SYSTEM EFFECTS ON INNOVATIVENESS AMONG INDIAN FARMERS

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ABSTRACT

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by Anant P. Saxena

The present study focused on the simultaneous and systematic consideration of individual variables and system variables in accounting for more variance in individual innovativeness than previously. Individual variables are operations of the communication, social and psychological behavior of the individual. System variables are the aggregative measures of individual variables for each system. Innovativeness was operationalized as having ever used (or tried) 10 innovations, regardless of when it was adopted and whether its use was continued.

The present data were part of the Diffusion Project, conducted in India by the Department of Communication at Michigan State University. The social systems in the study were eight Indian villages selected randomly to represent a range in village modernization. The sample numbered 680 farmers in these eight systems.

The major objectives of the study were threefold: (1) to ascertain the degree to which system variables affect the innovativeness of individual members of a system, (2) to determine the extent to which system independent variables affect individual innovativeness when the effects of individual independent variables are controlled, and (3) to understand the way in which system variables affect individual

innovativeness under specified situations when interactions among the independent variables are controlled.

The data were analyzed, first, by means of zero-order correlations between each system variable and individual innovativeness. Our analysis produced significant correlations for 14 of the 15 system variables. In most cases, both individual and system-level measures of an independent variable were related to innovativeness. Thus, we encountered system effects on individual innovativeness. System effects are the influence of systemic structure and/or composition on the behavior of the members of a social system.

Not only did we find system effects, but also that system effects made a unique contribution beyond individual effects in explaining innovativeness, i.e., the system effects occurred even when the corresponding individual-level variables were controlled. All of the 15 partial correlations for the system variables showed a significant relationship with innovativeness, except two. Even clearer support of system effects beyond individual effects was found when eight independent variables (both individual and system measures) were combined in a series of multiple correlations. The simultaneous consideration of both individual and system variables explained 62 percent of the variance in innovativeness, an increase in explained variance of 14 and 21 percent over that explained by individual and system variables, respectively.

In general, the relationship of all the individual variables with innovativeness is linear. Contrarily, all

the system variables were found to be curvilinearly related with innovativeness with "take-off" occurring at different points, depending on the variable.

System effects tend to predominate somewhat over individual-level effects. Predominance of system effects was visualized in the sequential interaction analysis, and also in a series of two-way analyses of variance. In the sequential interaction analysis, we observed that the total sample initially split on a system variable. Also, it provided us with a configuration of variables organized in such a way as to demonstrate how variables combine to maximally explain variation in innovativeness. As a result of the configurational analysis, three typologies (most, moderate, and least innovative) of innovativeness emerged.

A simultaneous consideration of both individual and system variables in the configurational analysis yielded a greater range in means, and a much reduced standard deviation around the means, for all the typologies, than when either individual or system variables were considered separately. A substantial degree of interaction between individual and system variables was also evident in the configurational analysis, especially in the case of the less innovative respondents.

For an analysis within a balance theory framework, the dichotomization of individual and system variables into high and low levels were used to construct four typologies of respondents. These were (1) modern individuals living in modern systems, (2) modern individuals living in

traditional systems, (3) traditional individuals living in modern systems, and (4) traditional individuals living in traditional systems. Within each of these typologies, three types of pressure (internal, individual and external) on individuals were assumed to be operative.

The results of the two-way analysis of variance illustrated our concern with the process by which social systems generate dissonance in individuals. We found that farmers high on both individual and system variables were more innovative than when they were high on one type of variable and low on the other, or when they were low on both individual and system variables. In the case of imbalanced situations, system effects seemed to predominate over individual effects, and the dominance was greater when individual effects were lower.

Our results document the existence of system effects on individual innovativeness, and warrant further consideration of system effects to building a more adequate theory. The study augurs the beginning of research designs which consider simultaneously and systematically both individual and system variables in predicting individual innovativeness.

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.

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A THESIS

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CHAPTER I

INTRODUCTION

> ... Any system not only bears in itself the seeds of its change, but generates the change incessantly, with every act, every reaction, every activity it discharges (Sorokin, 1961, p. 1312).

The Problem

The basic problem of the present thesis is focussed on the simultaneous and systematic consideration of a set of concepts, both in individual and aggregate (system) forms, in accounting for more variance in individual innovativeness* than previously. Past work considered a set of independent variables either as properties of the individual or properties of the system of which he is a part. None attended to both conceptual forms simultaneously.

It is hoped that this approach will provide a more precise picture of the relationships among the dependent variable of innovativeness and certain independent variables in both individual and system forms. Such a set of independent variables relate to the communication, social, and psychological behavior of the individual and of the system of which he is a member.

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*Innovativeness is "the degree to which an individual is relatively earlier in adopting new ideas than other members of his social system" (Rogers, 1962, p. 20).

In approaching the present problem, one must attend to the question of whether or not the properties of a social system have influence over the behavior of its members. Further, given such influence, what is its nature and direction? Such influence may be conceived as springing either from aspects of systemic structure* such as system norms, or from system composition** with respect to members' attributes, or from both.

Similarly, the properties of a system may be classified as (1) aggregate properties, which are based on characteristics of smaller units within the system being described, and (2) integral properties, which are not based on smaller units.*** Thus, an aggregate property of a system is its

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*Blau (1957 and 1960) and Campbell and Alexander (1965) refer to such effects as "structural effects."

**Davis and others (1961) call these phenomena "compositional" rather than "structural" because they think there is only a partial overlap between these relationships and what sociologists consider to be social structure. Our pretensions here are not so much that of ending the semantic debate but rather of striving to search for the existence of such effects relative to systems under the label of "system effects." So we subsume both structural and compositional variables under system variables.

