the regression equation are measured in standard scores.

**$R^2 = b_1r_1 + b_2r_2 + b_3r_3 + bnrn$ (McNemar, 1965, p. 178). Therefore, b_ir_i can be taken as the contribution of the 1th variable.

Table 11. Predictor Variables, Standardized Regression Coefficients (betas), and Percentage of Variance Explained by the Predictors of Innovativeness.

Predictor Variables	Measures of Innovativeness							
	CINOM		CINOC		ALINO		COMINO	
	B	V*	B	V	B	V	B	V
1. Change agents' visits	.519	37.4%	-	-	.291	7.8%	-	-
2. Manager's external communication	.232	10.1%	-	-	-	-	-	-
3. Manager's opinion leadership	-	-	-	-	-	-	.190	6.8%
4. Leader's opinion leadership among members	.149	4.2%	-	-	-	-	-	-
5. Pressure to innovate from central association	.217	4.6%	-	-	-	-	-	-
6. Loans from central association	.156	6.9%	.357	14.4%	-	-	.298	12.3%
7. Member-Training program	-	-	.222	6.6%	-	-	.222	8.4%

Table 11. Continued

Predictor Variables	Measures of Innovativeness							
	CINOM		CINOC		ALINO		COMINO	
	B	V	B	V	B	V	B	V
8. Oligarchy	.202	4.0%	-.244	9.8%	-	-	.244	8.4%
9. Centralization of influence	.167	2.9%	-	-	-	-	-	-
10. Group Solidarity	-	-	.199	4.6%	-	-	-	-
11. Change in membership size	-	-	.184	5.2%	-	-	.274	11.9%
12. Distance from town	-.171	1.2%	-	-	-	-	-.259	4.4%
13. Chairman's age	-	-	-.182	4.0%	-	-	.178	3.6%
14. Chairman's membership in organizations	-	-	-	-	.266	5.7%	-	-
15. Chairman's Mass Media exposure	-	-	-	-	-.296	2.1%	-	-
16. Manager's Mass Media exposure	-.198	-2.0%	-	-	-	-	-	-

Table 11. Continued

Predictor Variables	Measures of Innovativeness							
	CINOM		CINOC		ALINO		COMINO	
	B	V	B	V	B	V	B	V
17. Member's Mass Media exposure	-	-	-.262	4.1%	-	-	-	-
18. Member's education	-	-	-	-	.408	18.4%	-	-
19. Member's landholding	.195	1.9%	-	-	-	-	-	-
20. Member's contacts with the town	-.154	1.8%	.267	1.0%	.205	6.4%	-	-

*B = Beta Coefficient
V = Variance Explained

of innovativeness can be ranked in the following order.

Predictors of CINOM

Total variance explained is 75 percent.

1. The change agents' visits to the cooperatives (VISIT)
2. The manager's communication with the change agents and the leaders of the other cooperatives (MNEXCOM)
3. The total amount of loans received by the cooperative (LOAN)
4. The leaders perception of the pressure to innovate on them from the central association and the pressure on the members from the leaders (PSRI)
5. The leaders opinion leadership in matters related to innovativeness among the members of the cooperative society (LOPLD)
6. Oligarchy - rule by a few members (OLGAR)
7. Concentration of influence (CINFLU)
8. The manager's exposure to mass media of communication (MNMSCOM)
9. The average landholding of the members of the co-operative (MEMLAND)
10. The average level of the member's contacts with the town (MEMTWN)
11. The distance of the cooperative from the town (DISTWN)

Predictors of CINOC

Total variance explained is 51 percent.

1. The total amount of loans received (LOAN)
2. Oligarchy - rule by a few members (OLGAR)
3. Member-training program in the cooperative (TRNG)
4. The change in membership size since the date of registration of the cooperative (CNGSIZEI)
5. Group solidarity (GRSOLD)
6. The average level of the members' exposure to mass media of communication (MEMSCOM)
7. The age of the chairman (CAGE)

Predictors of ALINO

Total variance explained is 41 percent.

1. The average level of education of the members (MEMEDU)
2. The change agents' visits to the cooperative (VISIT)
3. The average level of the members' contacts with the town (MEMTWN)
4. The chairman's membership in organizations (CORG)
5. The chairman's exposure to mass media of communication (CMSCOM)

Predictors of COMINO

Total variance explained is 56 percent.

1. The total amount of loans received (LOAN)
2. The change in membership size since the date of

registration of the cooperative (CNGSIZEI)

4. Oligarchy - rule by a few members (OLGAR)

5. The manager's opinion leadership among the managers and chairmen of the other cooperatives (MNOPLD)

6. The distance of the cooperative from the town (DISTWN)

7. The age of the chairman (CAGE)

A number of beta coefficients in Table 11 are in a direction opposite to what normally would be expected. Thus, according to these betas, a higher degree of oligarchy predicts a higher degree of adoption of the mechanization program. Similarity, a higher degree of the manager's exposure to mass media communication, and the members' visits to the town, predict a lower degree of adoption of the mechanization program. A higher degree of members' exposure to mass media communication predicts a lower degree of adoption of the credit program. Finally, a higher degree of the chairman's exposure to mass media communication predicts a lower average level of individual adoption by the members of the cooperative.

Some explanation of these unexpected findings, and their implications, will be provided in the next chapter.

CHAPTER VII

SUMMARY, DISCUSSION, AND CONCLUSIONS

The main objectives of the present thesis were to (1) study the relationship between structural and compositional factors and innovative behavior of village agricultural cooperative societies at Comilla, East Pakistan, (2) to obtain separate measures for the collective adoption of innovations and individual adoption of innovations, examine their mutual relationship, and, to compare individual variables related to both of them, and (3) to construct linear models for prediction of innovativeness from a knowledge of structural and compositional characteristics of the cooperative societies. The units of analysis in the present thesis were social systems, village level agricultural cooperative societies.

Theory

A theoretical framework was developed so that an appropriate choice of variables could be made. Four types of innovative behavior were conceptualized. The typology was constructed with a view to make a distinction between adoption behavior at the individual level, and adoption behavior at the social system level. The four types of adoption behavior are: (1) individual adoption,

(2) contingent adoption, (3) collective adoption, and (4) authority adoption. The scope of the present study was limited to individual adoption and collective adoption, and a partial comparison of the nature of the two.

The adoption of an innovation was conceptualized as a process, over time, consisting of four sub-processes: (1) communication, (2) persuasion, (3) decision, and (4) action. A consideration of the nature of these sub-processes, and a review of the findings of past research, provided a guideline for the choice of the variables of this study.

The village cooperative societies at Comilla, the units (or subjects) of the present study, are part of a rural development pilot program organized by the Pakistan Academy for Rural Development. This program was considered as a development system composed of inter-related parts. It was noted that the nature of the development system imposed some degree of control over certain factors. As a result, it was possible to neglect certain variables.