***Lazarsfeld and Menzel (1961) used the term "analytic" and "global" in place of "aggregate" and "integral", to describe the properties of a system as used by Selvin and Hagstrom (1963). The latter authors do not agree with the terms used by the former authors and feel that "global" falsely suggests an overall description of the system, and "analytic" emphasizes the decomposition of system properties into individual data, rather than the combination of individual data into system properties. Cattell (1951) provides a threefold classification of system variables: syntality variables which describe the performance of the system acting as a whole (e.g., some kind of social program

mean on some attribute (e.g., $\bar{X}$ on education), which is an aggregation of the behavior of the individual members. In contrast, whether or not the system has an educational institution to impart education is an integral characteristic which is not derived directly from the behavior of the individual members or of any subsystem.

Another example differentiating the aggregate and integral properties of a system is found in the Diffusion Project;* the Phase I variables are measured at the village level and describe the "integral" properties of the village. The Phase II data were gathered from farming heads in from 8 to 20 villages per country, and thus the village mean

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that the system undertakes); structure variables are based on particulars of internal structure and interaction (e.g., average number of friends chosen from within the system); population variables are characteristics of the distribution of personality, status, and attitude-interest variables among the members of the system (e.g., proportion interested in campus politics). Cattell hopes to explain variations in syntality as functions of population and structure variable.

*The Diffusion of Innovations in Rural Societies Research Project, a three-phase study conducted since 1964 by the Department of Communication, Michigan State University, under contract with the U.S. Agency for International Development, used survey research and multivariate analysis to explore the diffusion of agricultural innovations in India, Brazil, and Nigeria. Phase I of the study used the village as the unit of analysis in order to explore the system effects of village environments on villagers' behavior. Phase II used the individual as the unit of analysis to explain variability in innovativeness of individual farmers. In Phase III, controlled field experiments were designed to compare the effectiveness of such inputs as adult literacy program, animation (leadership clinics for informal leaders), and radio forums in diffusing information about technological innovations.

values of variables represent the "aggregate" properties of the system.*

Our assumption is that the properties of a system will exert influence over an individual member's behavior. This assumption is made because the value system and normative milieu of the system typically influence the behavior of individual members by means of rewards and sanctions. Also, other possible constraints of a system limit alternatives that are open to their members. Thus, if there is no electricity in a village the question of adopting electrical equipment by the individuals of that village does not arise.

We are also assuming that individual behavior (on some dependent variable such as innovativeness) depends, or is in part a function of, the individual's position on a number of independent variables.

Based on these assumptions, the main thesis we advance is that more variance in individual behavior can be explained by utilizing both individual and system variables than by using only individual variables.** Thus, an individual's innovativeness may well depend in part on his literacy, for example, but also in part on the percent literate in the village in which he lives. Why would we expect these system effects?

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*In the present study we intend to use only "aggregate" system variables. Details of our limitation to use only aggregate system variables may be found in Chapter V.

**Because very few studies, as we shall show later, utilized system variables.

Normative and Deviant Behavior

Through past interactions, individuals have organized themselves into social systems and, through ongoing interaction, they maintain and adapt that organization. The system includes norms which affect the behavior of individuals. Norms have such effect when they become embedded into the life patterns of individuals through the lifelong process of socialization. Socialization, the teaching of norms and their later enforcement, is done in part by certain members of the system who transmit messages of approval or disapproval to other members. Thus, socialization is accomplished through communication, the transmission of messages with the intent to affect individual behavior. This kind of socialization may be regarded as within-system socialization.

To the extent that a social system enters into interaction with other systems, all of which, when put together, can be considered to form one larger social system (e.g., regional communities comprising a nation state), a similar type of "socialization" for each individual social system may occur. This type of socialization may be regarded as between-system socialization. Facilitating this kind of socialization is communication, just as in the case of individual socialization within a system.*

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*Direct measures of interaction among individuals within a system and between systems would have been desirable and likely would have been highly related to our dependent variable. However, lacking such direct measurement, we

The research question generated by these observations is: What are the effects of between-system socialization upon within-system socialization?* What happens to an individual who is already socialized in a particular social system when that social system enters the process of being socialized to norms of yet a larger social system? In broad outline, we can conceive of two opposing forces acting upon such an individual: (1) an internal source of influence to maintain an existing normative structure (within-system socialization), and (2) an external source of influence acting upon the system to either reinforce or change its normative structure (between-system socialization). To investigate the manner in which these two forces interact with each other, let us arbitrarily create dichotomies of social systems and individuals as to whether they are modern or traditional, and cast these in a two-by-two table as in Figure 1.

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conceive our individual and system variables as indirect measures of interaction in that individual behavior and systemic norms may well be considered as products of human communication.

*Our usage of the word "socialization" is slightly different from the usual sociological usage. Herein, we shall use the word "modernization" to include both within-system and between-system socialization. Modernization parallels at the individual level what development represents at the national or societal level. Modernization is the process by which individuals change from a traditional way of life to a more complex, technologically-advanced, rapidly-changing style of life (Rogers and Svenning, 1968).