Methodology

A sample survey design was used in the present study. A sample of 80 cooperative societies was selected by a stratified sampling method. Relevant information on these cooperative societies were obtained through a

variety of methods: (1) study of official records and documents, (2) ratings by judges, (3) key informants, and (4) interviewing leaders of the cooperatives.

The method of factor analysis was used in constructing indices for innovativeness and some of the independent variables. The usual method of constructing an innovativeness index from time-of-adoption data was modified by including items on the intensity of adoption of innovations. It was shown that the inclusion of intensity items was justified both theoretically and empirically.

In the analysis of the data, zero-order correlation, factor analysis, interaction analysis, and multiple regression analysis were used. A basic assumption involved in these analyses was the linearity of the relationships. This assumption could not be tested systematically for all relationships between pairs of the variables. But, where a low zero-order correlation was found, and when the variables were not limited to a few class-intervals, scatter diagrams were drawn. For some of the variables, correlations between a dependent and an independent variable for sub-samples (high and low on the independent variable) were compared.

Extreme non-linearity was detected in none of the cases examined. However, relationship between the member's education and adoption of mechanization showed

some degree of non-linearity.

MEASURES OF INNOVATIVENESS: THEIR INTERRELATIONSHIPS

Four measures of innovativeness were the dependent variables in the present study. These were (1) CINOM - a measure of collective adoption of a program for agricultural mechanization, (2) CINOC - a measure of collective adoption of a program on supervised credit, (3) ALINO - a measure of the average level of individual innovativeness of the members of the cooperatives, and (4) COMINO - a composite measure of innovativeness based on ratings by judges.

The first two measures were based on the time of adoption and the intensity of use of a selected number of innovations. The third measure was the average of ratings on innovativeness of ten members of each cooperative society.

Relationship Between Adoption of Mechanization and Adoption of the Credit Program

The results of factor analysis and intercorrelation of the items measuring CINOM and CINOC indicated the absence of one general collective innovativeness dimension. Collective innovativeness, of cooperative societies, measured in terms of adoption of tube-wells and tractors, was not highly correlated to collective innovativeness measured in terms of regular

savings and utilization of credit facilities. Further analysis indicated that the cooperative societies high in CINOM tend to reduce the intensity of weekly savings and take lesser amount of loans from the central credit association.

These results might suggest that the introduction of technological innovations in traditional agricultural settings is possible without a corresponding modernization of the traditional credit system. But one should be careful in drawing such a conclusion from limited evidence provided by a low correlation between two composite indices. There are other factors which should be considered before coming to a definite conclusion. The discussion that follows is an attempt to provide further information and understanding of this point so that the statistical relationship between CINOM and CINOC can be properly evaluated.

Discussion

The mechanization program at Comilla follows the credit program in terms of the time of initiation of the programs. A cooperative society starts with the credit program, and later considers adoption of the mechanization program. There is a strong positive correlation between adoption of mechanization and age of the cooperative societies.

The mechanization program is at an early stage of development. The cooperatives do not actually purchase tractors and irrigation pumps. The machines are owned by the central association. The cooperatives pay rent when they use the machines. The amount of capital required by the cooperatives for mechanization purposes is relatively low in comparison with the total credit requirements of the cooperatives.

The credit programs at Comilla is designed to meet various kinds of credit requirements of the cooperative societies. Generally, a cooperative society requires relatively higher amount of credit at the initial stage, so that the members can release mortgaged land, pay off old debts, purchase bullocks and other basic requirements. This is a process through which a cooperative elevates itself from a condition of "agricultural desperation" to a condition where more normal agricultural activities can be undertaken.

The amount of credit received by a cooperative society often depends on the amount of savings collected from the members. As a general policy, the central association uses distribution of loans as an incentive for developing thrift and other habits of cooperation among the members of the cooperative societies. This incentive policy has produced desired results. Most of

the cooperatives continue to save money even if no credit is required immediately. But the amount of savings tend to fluctuate with the need for credit.

With their old debts paid, their land released from mortgage restrictions, and new bullocks purchased, most of the cooperatives are now better off than previously. They are less dependent on credits from the central assoication.

The more innovative cooperatives have adopted mechanization programs. The productivity of the farmers in these societies has increased. They are now in a position to meet the major part of the cost of mechanization, because the capital requirement for limited mechanization is not very high. Also, they are more inclined to make more productive use of their savings. Savings in the cooperative are less productively used. Alternative means of investment (purchase of land and investment in trades) are more attractive. They can keep the level of savings in the cooperative at a minimum, because now there is little need for borrowing money from the central cooperative association.

Under these situations, both high and low innovative cooperative societies are likely to make less intensive use of the credit program. Therefore, the correlation between the present indices of CINOM and CINOC may be low.

It is not possible to provide concrete statistical data in support of the arguments developed in the previous paragraphs. Such data were not collected in the present study. But some data could be obtained from available records of the cooperative societies and the central association. Moreover, one can expect that with further intensification of the mechanization program at Comilla, the cooperatives' need for credit will increase rapidly. Then, the more innovative cooperative societies will intensify practice of the credit program. Measures of CINOM and CINOC, over a longer period of time, might become positively correlated.

The statistical relationship between CINOM and CINOC, interpreted in the light of additional information and observation, leads to the following general conclusions.

1. The adoption of the mechanization program by the cooperative societies at Comilla is, in the long run, dependent on the adoption of the credit program. The relationship is complex. The costs of mechanization and the cooperative's ability to bear such costs from the internal funds, determine the nature of that relationship.

2. When collective adoption of the credit program is measured in terms of intensity of savings and borrowings

by the cooperatives, its relationship to collective adoption of the mechanization program may remain undetected, if the innovative cooperatives' need for external credit is low. In such a situation, the measure of adoption of the credit program should be adjusted for the total need of credit from external sources.

Relationship Between Collective and Individual Innovativeness

The correlation between the average level of individual innovativeness (ALINO) of the members of the cooperatives and collective innovativeness on mechanization (CINOM) was positive and significant. The correlation between ALINO and CINOC was not significant.

These findings suggests that collective innovativeness is something different than just the sum of individual innovativeness of the members of the collectivity. The conceptual distinctions, made earlier in Chapter III, is supported by the data. Moreover, the present findings have some important methodological implications.

In measuring innovativeness at the individual level, one must be careful in selecting the innovations on which the measure is based. If some of the innovations are, in fact, adopted collectively, treating them as

individual adoption will introduce error in the measure of individual innovativeness. All individuals will receive the same score for using innovations adopted on a collective basis.

Actually, the real problem is proper identification of the unit of analysis. This becomes serious when information is obtained from a random sample of individuals and no attempt is made to relate the adoption decision of an individual to the adoption decisions of the other members in his social system.

Factors Related to Innovativeness

The correlations between 47 independent variables and the four dependent variables were measured in terms of Pearsonian zero-order correlation coefficients. The independent variables were related to the cooperatives' internal structures, external relationships with other components in the development system, and with characteristics of the members and leaders (compositional variables).

The results indicated that different sets of variables were correlated with collective innovativeness than with the average level of individual innovativeness of the cooperatives, but some variables were common to both sets of correlates. The correlates of the composite measure of innovativeness were a combination of the correlates of the other measures of innovativeness.

Thus, the need for making conceptual distinctions between various types of innovative behavior was again demonstrated by the present results.

Among the correlates of collective innovativeness the structural variables (internal and external) were heavily represented. The compositional variables (except a few measures of the leaders' characteristic) were not correlated with collective innovativeness. The variables correlated with individual innovativeness were mostly compositional in nature.* A few variables measuring the cooperative's relationships with the change agency, were correlated with individual innovativeness.

Five Major Factors

It was observed that a considerable degree of interrelationship was present among the 47 independent variables. A factor analysis of the independent variables yielded five factors (or underlying variables). These factors were treated as higher-order variables abstracted from the large number of independent variables.

The five major factors were: (1) integration, (2) organizational health, (3) growth, (4) leader's

---

*It may be noted that most of these variables measure the individual's relationship with external systems (e.g., educational system, mass media of communication system).

modernity, and (5) members' modernity. Integration was defined as the degree of the cooperative's social relationships with the other components in the development system. The organizational health of the cooperative was conceptualized as that internal state of the cooperative which generates collective capacity of the members for interaction, communication, decision-making, and action. Growth was defined as increase in the membership size over time. Finally, modernity was defined in terms of certain individual characteristics which reflects a person's transition from a traditional style of life to a more complex, urban, industrial, and participant style of life.

The collective adoption of the mechanization program by the cooperatives was found to be correlated with integration and with leader's modernity. Collective adoption of the credit program was correlated with organizational health, growth, and leaders' modernity. The average level of individual innovativeness of the members of a cooperative was correlated with integration and the members' modernity. Finally, the composite measure of innovativeness was correlated with all the five factors except the member's modernity.

Multivariate Analysis

In order to obtain a deeper insight into the relationship between the variables studied in the present

thesis, the relationship between an independent and a dependent variable was examined (1) at different levels of a third independent variable, and (2) by keeping all other independent variables constant. The first analysis was aimed at detection of interaction effects. The second analysis was a multiple regression analysis for construction of prediction equations.

The interaction analysis indicated that some of the independent variables (found to be uncorrelated with innovativeness in the previous zero-order correlation analysis) were correlated with innovativeness at "high" or "low" levels of a third variable.

Among the cooperatives where group solidarity was low and members' education was low, the leaders' internal communication (within the cooperative) was positively correlated with the adoption of nechanization when the cooperatives were visited frequently by change agents. When the pressure to innovate from the members was low, the adoption of mechanization was negatively correlated with the average landholding of the members. Change agents' visits to the cooperatives was positively correlated with the adoption of the credit program, when the average level of education of the members was low.*

---

*These findings are discussed in the next section.

The results of the multiple regression analysis indicated that 11 independent variables explained 75 percent of the variation in the index of adoption of the mechanization program by the cooperatives. The percentages of the variance explained in the other measures of innovativeness were as follows: (1) eight variables explained 51 percent of the variation in CINOC, (2) five variables explained 41 percent of the variation in ALINO, and (3) seven variables explained 56 percent of the variation in COMINO.

The independent variables that appeared as significant contributors* to the variation in the measures of innovativeness, showed patterns similar to the patterns revealed in the correlation analysis previously reported. But, as regards the specific variables, there were some differences. Some of the significant correlates of innovativeness (in the correlation analysis) failed to appear as significant contributors in the regression analysis. Similarly, some of the non-significant correlates of innovativeness (in the correlation analysis) appeared as significant contributors in the regression analysis. This happened because in the regression analysis, the interrelationship among the independent variables was

---

*A variable was called a "significant contributor" when its beta coefficient was significantly different from zero at the 5 percent level of probability.

taken care of or controlled on. The relationship between an independent and a dependent variable was computed keeping all other independent variables constant. In other words, the effects of all other variables on the relationship between the two variables was statistically eliminated.

In general, the results of the regression analysis supported the previous findings on the relationships between innovativeness of the cooperative societies and integration, organizational health, growth, leaders' modernity, and members' modernity. But there was one notable exception: the degree of mass communication exposure of the leaders and of the members of the cooperatives was found to be negatively related to innovativeness, when all other variables were held constant.

Discussion

It is necessary to explain some of the findings summarized in the previous sections, before dwaring general conclusions from them. The findings from the interaction analysis would be explained and interpreted. In addition, the following results need further explanation and elaboration:

1. The correlation between integration and CINOC is not significant. But the correlation between integration

and CINOM is significant.

2. The correlation between organizational health and CINOM is not significant. But the correlation between organizational health and CINOC is significant.

3. The cooperatives members' modernity is uncorrelated with both CINOM and CINOC. But, members' modernity is highly and positively correlated with ALINO. The leaders' and the members' exposure to the mass media of communication is negatively related to innovativeness when other factors are held constant.

Interaction Effects

The correlation coefficients presented in Table 9, Chapter V, reveal the intricate nature of the relationships between innovativeness and communication, participation and certain characteristics of the members of the cooperative society.

The degree to which the manager and the chairman of the cooperative communication informally with the members (and other leaders within the cooperative) is a significant correlate of collective innovativeness, when the group solidarity is low and when the average level of formal education of the members of the cooperative is low. It seems that the low levels of education and group solidarity are barriers to the flow of communication within the cooperative society.

So, the process of collective decision-making is retarded. But, this difficulty is overcome when the leaders make special efforts in increasing the flow of communication within the cooperative society.

The participation of the members of the cooperative in collective decision-making is a significant correalte of collective adoption of innovations (CINOM), when the cooperative is frequently visited by the change agents. The visits of the change agents provide information and motivation for a positive decision toward adoption of innovations. The members are more able to identify themselves with the purpose of the collective decision-making process. So, the members' participation facilitates an early decision for the adoption of innovations. The members participation linked with the frequent visits by the change agents ensure regular flow of communication between the change agency and the cooperative society.

The degree to which the change agents visit the cooperative society is significantly correlated with collective adoption of innovations (CINOC) when the average level of formal education of the members is low. This result indicate the importance of direct contacts between the change agents and the farmers, when the farmers can not be reach through the printed media of communication (because of the low level of

education of the farmers).

The correlation between the average level of landholding of the members of the cooperative and collective adoption of innovations (CINOM) is negative, when the pressure to innovate from the members is low. The implication of this finding is that the farmers with higher landholding are likely to be more reluctant in adopting innovations collectively if the level of motivation for innovation adoption is low, than the farmers with lower landholdings. The richer farmers are less persuadable than their poorer neighbors. They are likely to resist collective adoption.