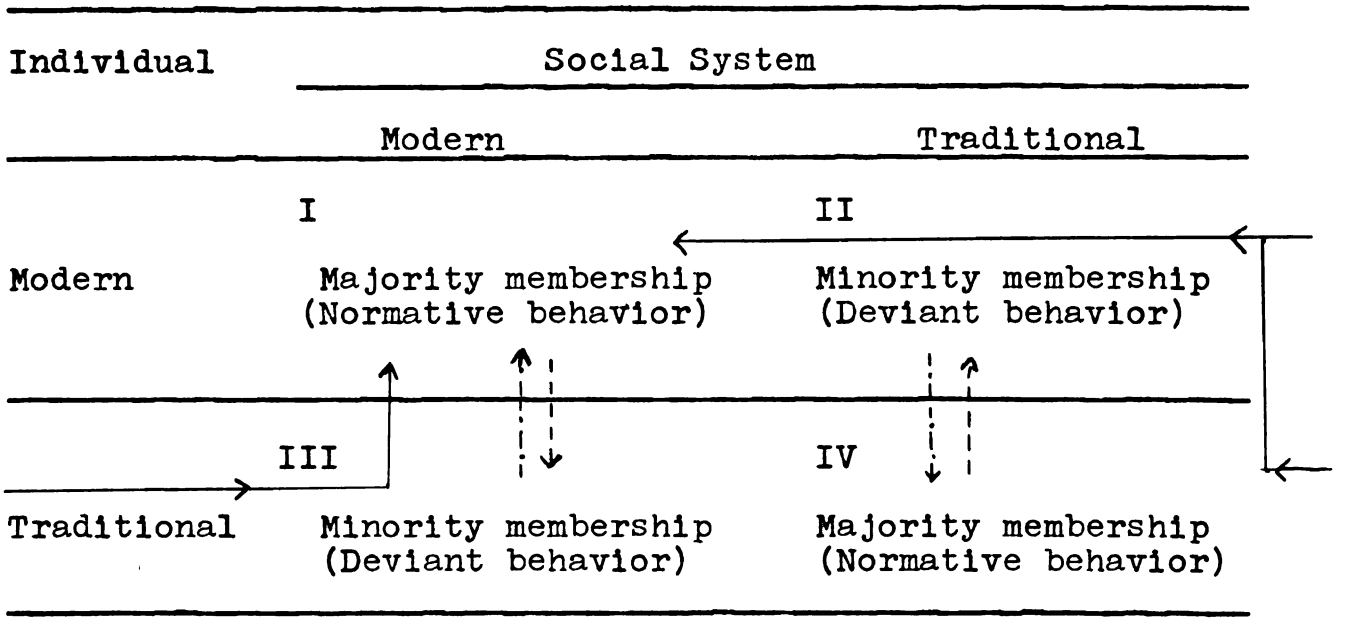

Figure 1. Normative and Deviant Behavior as Explained by Individual and Social System Modernization.

Legend: _____ Direction of Internal pressure to change (weak)
-.-.- Direction of Internal pressure to change (strong)
_____ Direction of External pressure to change

If the majority of the members of a social system are in cell I, then there will be strong pressure exerted within the system on the minority membership in cell III to move to I. Members in cell III may resist this pressure and in so doing may be considered as deviants from the social system's norms. In addition to the pressure from within, there is pressure from outside the social system (such as from change agents) which is also brought to bear upon the minority members in cell III to move to I. Thus, the minority members in a modern social system experience a double pressure to change, which is counterforced only by its own internal pressure not to change.

If the majority of the members of a social system are in cell IV, there will be strong pressure from within the social system exerted upon the minority membership in cell II to move back to IV. The members in cell II may have at one time been like the members of cell IV in terms of normative behavior, and have since broken away. In this sense, they too may be considered as deviants. There is counter pressure upon the minority membership to continue to accept change. This pressure emanates from an external source. The same external source also brings pressure to bear upon the majority members in cell IV to accept change and move into cell I. A subsidiary source of pressure in cell IV to accept change also comes from the minority membership in cell II. Thus, the minority members in a traditional social system experience a major pressure not to accept change (internal pressure) and this pressure is counterforced by another which encourages change (external pressure). In the case of the majority members in a traditional social system, the major influence to change emanates primarily from an external source and is counterforced primarily only by its own resolve not to change.

Given this conceptual frame, we can hypothesize not only the direction of expected change but also the rate of change of the membership of each cell relative to the members of all other cells.

The direction of change is for the normative behavior of the members of cell IV to change into the normative

behavior of the members of cell I. This occurs by individual members of cell IV migrating to cell II until cell II has the majority membership of the social system, i.e., until cell II looks like cell I, i.e., the deviant behavior of cell II becomes normative behavior when the majority of the social system members have moved into cell II.

The rate of change is likely to be greatest in cell III because of the double pressure upon it to change. The next greatest rate of change is likely to occur in cell IV, provided the external pressure to change is strong and enduring. Cell II members, who have already accepted some change, will continue to accept more change, but probably at a slower rate than the members of cells III and IV.

Interaction Between the Individual and His Social System

To propose the probable manner in which the suggested changes in the different cell types are impelled, let us look at these cell types in terms of Newcomb's (1953, 1959) A-B-X model, or rather, in terms of an extended version of the model which we might call the ABC-X model, where A refers to internal socialization (within social system), B refers to external (between social system) socialization, C refers to the individual attitudinal disposition to socialization, and X refers to the new norms to which the social system is being socialized. The manner in which changes in the different cell types of Figure 1 are impelled is depicted in Figure 2.

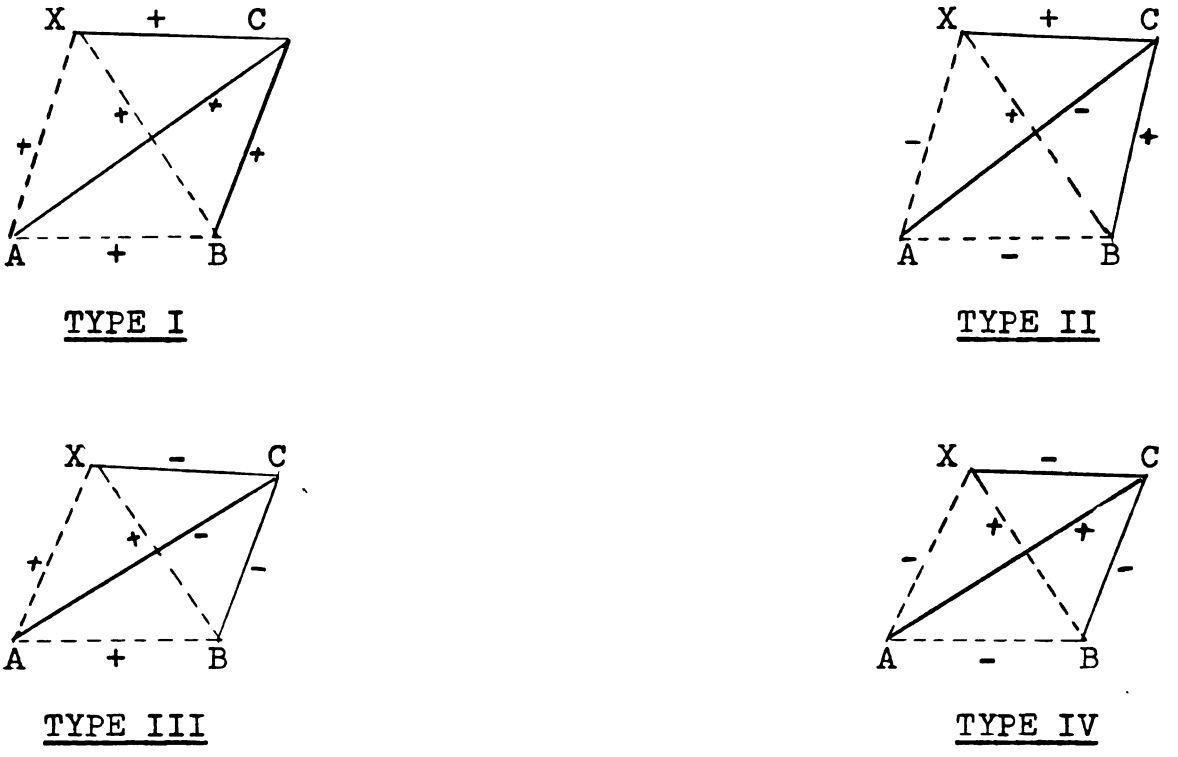

Figure 2. Types of Balanced and Imbalanced Situations Involving the Individual and His Social System.

Legend: ---- Relationships among systemic orientation towards internal pressure (A), external pressure (B), change (X) and individual attitudinal disposition to change (C).

____ Relationships among an individual's orientation towards internal pressure (A), external pressure (B), change (X), and individual attitudinal disposition to change (C).

\+ Positive orientation to each other.

\- Negative orientation to each other.

The relationships between A, B, C, and X can be explained in terms of Newcomb's model. Basic to his theory is the notion that individuals will tend to maintain minimal discrepancy between their own attitude towards the change (X) and those of systemic orientation, depending upon the valence that is jointly attributed to change (X) by the individual

and the system.

Why would we expect differences in the rate of change in these four types of balanced and imbalanced situations? Type I and Type IV are balanced, in that the overt behavior of the individuals demanded by the system is in line with their attitude. Types II and III are imbalanced systems. Balance theory suggests that over time there will be a tendency for the individuals in types II and III to either change their attitudes to make them consonant with the behavior demanded by the system, or to give up their existing behavior. From the viewpoint of balance theory, we can describe these types as follows:

Type I: Modern individuals living in a modern system. The situation is balanced in that there is pressure only to maintain change and to expend it.

Type II: Modern individuals living in a traditional system. The situation is imbalanced in that there is external pressure to change but also an internal counter force to resist change.

Type III: Traditional individuals living in a modern system. The situation is imbalanced in that both pressures (internal and external) demand change on the part of the individual, and there is no counter-force against change except that which comes from themselves.

Type IV: Traditional individuals living in a traditional system. The situation is balanced until the

external pressure to change is felt.

Our model also provides a basis to predict how the relationship between individual and system variables can be changed and with what effect. Thus, taking Type IV as an example, changing an individual's orientation (C) either toward change (X) or toward external pressure (B) will make the system imbalanced, which will lead to changed behavior. Similarly, changing the relationship between change (X) and internal pressure (A), or the relationship between internal pressure (A) and external pressure (B) may perform the same function.

How can these relationships be altered? The crucial variables that may change an individual's orientation towards external pressure may be variables like source credibility, extension contact, etc. An individual's orientation towards change can be accomplished by means of mass media exposure, urban contact, education, literacy, etc. These variables all have one common link; they are all communication variables.*

Testing the aforementioned propositions fully would require data gathered over time. Our data will allow testing some of the propositions with the data collected at one point in time and thus, possibly provide answers as to which of the systems (balanced or imbalanced) will be more innovative at one point in time. To determine which of the systems will undergo more change over time is beyond the scope of this inquiry. However, a few speculations on this matter

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*By communication variables we mean those transactions by which messages are transmitted between and among human beings. Literacy and education are mainly facilitators of these transactions.

are made for the purpose of further exploration.

Objectives

The present research is designed to test the existence of system effects in a setting widely different from the U.S. in culture and level of economic development. Using natural systems based on territory (such as village or community), the present study attempts to predict individuals' agricultural innovativeness.

Earlier studies demonstrated that some characteristics of the system have an effect on the individual's innovativeness, but they do not show exactly how much influence the system exerts over individuals' behavior. One of the concerns of the present study, therefore, is to ascertain the degree to which system variables affect the innovativeness of individual members of a system. Our intent here is to answer such questions as: Are there system effects? Do the properties of systems affect individual innovativeness? How much influence does the system exert over the individuals' behavior?

Another concern of the present research is to determine the extent to which system variables affect individual innovativeness when individual effects (differences among individuals) are controlled. Such consideration allows us to gauge if there are system effects beyond individual effects. We also will examine the nature of relationships (linear or otherwise) of innovativeness with individual and system variables.

Still another concern of the present research is to understand the way in which system variables affect individual innovativeness under specified situations when interactions among independent variables are controlled. Here, our efforts will be to answer such questions as: Does the strength of system effects vary with different combinations and levels of independent individual and system variables? Do system effects tend to predominate in these combinations?