Integration and Collective Innovativeness

The correlation between integration and CINOC is .15 (the critical value of r is .183, when N = 80). This low correlation may arise due to the fact that some of the items in the scale for CINOC are not adjusted for the "need for credit". As a result, some of the more innovative cooperatives (which have saved and borrowed smaller amounts of money in more recent years because of the increase in their income due to mechanization and investment of savings in more productive purposes) are rated low on CINOC.*

*A more detailed discussion on this point was provided previously in this chapter.

Organizational Health and Collective Innovativeness

The correlation between organizational health and CINOM is .17 (the critical value of r is .183, when N = 80). This correlation suggests that some of the adopters (the cooperatives) of the nechanization program are relatively poor in organizational health. An examination shows that the same cooperatives are rated high in oligarchy.* The correlation between oligarchy and CINOM is positive (r = .20). But the correlation between oligarchy and CINOC is negative (r = -.14).

It is difficult to explain this complex inter-relationship between collective innovativeness, oligarchy, and organizational health, but an attempt will be made.

The introduction of the mechanization program at Comilla is a recent phenomenon. This program consists of the use of machines with which most farmers are not familiar. The adoption of this innovation by a concensus of the members of the cooperative is likely to be a relatively slow process. But, if the cooperative is dominated by a few innovative individuals, an early start on the mechanization program is possible. This may explain the positive correlation between oligarchy

*The correlation between degree of oligarchy and the organizational health factor (in the factor solution) is -.50.

and mechanization.

The credit program, on the other hand, is an older and more established program. The concepts of "savings" and "borrowing" are not new to the traditional farmers. They simply practice these old ideas under a new organizational set-up. Most of the cooperatives have been practicing this innovation for a number of years. The intensity of savings and borrowing depends on a high degree of participation by the majority of the members. A few innovative members in power cannot raise the level of savings by themselves, unless most of the members agree to save more money. So, oligarchy and CINOC are negatively related.

It seems that organizational health is more important at a stage when intensive practice of an innovation is undertaken. A healthy cooperative may even delay adoption of an innovation until a concensus of the members is reached. A cooperative ruled by a few innovative members may respond more quickly in starting the use of an innovation, but is likely to perform poorly at a later stage of intensive use, than a healthy cooperative.

Modernity and Collective Innovativeness

The correlation between the cooperative members' modernity and CINOM is not significant ($r = -.07$). The correlation between modernity and CINOC is also not

significant (r = .03). Moreover, the beta coefficients in the multiple regression analysis shows that the relationships between some of the measures of mass media exposure of the members and the leaders of the cooperative and innovativeness are negative.

In order to explain these findings, the nature of the relationship between modernity and the transformation of traditional agriculture to modern agriculture at Comilla, must be explained.

The village agricultural cooperative societies are located in an area of about 10 miles square around Comilla Town. The Comilla Town is an important trade center, and the seat of the governmental district administration. A large number of educational institutions are located in this town. In recent years, a number of textile mills and other industrial firms have been established at Comilla. As a result, the villages around Comilla Town are highly exposed to the influence of urban and industrial ways of life. The villages are at a transitional stage in the process of modernization.

Four types of farmers can be identified among the members of the cooperatives at Comilla. Table 12 describes these four types in terms of (1) the level of modernity of individual farmers, (2) the interest and involvement of the farmers in agriculture, (3) the level of individual innovativeness of the farmers, and (4) the

collective innovativeness of the farmers as a category.

Type I farmers are high in modernity. They are highly interested and involved in agriculture. They are more innovative than the other types of farmers. Since the scale of farming at Comilla is very small, these farmers must adopt the methods of intensive cultivation. Otherwise, they cannot raise sufficient income from agriculture. So, they are ready to adopt innovations at individual and collective levels.

Table 12. Four Types of Farmers Among the Members of the Cooperatives at Comilla

Types	Individual Modernity	Interest and Involvement in Agriculture	Individual Innovativeness	Collective Innovativeness
I	High	High	High	High
II	High	Low	High	Low
III	Low	High	Low	Low
IV	Low	Low	Low	Low

Type II farmers are essentially a product of the transitional phase of modernization. They are high in modernity but low in interest and involvement in agriculture. To them, farming is a necessary occupation, but a boop business. They are ready to adopt such

innovations as a new variety of seeds, chemical fertilizers, insecticides, etc., which are adopted at the individual level and require less investment, but collective adoption of mechanization and credit programs demands too much commitment on their part and possibly much higher money investment. These farmers would rather put their savings in trades rather than in the saving accounts of the cooperative society. Probably, these farmers will ultimately move from agriculture to industrial sector of the economy of the country.

Type III and type IV farmers are low in modernity and low in innovativeness. Probably, the type III farmers are ready to go along with type I farmers in adopting innovations collectively. But as individuals they are not innovative.

With this composition of the membership of the cooperatives at Comilla, one is likely to find a positive relationship between modernity and individual innovativeness. The relationship between modernity and collective innovativeness is likely to be curvileaner or absent.

Exposure to Mass Media of Communication and Collective Innovativeness

The beta coefficients in Table 11 indicate that the manager's exposure to the mass media of communication is negatively related to CINOM, when all other independent

variables are kept constant. Similarly, the average level of the members' exposure to the mass media of communication is negatively related to CINOC.

These findings can be partially explained in terms of the general relationship between modernity and innovativeness, discussed in the preceding section. The negative relationship is probably due to the successive elimination of the effects of other variables which mediate between "mass media exposure" and "innovativeness".

The mass media of communication to which the farmers of Comilla are exposed, contain very little information on agricultural innovations. The contents of the newspapers and the radio programs are more urban oriented. It is likely that the farmers who are more exposed to the mass media of communication, are less interested and involved in agriculture. The farmers who are more interested and involved in agriculture find less interest in the contents of the mass media of communication. So, these farmers make less use of the mass media of communication.

Conclusions

The rural development pilot project at Comilla, East Pakistan, is an experiment in the modernization of traditional agriculture. This activity has been successful in introducing modern methods of agriculture

in traditional villages by working with village cooperative societies. The success at Comilla has attracted the attention of many people working on rural development in various parts of the world. Many questions have also been raised.

The present thesis is one attempt at understanding the complex processes of innovation diffusion at Comilla - a beginning of a possible research program to be extended over several years. It is hoped that the results of this exploratory study will be useful to the students of diffusion theory and research, and to the practitioners in rural development.

A step has been taken towards a new direction in agriculture diffusion research. It has been possible to demonstrate that conceptual distinctions should be made between different types of adoption behaviors. The study of innovation behavior at the level of the individual and at the level of the social system provides a better insight into the process of innovation diffusion in a development system.

The need for viewing innovation diffusion as a process that has both inter-systamic and intra-systemic dimensions (Waisanen and Durlak, 1967) is clearly demonstrated, in the present thesis. The flow of information between the various sub-systems of a development system is a necessary condition for the

diffusion of innovations. This is the inter-systemic dimension (because the units of analysis in the present study are cooperatives, which are the innovating systems). The concept of integration refers to this dimension. The degree to which a cooperative society is integrated in the development system, is correlated with the innovativeness of the cooperative society (both collective and individual innovativeness).