Blau (1960) and Davis and others (1961) identified a typology of system effects on the basis of (1) their linearity or non-linearity, and (2) whether such effects have a direct or indirect relationship to the individual-level dependent variable. These authors do not provide a rationale for predicting the nature and direction of effects, nor specify when and under what conditions the strength of system effects will vary. With the help of balance theory, the present study is the first attempt to provide a rationale for predicting the nature and direction of system effects and the specification of situations under which such effects are likely to vary.

We also propose to establish certain typologies of innovativeness, taking into account both individual and system variables, i.e., how the system and individual stand in relationship to each other.

Specifically, the major objectives of the present research are three-fold:

1. To ascertain the degree to which system variables affect the innovativeness of individual members of a system.

2. To determine the extent to which system independent variables affect individual innovativeness when the effects of individual independent variables are controlled.
3. To understand the way in which system variables affect individual innovativeness under specified situations when interactions among independent variables are controlled.

CHAPTER II

REVIEW OF LITERATURE

In this chapter we propose to define system effects and present a brief review of literature dealing with system effects. We shall review the literature in two sections. In the first section, a few major findings with respect to each study will be listed, describing the nature of the social system and the kind of behavior studied. In the second section, the methodology used by past researchers in determining system effects will be described. The description of these methodologies will be followed by a discussion of their limitations. Finally, an outline of the procedure that will be used in the present study in determining system effects will be mentioned.

What Are System Effects?

System effects are the influence of systemic structure and/or composition on the behavior of the members of a social system.

Blau (1957) defined "structural effects", a term similar to system effects, as follows:

> If ego's X affects not only ego's Y but also alters Y, a structural effect will be observed, which means that the distribution of X in a group is related to Y even though the individual's X is held constant.

The definition by Davis and others (1961) of system effects is somewhat similar to that of Blau (1957). Davis and

others (1961) refer to such effects as "compositional." Compositional effects, according to these authors, are the effects of the composition of the system in which one is a member, on his behavior (Figure 3). These authors state:

> A compositional effect exists when the absolute value of either (a) the within group difference and/or (b) the between group difference for A's and/or $\bar{A}$ can be described as a function of P, where A refers to an individual attribute present, $\bar{A}$ refers to an individual attribute absent, and P refers to the per cent of A in a group.

Thus, variation in the group composition (P) produces an effect on the dependent variable (D) even when the individual attribute (A) is controlled.

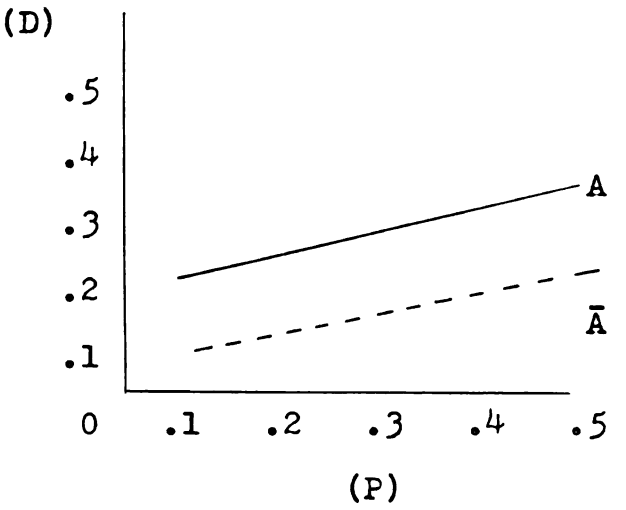

Figure 3. An Illustration of System Effects

Past Studies on System Effects

The phenomenon of system effects is not new. Its origin may be traced to Durkheim (1897) who noted not only that suicide rates varied considerably among different religions,

but also that suicide rates for a given religion are much lower when its adherents are in a distinct minority in the society. Similarly, Groves and Ogburn (1928) showed that the marriage rates for men and women vary in opposite directions with the sex ratios of the communities in which they live. Studies by Faris and Dunham (1939) on psychosis rates, and Stouffer and others (1949) on U.S. soldiers, were similarly concerned with system effects.

A number of more recent studies also demonstrates the presence of system effects:

1. Berelson and others (1954) demonstrated the effects of community composition in terms of party affiliation on voting behavior.

2. Lipset and others (1956) found system effects in their study of a labor union.

3. Wilson (1959) showed systemic influences on the aspirations of high school students.

4. Blau (1960) observed that prevailing values in work groups had system effects (in a public assistance agency) on the conduct of the individual. In some cases, the group values and the individual's orientation had similar but independent effects; in other cases, they had opposite effects; and in still other cases, the effects of the individual's orientation were contingent on the prevalence of this orientation in the group, a pattern which identifies characteristics associated with deviancy.

5. Davis and others (1961), in a study of the Great Books reading program, encountered system effects.

A number of research investigations have examined system effects in formal organizations. Becker and Stafford (1967) conducted a mail survey of 140 saving and loan associations in Illinois to explain variation in organizational efficiency and innovativeness. Five independent variables explained 40 percent variance in organizational efficiency and innovativeness. The independent variables included the size of the organization in terms of assets, the growth rate of the surrounding community, the adoption of innovations, size of the administrative component, and the management's leadership style.

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

Further evidence of the existence of system effects may be found in a number of studies dealing with the diffusion of innovations. Marsh and Coleman (1954) indicated that both socio-economic characteristics of farmers and their neighborhood of residence are significantly associated with the individual farmer's innovativeness score. Even when the socio-economic characteristics of the farmers are held constant, the differences attributable to differences in

neighborhoods still exist. In their Kentucky restudy, Young and Coleman (1959) also found that farmers in modern neighborhoods had a more scientific orientation toward farming matters than those in traditional neighborhoods.

Duncan and Kreitlow (1954) matched and compared 19 pairs of rural neighborhoods on the adoption of 30 school practices, using an index of 25 farming practices and four elements of organizational participation. They used neighborhood as the unit of analysis, and the mean score of 10 respondents in each neighborhood as the acceptance level of the entire neighborhood. They found that heterogeneous neighborhoods were consistently more favorable toward a majority of the innovations than were homogeneous neighborhoods.

In a study of 47 Wisconsin townships, van den Ban (1960) classified the townships into four categories according to the average adoption scores of the farmers. He observed a significant difference among the four categories in the proportion of high adopters, after controlling the effects of such variables as education, 4-H Club membership, size of farm, and net worth. He then made case studies of two townships, one modern and one traditional, and concluded: "Differences in the adoption of new farm practices between the townships studied can be only partly explained by differences in individual characteristics or by values directly affecting farming. Differences in social structure seem to be more important."

Faced with the problem of low prediction level, allegedly

due to exclusive emphasis on the individual, Rogers (1961) included a community variable, "norms on innovativeness," in his analysis. He found that the prediction of the innovativeness of truck farmers much improved because of the inclusion of this previously-unused variable.

Coughenour (1964) analyzed the data on the diffusion of five farm practices in 12 Kentucky localities. He found that speed of diffusion is related to socio-economic and attitudinal resources of each locality and also to the nature of social relationships with information sources and media contacts.

Qadir's analysis (1966) of data from some 600 villagers in 26 Philippine neighborhoods, on the other hand, revealed that compositional system variables (e.g., mean neighborhood education, mass media exposure) are about as effective as predictors of individual innovativeness as are individual variables like education, mass media exposure, etc. Operationalizing "differentiation" as the adoption of modern practices, he concludes:

> The composition of the more differentiated localities shows a concentration of individual households with high education, modern orientation, media contact, material possession, and communication facilities, which together generate a social climate in favor of adoption of modern practices [like our cell I in Figure 1].* Under such a climate, even individual households lacking high education, modern orientation, etc., act like adopters [like our cell III in Figure 1].* On the other hand, the less differentiated locality

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*Parenthetical comments are provided by the present author.

> has a generally low level of education, modern orientation, media contact, material possessions, and communication facilities, which together account for the rigidity of the social structure [like our cell IV in Figure 1]. As a result, individual households even with a high level of education, modern orientation, are found to fall behind those with low level of education, modern orientation, etc., in the more differentiated locality in the adoption of change [like our cell II in Figure 1].

The foregoing account of past research on system effects illustrates that the bulk of such studies have been completed (1) in more developed countries, especially in the U.S., (2) in formal organizations or small group settings, and (3) with the objective of identifying only the presence or absence of system effects.

How to Determine System Effects

Some 60 years ago, Durkheim (1951) demonstrated the method of isolating system effects by ascertaining the relationship between the distribution of a given independent variable in various systems and a dependent variable, while holding the independent variable constant for individuals. If a system effect is found, it will provide evidence that differences in the system variable are responsible for the variation in the dependent variable, since individual differences on the independent variable have been controlled.

The strategy of Blau (1957) is similar; he characterized an individual in terms of his score on variable Z, and his systemic score on variable Zgp. As shown in Figure 4, this strategy involves (1) determining

an empirical measure, Z, relative to some characteristic of the individual member of a system, (2) combining the scores for measure Z, into an index for each system (Zgp) to refer to the characteristics of the system, and (3) determining the relationship between the systemic attribute (Zgp) and some dependent variable, W, while the corresponding characteristic of the individual (Z) is held constant. Thus, the effect of Zgp on W will be a "pure" system effect, with the effect of the individual level of the independent variable removed. This strategy has two severe limitations: (1) the problem of contaminating individual differences (within-column in Figure 4) with system effects, and (2) the problem of contaminating system effects with individual effects.

While Blau dichotomizes both the individual and the system variables (Z and Zgp), the strategy employed by Davis and others (1961) dichotomizes only the Z variable. Thus, the systems are spread out along a horizontal axis according to their Zgp scores. This procedure eliminates the problem of contaminating individual differences with system effects, but the problem of eliminating individual effects in the systemic remains.

Individual	System	
	Low Zgp	High Zgp
High Z	*$\bar{W}$	*$\bar{W}$
Low Z	*$\bar{W}$	*$\bar{W}$

Figure 4. Hypothetical Example of the Blau Technique in which the Dependent Variable (W) is Related to the Individual Variable Z and the System Variable Zgp.

*Cell entries indicate the mean W for all individuals in that cell.

To the extent that individual variables involved are truly dichotomous, the problem of contamination does not arise. But this is not true in the case of most social science variables which are continuous. Thus, Tannenbaum and Bachman (1964) propose several modifications of Blau's (1957) or Davis and others' (1961) method. One modification is to achieve less within-category variance on the individual variable (Z). This objective can be accomplished by using a larger number of categories for the individual variable (Z). Then, the technique of Blau may be used except that it will have an Nx2 rather than Blau's 2x2 form, in which N is the number of categories used for the individual variable (Z). This technique will culminate in holding individual level effects more or less constant. This technique can further be modified to cover a borader range of group variables (Zgp), as suggested by Davis and others, in order to (1) hold systemic characteristics strictly constant and

thus avoid the problem of spurious individual effects, and (2) achieve statistical efficiency.

Another method proposed by Tannenbaum and Bachman consists of correlating the system variable (Zgp) with the dependent variable (W) at each of the N levels of the individual variable (Z). Such procedure requires that each individual be assigned a Zgp score according to the system in which he is located as well as his own individual W score. These correlations do not provide information about individual level effects. The individual effects might be detected through the use of intersystem correlations (i.e., by correlating Z and W separately within each system, and thus holding system effects constant), or by the technique of partial correlation. Thus, a system effect can be measured by correlating Zgp and W with Z partialled. Likewise, an individual level effect can be determined by the correlation of Z and W with Zgp partialled.

Multiple regression techniques may also be used. Thus, the change in W expected with a unit change in Zgp and Z, provides a measure of the system and individual effects, respectively.