Among the intra-systemic factors, the variables related to the processes of collective decision and mobilization of human resources for joint activities, are correlated with collective innovativeness. These variables are represented by the concept of organizational health. Organizational health is a positive correlate of collective innovativeness. But this factor seems to be more important at a later stage of the adoption process, when intensive use of the innovations is made.

The relationships between the innovativeness of the cooperative at Comilla and the individual modernity of the leaders and members of the cooperative do not suggest a simple pattern. The leaders' modernity is positively correlated with collective innovativeness. The average level of individual modernity is positively correlated with the average level of individual innovativeness of the members. But, the average level of individual

modernity is not correlated with collective innovativeness.

The process of modernization at Comilla has disrupted the traditional fabric of life, where agriculture was a way of life and the concensus of opinion was a treasured value. Modernization has introduced diversity of opinions and expectations of different ways of life, while the dependence on agriculture is still a hard fact of life. In this state of transitional disequilibrium, individual modernity and innovativeness are correlated in a complex manner.

The promotion of collective action for the modernization of agriculture at Comilla is a difficult task indeed. The efforts at Comilla are an interesting case for social scientists, to study, analyze, and evaluate.

Needed Research

Many questions have been raised in the present thesis that need further study. Some of these questions are specific for Comilla; others are more general.

As regards the project at Comilla, it is suggested that research should be continued on a long-term basis. The organization of such research programs should be interdisciplinary in nature.

The theoretical problem that requires immediate attention is the need for an adequate conceptualization of the collective adoption process. Rogers (1968b) has discussed this problem and suggested a framework which can be used for empirical research. Similarly, the study of the other types of adoption behavior (authority adoption and contingent adoption) is desirable.

The relationship between the collective adoption and the attributes of innovations is another important problem for future research. What types of innovations are adopted at a faster rate (or slower) on collective basis than on an individual basis? Under what conditions?

Finally, there are a number of specific questions that require serious study. What are the factors that facilitate integration? What are the roles of the leaders in the process of collective adoption of innovations by a social system? What aspects of the members' participation in collective adoption are crucial to maintain the innovativeness of a social system?

It is important to recognize the limitations of survey research. The findings of the present study indicate the need for field experimental research, so that the relationships between variables can be interpreted in causal, or at least time-ordered, terms.

SELECTED BIBLIOGRAPHY

Carter, C. F. and Williams, B. R. "The Characteristics of Technically Progressive Firms", Journal of Industrial Economics, Vol. 7, 1959, pp. 87-107.

Coch, L. and French, J. R. P. "Overcoming Resistance to Change", Human Relations, Vol. 1, 1948, pp. 512-532.

Coleman, James. An Introduction to Mathematical Sociology. New York: The Free Press of Glencoe, 1964.

Coleman, James S., Elihu Katz and Herbert Menzel. Medical Innovation: A Diffusion Study. Indianapolis: The Bobbs-Merrill Company, 1966.

Coughenour, M. C. "The Rate of Technological Diffusion Among Locality Groups", American Journal of Sociology, Vol. 69, 1964, pp. 325-339.

Davis, Richard H. Personal and Organizational Variables Related to the Adoption of Educational Innovations in Two Liberal Arts Colleges. Unpublished Ph.D. Thesis, University of Chicago, 1965.

Defleur, Melvin L. and Larson, Otto W. The Flow of Information: An Experiment in Mass Communication, N O., Harper.

Deutschmann, Paul J. and Fals Borda. Communication and Adoption Patterns in an Andean Village, San Jose, Costa Rica: Programa Interamericano de Informacion Poplar, 1962.

Dodd, Stuart C. "The Transact Model: A Predictive and Testable Theory of Social Action", Sociometry, Vol. 18, 1955, pp. 432-447.

Fairchild, Henry W. and Haq, Shamsul. A New Rural Cooperative System for Comilla Thana: First Annual Report. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1961.

Farouk, A. and Rahim, S. A. Modernization of Subsistence Agriculture: An Experimental Survey. University of Dacca: Bureau of Economic Research, 1967.

Fliegel, Frederick C. and others. Innovation in India. Hyderabad, India: National Institute of Community Development, 1967, pp. 27-53.

Flinn, William L. Community Norms in Predicting Innovativeness, Paper presented at the Rural Sociological Society, Northridge, California, 1963.

Hagerstrand, Torsten. "Quantitative Technique for Analysis for the Spread of Information and Technology", in C. A. Anderson and M. J. Bowman (eds.), Education and Economic Development, Chicago, Aldine, 1965.

Hussain, Zakir. A Field Investigation into the Management of Village Cooperatives in Comilla Experimental Area. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1967.

Khan, Akhter H. and Hussain, Zakir. A New Rural Cooperative System for Comilla Thana: Third Annual Report. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1963, p. 1.

Khan, Aziz. A New Rural Cooperative System for Comilla Thana: Sixth Annaual Report. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1966, pp. 67-100.

Lerner, Daniel. The Passing of Traditional Society. New York: The Free Press, 1958, pp. 43-75.

Lewin, Kurt. "Group Decision and Social Change" in E. E Maccoby, T. M. Newcomb, and E. L. Hartley (eds.), Readings in Social Psychology, New York: Holt, Rinehart and Winston, 1958, pp. 235-238.

Likert, Renesis. The Human Organization. New York: McGraw-Hill Book Company, 1967, p. 27.

Lionberger, Herbert F. Overlap Dispersion of Selected Functions in Adoption Decisions of Farm Operators in Two Missouri Communities, Paper Presented at Rural Sociological Society, Washongton, D.C., 1962.

Mansfield, Edwin. "Size of Firm, Market Structure and Innovation", Journal of Political Economy, Vol. 7, 1963, pp. 556-576.

Marsh, Paul C. and Coleman, Lee A. "Group Influences and Agricultural Innovations: Some Tentative Findings and Hypotheses", American Journal of Sociology, Vol. 61, 1956, pp. 588-594.

Mason, Robert G. Information Source Use in the Adoption Process, Unpublished Ph.D. Thesis, Stanford University, 1962.

McNemar, Quinn. Psychological Statistics. New York: John Wiley and Sons, Inc., 1965, p. 178.

Miles, Matthew B. "Innovation in Education--Some Generalizations", in M. B. Miles, Innovation in Education. New York: Bureau of Publication, Teachers College, Columbia University, 1964, pp. 631-661.

Neurath, Paul M. "Radio Farm Forum as a Tool of Change in Indian Villages", Economic Development and Cultural Change, Vol. 10, 1962, pp. 275-283.

Niehoff, Arthur H. A Casebook of Social Change. Chicago: Aldine, 1966.

Qadir, Syed A. Village Dhanishwar: Three Generations of Man-Land Adjustment in an East Pakistan Village. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1960.

Qadir, Syed A. Adoption of Technological Change in the Rural Philippines: An Analysis of Compositional Effects. Unpublished Ph.D. Thesis, Cornell University, 1966.

Queely, Mary and David Street. Innovation in Public Education: The Impact of the "Continuous Development Approach". Chicago: The University of Chicago, Center for Social Organization Studies, Working Paper, 1965.

Rahim, Syed A. The Diffusion and Adoption of Agricultural Practices: A Study in a Village in East Pakistan. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1961.

Rahim, Syed A. Communication and Personal Influence in an East Pakistan Village. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1965.

Rahim, Syed A. Innovation Adoption in the Cooperatives at Comilla. Unpublished material. Comilla, East Pakistan: Pakistan Academy for Rural Development, 1966.

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

Rogers, Everett M. and Burdge, Rabel J. Community Norms, Opinion Leadership, and Innovativeness Among Truck Growers. Wooster, Ohio: Agricultural Station Research Bulletin, 1962.

Rogers, Everett M. and others. Construction of Innovativeness Scales. Columbus, Ohio: Agricultural Experiment Station, MIMEO Bulletin, 1962.

Rogers, Everett M. and Shoemaker, Floyd F. Diffusion of Innovations: A Cross-Cultural and Communication Approach. (Manuscript of a forthcoming book.) New York: Free Press of Glencoe, 1968.

Rogers, Everett M. Modernization Among Peasants: The Impact of Communication. (Manuscript of a forthcoming book.) New York: Holt, Rinehart and Winston, 1968.

ven den Ban, Anne W. "Locality Group Differences in the Adoption of New Farm Practices", Rural Sociology, Vol. 25, 1960, pp. 308-320.

Waisanen, F. B. and Durlak, Jerome T. The Impact of Communication on Rural Development: An Investigation in Costa Rica. Draft manuscript (mimeo) Michigan State University, 1968.

Whiting, Gordon C. Innovation in Brazil. East Lansing, Michigan: Department of Communication, Michigan State University, 1968, pp. 17-26.

Yadav, Dharam P. Communication Structure and Innovation Diffusion in Two Indian Villages, Technical Report 2, Project on the Diffusion of Innovations in Rural Societies, East Lansing, Michigan: Department of Communication, Michigan State University, 1967, pp. 165-192.

Young, James N. and Coleman, Lee A. "Neighborhood Norms and the Adoption of Farm Practices", Rural Sociology, Vol. 24, 1959, pp. 327-380.

APPENDIX A

QUESTIONNAIRES AND SCHEDULES

Questionnaire #1: Performance Rating
Questionnaire (Rating by Chief Inspectors)

Rating Scale

Very Poor 0 1 2 3 4 5 6 7 8 Excellent 9

Name of the Cooperative _____

Items	Rating Score
1. Saving.	
2. Utilization and Repayment of loans.	
3. Adoption of improved practices.	
4. Use of modern implements (pumps, tractors, etc.).	
5. Joint storage and marketing.	
6. Special programs (women's program, family planning, feeder schools, etc.).	

Questionnaire #2: The Change Agents' Visits to the Cooperatives

This is a list of 80 village agricultural cooperative societies at Comilla. Please indicate the extent to which you have visited these societies in the past. Use the following codes in recording your answer against each cooperative society.

Visited five times or more	=	2
Visited less than five times	=	1
Never visited	=	0

Name of the Cooperative	Rating Score

Name of the rater:

Designation:

Date:

Questionnaire #3: Rating of Cooperatives on Selected Characteristics by the Inspectors

1. (a) Name of the Inspector. (b) Block #.

2. (a) Name of the cooperative rated.
   (b) Name of the manager of the cooperative.

3. Names of the three top influential members of the cooperative in order of importance: (1) (2) (3)

4. Which of the following statements apply to this cooperative society (check one)?
   (a) There is a single influential who has influence over most of the members.
   (b) There are a few influentials who have influence over most of the members.
   (c) There are a number of influentials who have influence over different groups of members.

5. The following statements describe various characteristics of the cooperative society. Indicate, by 1, 2 or 3, the extent to which each statement is applicable to the cooperative society.
   (1 = not applicable, 2 = moderately applicable and 3 = highly applicable.)
   (a) This cooperative is ruled by a coterie of a few members.
   (b) The members of the managing committee work together and take interest in all activities.
   (c) Much supervision, guidance and persuasion (by the inspector) is needed to get work done by this cooperative.
   (d) It is necessary to explain various programs repeatedly to the members of this society.
   (e) Weekly meetings are regularly held.
   (f) The official records and documents are properly maintained.
   (g) The model farmer uses improved practices and teaches other members.
   (h) The plans and programs of work are prepared regularly.
   (i) The members actively participate in the discussions in the weekly meetings.
   (j) The members of the managing committee divide work among themselves and each member perform his duties regularly.
   (k) If a member fails to put weekly savings deposit regularly, a fine is realized from him.

(l) If a member fails to repay loans or neglect any other responsibility, considerable pressure is put on him by the other members. No concession is made to any member (rich or poor).
(m) The members regularly use "lesson sheets" and other educational material supplied by the central association.
(n) The model farmer and the manager use the weekly meeting as a teaching forum.
(o) The leaders frankly communicate with the inspectors about their problems and intentions.
(p) When the inspector is present in the weekly meeting, the members ask him questions and seek clarification on various matters.
(q) The manager takes active part in the discussions at the weekly meetings of the managers.
(r) The members listen attentively to various talks and discussions at the weekly meetings and ask questions.
(s) The officials of this cooperative have to be constantly supervised and directed (by the inspector) otherwise they show negligence in their work.

6. The following questions are about your (the inspector's) own involvement in the cooperative society.
(a) Are you a member of this cooperative? Yes/No.
(b) Any friend or relative of yours a member of this cooperative? Yes/No.
(c) Do you enjoy supervising this cooperative? Yes, very much/Yes, more or less/No.
(d) Will you mind if this cooperative is taken away from your jurisdiction? Yes/No.
(e) Do you think that you have made special efforts in establishing and building up this cooperative? Yes, very much/Yes, more or less/No.
(f) What is your opinion about the future of the cooperative?
    (a) Its condition will improve.
    (b) Its condition will not change.
    (c) Its condition will deteriorate.

Schedule #4: Used by Field Investigator to Collect Information About the Cooperatives
August 1967

1. Name of the cooperative.

2. Date of registration.

3. Name of the manager.

4. Name of the chairman.

5. Present membership size.

6. How many of the present members were members at the time of registration?

7. Write down the names of the villages from which members are enrolled in this cooperative.

8. If any member works at the Academy or the central association write their name and the nature of work.

9. Since the establishment of this society how many persons have served as manager or chairman. Write down their names.

10. How far is this cooperative from the office of the central association (Avoy Ashram)?

11. Attendance in weekly meeting

Year	Month	Total No. of Members	No of Meetings Held	Total Attendance	Remarks
1961	January				
	June				
	August				
	September				

(Similar table for 1962, 1963, 1964, 1965, 1966, 1967.)