The effects of variables correlated with each other may pose the problem of confounding. For example, Davis and others (1961) classified his systems according to the proportion of members who were new to the system, the proportion having contact with other members outside of the system, and the proportion who were active in discussions.

These three characteristics are confounded in that the individuals who are new to the systems are likely to have few outside contacts and to be inactive in discussions. Thus, the characteristics of the system formed from these individual variables are probably associated, and if so, the effects attributed to one of these variables are really, at least to some extent, the effects of all three variables.

Selvin and Hagstrom (1963) therefore propose two solutions to solve the problem of confounding. One is to make the univariate description adequate by removing the unwanted variables experimentally or statistically. The other solution is to abandon entirely the effort to describe the systems according to a single characteristic and to construct a multivariate description. These authors use factor analysis to solve the problem of confounding. Systems are classified by means of factor scores, which are then used in the analysis of system effects. Valkonen (1966) suggests use of the factor scores of systems as the properties of the system in correlationsal techniques. A variable which has a high loading on the factor may be chosen to represent each factor. If an orthogonal rotation is applied, the factor scores will be relatively uncorrelated with each other. Instead of factor scores, a set of the original variables could also be used to characterize the systems.

Procedure To Be Used in the Present Study

We propose to use all the aforementioned techniques of matching, correlation, and multiple regression in the present study.

1. Multiple correlation will be used to predict individual innovativeness by assigning two values to the same attribute for every individual (one to represent his individual score, and the other to represent the score of the system on the same independent variable) for each of the independent variables.

2. First-order partial correlations will be used to hold constant either individual or system level variables and to assess the relative contribution of each in explaining the dependent variable.

3. Multiple correlation analyses with all the independent variables will be computed to determine the variance in innovativeness that can be explained by individual and system variables in their separate and combined form. Thus, there will be three multiple correlation analyses: one with independent individual variables, the other with the independent system variables, and one with both independent individual and system variables.

4. Individual and system variables will be matched on each of the independent variables to form the four possible situations (balanced and imbalanced) discussed in Chapter I: (1) modern individuals living in a modern system; (2) modern individuals living in a traditional system; (3) traditional

individuals living in a modern system; and (4) traditional individuals living in a traditional system. A two-way analysis of variance design will be used to test the significance of differences in innovativeness attributable to differences in individuals, systems, and their interaction. Then, hypotheses will be tested in respect to the innovativeness for each of the four situations.

In order to provide a meaningful interpretation of the results of our correlational analyses, two assumptions must be satisfied. One assumption is that the relationship between the dependent variable and the independent variables is linear. A second assumption, which is a must for the comparison of partial correlations, is that there is no interaction. That is, the various levels of the independent variables do not interact with the dependent variable.

It is necessary, therefore, to test whether or not these assumptions are met. To test the linearity of the relationship between the dependent variable and the independent variables, the zero-order correlations will be compared with the corresponding eta. If the difference between the two is small, a linear relationship may be assumed. For testing the presence of interaction, a two-way analysis of variance design will be followed wherein differences among individuals and systems will correspond to row and column differences respectively.

If the two assumptions are not met, the technique of sequential interaction analysis (Sonquist and Morgan, 1964)

will be followed. This technique is the only multivariate analysis that does not impose the assumption of additivity (linearity) and allows one to observe interaction effects.

CHAPTER III

METHODOLOGY*

The Data

Data gathered from eight Indian villages in Phase II of the Diffusion Project will be used in the present analysis. The two phases of the Diffusion Project differ mainly in respect to the unit of analysis.

In Phase I, the village is the unit of analysis; data from 108 villages were collected from the states of Maharashtra, Andhra Pradesh, and West Bengal. These states were selected to represent different modes of involvement of local self-government in development administration: (1) Andhra Pradesh, to represent locally elected people at the block level, (2) Maharashtra, to represent locally elected people involved at the district level, and (3) West Bengal, to represent the control over development administration coming mostly from the state level (as the emphasis on local self-government has only recently been introduced in this state). Two or three villages were randomly selected in each district and certain restrictions were imposed to represent a more or less normal distribution of villages ranging from least to most successful village in terms of

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*The earlier part of this section was drawn heavily from Roy and others (1968).

the adoption of agricultural innovations. The emphasis in Phase I was to investigate the integral properties of the villages as related to their innovativeness.

Of the 108 Indian villages, eight were selected in Phase II. The unit of analysis in Phase II is the individual farmer, 680 of whom constitute the sample. The emphasis in Phase II was to explain the variance in innovativeness of individual farmers.

Questionnaire Construction

A questionnaire was designed to use in personal interviews with the farm operators. It had both structured and open-ended questions. The questionnaire was first translated into Telugu and the format was given a substantial pretesting in the state of Andhra Pradesh. Questions which obviously were not understood were revised.

After the first revision, the questionnaire was also translated into Marathi and Bangali, the languages of the other two states. The questions were then pretested again in all three languages and revisions were made. Final reproduction of the questionnaire resulted in three sets of bilingual instruments, corresponding to the three regional languages, with English as the common language. We paid particular attention to the translation in order to use expressions familiar to the farmer and to maintain identity of meaning across the different languages.

The questionnaire so designed was used by teams of four

interviewers led by a supervisor in each of the three states. All team members had prior field interviewing experience and had participated in Phase I interviewing.

Field Work

Personal interviews were conducted during March and April of 1967 by teams of four interviewers led by a supervisor in each of the three states. The teams worked from a temporary residence in a sample village. They prepared lists of eligible respondents by consulting registration lists and knowledgeable people in the village. On the completion of the lists, they interviewed eligible respondents.

In most cases, the interview was conducted in private and lasted about one hour and fifteen minutes. The general purpose of the study was known to the interviewee from the earlier visits made during Phase I of the study.