12. Loans received

Serial No.	Date when loan received	Amount in Rupees	Type of loan

13. Distribution of loans among 10 members selected randomly.

Name of the members	Amount of loans received: Loan #1	Loan #2
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

14. Characteristics of the ten members

Characteristics	Member 1	2	3	4	5	6	7	8	9	10
(1) Education										
(2) Land										
(3) Occupation										
(4) Reading of newspaper										
(5) Contacts with town										
(6) Adoption of improved practices										

Codes for 4, 5 and 6; high = 3, medium = 2, low = 1.

Schedule #5: Schedule for Interviewing Managers and Chairmen of the Sample Co-operative Societies in Comilla

1. Name of the Society: Time interview started

2. Particulars about the respondent:
   (a) Name
   (b) Manager/Chairman
   (c) Length of time serving in this position
   (d) Age
   (e) Education: School level -
       Last class -
       Certificate or degree -
       Special training -
   (f) Occupation: Primary
       Secondary
   (g) Membership in other organizations:
       Name of Organizations Position held
   (h) Land owned
   (i) Annual gross cash income
   (j) Number of members in the family
   (k) Number of relative families in the village

3. Communication: Contacts with mass media and interpersonal sources (Codes: High = 3, Medium = 2, Low = 1)
   (a) Mass media
       (i) News Paper (ii) Radio News
       (iii) Cinema (iv) Magazine
   (b) Interpersonal communication on matters relating to Co-operative society: X = from Project Officials to respondent and, Y = from respondent to Project Officials
       (i) Akhter Hameed Khan X/Y
       (ii) Zakir Hussain X/Y
       (iii) Shamsul Huq X/Y
       (iv) Mohammedullah X/Y
       (v) Waziullah X/Y
       (vi) Shamsul Alam X/Y
       (vii) Shafiqul Islam X/Y
       (viii) Subash BhowmiK X/Y
       (ix) Chief Inspector X/Y
       (x) Inspector X/Y
   (c) Communication, on matters relating to various programmes, with other Village Societies
       (i) Seeking information, advice from manager/chairman of other societies: No. of persons - Name and designation and society of top man:
       (ii) Giving information, advice to manager/chairman of other societies: No. of persons - Name and designation and society of top man:

(iii) Attending meetings of other societies.
(iv) Visiting other societies with groups of members to see demonstration.
(v) Examining records of other societies.

(d) Communication within Co-operative Society
(i) How much of the total working time spent weekly in instructing and advising members personally
Total per week: With members:
(ii) Discussion with chairman/manager
(iii) Discussion with model farmer
(iv) Discussion with members of Managing Committee
(v) How many members regularly seek information and advice on matters relating to farming and co-operative.
No. of members:

4. Group factors:
(a) The number of members at present.
No. of members:
(b) How many members actively help the respondent in his work?
No. of members:
(c) Are there factions or parties in the Group? How many? Why?
(d) What is the distribution of members in the following types.
(Enter figures as fraction of a rupee)
(i) Totally devoted to the interest of the society. Put societies' interest above all personal interests.
(ii) Williang to work jointly for the society to serve personal interests.
(iii) Attach priority to personal interests. Reluctant to sacrifice small personal gains for the benefit of the society.
(iv) Indifferent, blind conformists.
(e) How many members have real feeling for the society?
(f) Is there an effective system of fine for defaulting members? Yes/No
(g) Are the weekly meetings' vanues of arbitration for settling disputes between members? Yes/No
(h) Are the various responsibilities distributed among the members of the Managing Committee? Yes/No
(i) Are the by-laws strictly followed? Yes/No
(j) Are the office bearers regularly elected by the members' votes? Yes/No

5. Technical assistance:
   (a) Has Japanese Experts worked in this village? How many years?
   (b) Any time soil of members' fields tested? Yes/No
   (c) Any time members chosen by K.T.C.C.A. for demonstration of new seed varieties or for seed multiplication? Yes/No
   (d) Any time new machines or implements given for testing or demonstration? Yes/No
   (e) Any member or office bearers received special training?
   (i) Tractor driver (ii) Pump driver
   (iii) Accountant (iv) Others (write)

6. Pressure operating on the leadership:
(Code: High = 3, Medium = 2, Low = 1)

Area	Source of Pressure		
	Office bearers to members	Members to office bearers	K.T.C.C. A. to office bearers
a. Savings	3 2 1	3 2 1	3 2 1
b. Share purchase	3 2 1	3 2 1	3 2 1
c. Taking loan	3 2 1	3 2 1	3 2 1
d. Repayment of loans	3 2 1	3 2 1	3 2 1
e. Irrigation pumps	3 2 1	3 2 1	3 2 1
f. Tractors	3 2 1	3 2 1	3 2 1
g. Purchase of implements	3 2 1	3 2 1	3 2 1
h. Improved seeds	3 2 1	3 2 1	3 2 1
i. Joint selling or purchase	3 2 1	3 2 1	3 2 1
j. Increasing membership	3 2 1	3 2 1	3 2 1

7. Feed back:
   (a) (i) What is the trend of per member annual gross savings?
   Rising Falling
   Up and down Constant
   (ii) Now show him the graph and let him explain the salient features (high points, low points, nit points, etc.)
   (b) (i) What is the trend of per member loan taken?
   Rising Falling
   Up and down Constant
   (ii) Now show the graph and let him explain the salient points as before.

(c) (i) What is the trend of membership?
Rising Falling
Up and down Constant
(ii) Show him the graph and let him explain the salient features as before.

8. Any further comments by the respondent on problems and prospects of the Cooperative Society.

9. (a) Time taken in interviewing:
(b) Was the respondent cooperative? High Moderate Low
(c) Did he talk frankly? High Moderate Low
(d) What is your impression about the respondent as a manager or chairman? Very good Fair Poor

Name of Interviewer Date of Interview

APPENDIX B

APPENDIX B: LIST OF VARIABLES AND OPERATIONAL ITEMS

1. Collective Adoption of Mechanization Program (CINOM).

   (a) Months ago tube-well installed?
   (b) Acres of land irrigated by tube-well in 1966-67?
   (c) Acres of land irrigated by tube-well in the year of installation?
   (d) Average rate of change in the acres of land irrigated?
   (e) Months ago tractors used for the first time.
   (f) Number of times tractors taken in year 1966-67?
   (g) Months ago the cooperative was established?
   (h) Months ago the cooperative was registered?

2. Collective Adoption of Credit Program (CINOC).

   (a) Per member savings in 1966-67?
   (b) Average rate of change in per member savings during 1965-67?
   (c) Per member loan taken in 1966-67?
   (d) Average rate of change in per member loans taken?
   (e) Average rate of change in per member loans during 1965-67?

3. Average Level of Individual Innovativeness (ALINO).

   (Average or scores for ten members. Each member was rated on a three point scale. Based on item #14(6) of schedule #4.)

4. Composite Measure of Innovativeness (COMIMO).

   (Based on total performance ratings on questionnaire #1.)

5. Change Agents Visits to the Cooperative (VISIT).

   (Based on scores in questionnaire #2.)

6. Demonstration of Innovations in the Cooperative Village (DEMO).

   (Based on question #5(a), 5(c), 5(d) of schedule #5.)

7. Manager's Communication with the Change Agents and Other Cooperatives (MINECOM).

   (Based on question #3(b), 3(c)--(i), (ii) of schedule #5.)

8. Chairman's Communication with the Change Agents and Other Cooperatives (CECOM).

   (Based on questions #3(b), 3(c)--(i) and (ii) of schedule #5.)

9. Manager's Communication within the Cooperative (MNICOM).

   (Based on question #3(d)--i, ii, iii and iv of schedule #5.)

10. Chairman's Communication within the Cooperative (CICOM).

    (Based on questions #3(d)--i, ii, iii and iv of schedule #5.)

11. The Degree to which Influentials are Channels of Communication Between Central Agency and the Cooperative (INFCOM).

    (Based on question #3 of questionnaire #3.)

12. Manager's Opinion Leadership Among Other Managers and Chairman (MNOPL).

    (Number of times the manager was named as a source of information and advice on matters relating to cooperatives, by other respondents of schedule #5.)

13. Chairman's Opinion Leadership Among Other Managers and Chairman (COPL).

    (Number of times the chairman named as a source of advice and information on matters relating to cooperatives, by the respondent of schedule #5.)

14. Leaders Opinion Leadership Among the Members within Cooperative (LOPL).

    (Based on question 3(d)-v of schedule #5.)

15. Management-Routine Operations, Disciplines (MANGI).

    (a) Regularly in realizing fines from defaulting members (inspector's rating).
    (b) Manager's report on effectiveness of the system of fines (yes or no).
    (c) Average number of meetings held per month (for total period).
    (d) Average number of meetings held in 1966-67.

16. Management--Planning, Coordination and Supervision (MANGII).

    (a) The inspector finds interest in supervising this cooperative.

(b) The managing committee work with interest and coordination.
(c) Weekly meetings are held regularly.
(d) Work plans are prepared.
(e) Records are maintained regularly.
(f) The inspector has personal contribution in developing this cooperative.

17. Poor Initiative--Dependence on External Guidance and Supervision (ESUP).

(a) Pressure from outside necessary to get work done (inspector's rating).
(b) Regular explanation of programs necessary (inspector's rating).
(c) Strict guidance is necessary (inspector's rating).
(d) Absence of initiative from the members (inspector's rating).

18. Change in Officers (CIO).

(Number of different persons held the offices of manager and chairman).

19. Time Spent by the Leaders in Cooperatives' Work (TSPNT).

(Based on questions 3(d)-I of schedule #5.)

20. Members Participation in the Discussions in the Weekly Meetings (PART I).

(a) Members show interest in weekly meeting (inspector's rating).
(b) Members discuss, ask questions (inspector's rating).
(c) Manager raises questions, discusses in the weekly meetings (inspector's rating).

21. Members Attendance in the Weekly Meetings.

(a) Average percentage attendance in 1966-67.
(b) Average percentage attendance for all years.

22. Leaders Perception of Pressure on Them from Central Agency, and Pressure from Them on Members (PSRI)

(Based on question #6 of schedule #5.)

23. Leaders' Perception of Pressure on Them from the Members (PSRII)

(Based on question #6 of schedule #5.)

24. Training Program: Member-Training Program within the Cooperative (TRNG).

    (a) Model farmers adopt innovations and teaches members (inspector's rating).
    (b) Members use extension literature (inspector's rating).
    (c) Weekly meeting is a training forum (inspector's rating).

25. Oligarchy: The Cooperative is Ruled by a Few Members (OLGAR)

    (Based on question #5Ia), questionnaire #3.)

26. Centralization of Influence--Presence of One, a Few or Several Influentials (CINFLU)

    (Based on question #4, questionnaire #3.)

27. Group Solidarity: Degree to which the Members have Strong Attraction for the Cooperative (GRSOLD).

    (Based on question #4(b), 4(c), 4(d) and 4(e) or schedule #5.)

28. The Total Amount of Loans Received from the Central Association (LOAN).

    (a) Amount received as shown in the registers of the Central Association.
    (b) Amount received as shown in the registers of the Village Cooperative.

29. Number of Persons Trained in Various Skills at the Central Association (SKILL).

    (Based on question #5(e) of schedule #5.)

30. Present Membership Size (SIZE).

31. Percentage Change in Membership Since the Date of Registration (CNGSIZEI).

32. Percentage Change in Membership Since the Date of Establishment (CNGSIZEII).

33. Gini Index of the Distribution of Loans Received by the Members (GNLN). (The index obtained by graphical method.)

34. Gini Index of the Distribution of Land Owned by the Members (GNLD). (The index obtained by graphical method.)

35. Age of the Manager (MAGE).

36. Age of the Chairman (CAGE).

37. Education of the Manager (MEDU).

    (Years of formal schooling.)

38. Education of the Chairman (CEDU).

    (Years of formal schooling.)

39. Economic Status of the Manager (MECO).

    (Based on question #2(h) and 2(i) of Schedule #5.)

40. Economic Status of the Chairman (CECO).

    (Based on question #2(h) and 2(i) of Schedule #5.)

41. Manager's Membership in Organization (MORG).

    (Based on question #2(g) of Schedule #5.)

42. Chairman's Membership in Organizations (CORG).

    (Based on question #2(g) of Schedule #5.)

43. Managers Exposure to Mass Media of Communication MMSCOM).

    (Based on question #3(a) of Schedule #5.)

44. Chairman's Exposure to Mass Media of Communication (CMSCOM).

    (Based on question #3(a) on Schedule #5.)

45. Average Level of Education of the Members (MEMEDUO.

    (Based on item #14(1) of Schedule #4.)

46. Average Land Holding of a Member (MEMLAND).

    (Based on item #14(2) of Schedule #4.)

47. Percentage of Members Having One or More Secondary Occupation (MEMOCU).

    (Based on item #14(3) of Schedule #4.)

48. Average Level of Mass Media Exposure of Members (MEMSCOM).

    (Based on item #14(4) of Schedule #4.)

49. Average Level of Contacts with the Town of the Members (MEMTWN).

    (Based on item #14(5) of Schedule #4.)

50. Distance of the Cooperative from the Town (DISTWN) (Distance in miles)

51. Physical Accessibility of the Cooperative From the Town (ACESS)

    (Based on ratings made by the field investigators.)