Interview schedules were checked by the supervisor in the field, making it possible to return to the respondent if one or more questions had been ommitted. Two weeks were spent in each location obtaining the individual respondent data.

Sample

As mentioned earlier, three states were selected to represent different modes of involvement of local self-government in development administration. Two or three

villages were selected in each state from the 108 villages which had been included in the first phase of the Project. Selection of the villages was restricted to a single development block in each state to minimize travel costs. In selecting villages, we imposed the same restrictions as in Phase I of the study to select villages that represented a distribution of villages ranging from least to most successful village in terms of adoption of agricultural innovations.

We selected only farm operators, those who actually made the day-to-day decisions on the farm and who were farming at least 2.5 acres (one hectare) of land at the time of the data-gathering. Respondents could own or rent the land they farmed. We excluded the smallest farmers and landless laborers, because either many of the innovations are not applicable to them or they are not involved in making decisions regarding the adoption of farm innovations.* By doing so, we were dealing with the farmers who utilize most of India's agricultural innovations.

We selected only those farm operators who were heads of farm households and were 50 years of age or younger at the time of the data-gathering. This restriction was

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*The India Census of Agriculture (1965) states that about 24 percent of the village population in the nation consists of landless laborers. The figures are 42, 34, and 28 percent for Andhra Pradesh, Maharashtra, and West Bengal, respectively. Of the farmers who own some land, 60 percent own 2.5 acres or more and cultivate 93 percent of the total arable area in the country.

imposed to avoid the ambiguous decision-making situation in which the older generation is gradually transferring responsibility for farming decisions to the younger, making it difficult to determine who in fact makes farm decisions.

From each state we interviewed 200 to 250 farmers who fitted the size of holding and age specifications. Three villages from each state were selected, except Maharashtra in which case we felt two villages will be sufficient to provide enough cases.

Since we imposed a number of restrictions on our sample, it is not "representative"* in a statistical sense. However, it does permit the kind of statistical analyses we want to make. Our analyses are mostly correlational and hence we purposively included farmers covering a wide range in agricultural modernization.

Operationalization of Variables

We turn now to consideration of the manner in which the dependent and independent variables were indexed. The various techniques of scoring, weighting, and scale analysis are documented here. Appendix contains the scale items used in the present analyses, and specific questions asked to secure responses to these items.

Innovativeness

The dependent variable in the present study is innovativeness. The conventional definition of

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*Of all of village India, at least.

innovativeness is the degree to which an individual is earlier than others in his social system in adopting new ideas.

Though problems of weighting, validity, reliability, and internal consistency were considered in general, more specific considerations were given to (1) include items that were applicable to the farmers in all three states, (2) the unidimensionality of the items, and (3) examine the distribution of the final measures to ensure a somewhat normal distribution.

The final interview schedule obtained after two pre-tests contained ten innovations that were equally applicable to all the farmers in the sample and were related to fertilizers and manures, new seed varieties, insecticides and pesticides, and the breeding and protection of cattle. All ten items were used and scored as a simple unit-weighted index. This procedure of unit-weighting was felt to be simpler (and not much different) than either determining scale types for each farmer or factor weighting of items for each farmer.

For each innovation, the questions "Do you know anything about ...?" "Have you ever used ...?" and "Are you still using ...?" were asked to elicit responses at three stages in the innovation-decision process which are conventionally referred to as knowledge, trial and adoption.

One of the techniques used to test the scalability of the ten items in terms of the three variables (knowledge,

trial, and adoption) was Guttman scaling. The Guttman scale for the knowledge measure showed the highest degree of unidimensionality (the coefficient of reproducibility is .94), but in order to meet the second criterion of marginal frequencies being more than 10 percent, a number of items would have to be dropped. The trial measure showed an acceptable level of scalability (the coefficient of reproducibility is .90), and on the second criterion of the marginal frequencies only one or two items were borderline cases. The adoption measure was below the acceptable level (the coefficient of reproducibility is .88), and about three items were rejected to meet the criterion of marginal frequencies. Thus, among the three measures of innovativeness, the trial measure* was regarded as the best measure.

Factor analysis was another method used to test the unidimensionality of the ten items. The three intercorrelation matrices of ten items for knowledge, trial and adoption were subjected to factor analysis to determine the amount of variance that any single dimension would explain and to extract the principal component factor. The results of the factor analysis were well in accord with those of the Guttman scaling and hence the trial measure was finally selected as the best measure of innovativeness.

In addition to unidimensionality, certain other considerations were given some attention in determining

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*We term this a "trial" dimension in that the respondent was asked if he had ever tried the innovation.

the best measure of innovativeness. One of these was the distribution of scores for all the three measures. The knowledge and adoption curves were skewed to the left and right, respectively, while the trial curve had a more nearly normal, though a somewhat flattened, distribution. In terms of variation in the scores, the knowledge scores varied from a high of 9.85 (out of a possible 10) to a low of 6.03. The adoption scores varied from 5.41 to 1.62. The trial scores had a wider variation ranging from 2.56 to 7.33.

Another consideration was more of the way in which questions were phrased. The question "Are you still using ...?" often unjustly penalized farmers who had essentially used and had adopted an innovation, but for reasons of non-availability or crop rotation, or for some other reasons, were not using the innovation currently. Thus, "Have you ever used ...?" might be a more reliable indicator of innovativeness than "Are you still using ...?"

Thus, for the purpose of the present investigation, we operationalized innovativeness as the trial of an innovation regardless of when it was adopted, and whether its use was continued.

Independent Variables

A large number of variables were selected as possible correlates of innovativeness. While selecting these variables, a number of criteria were employed. One was

previous research findings relative to individual innovativeness, especially in less developed countries. The other criterion was more intuitive and intellectual, which was felt necessary because of the paucity of research on system effects in the research tradition on the diffusion of innovations.

Inclusion of system variables was mainly guided by the consideration that any type of human behavior can be partitioned in terms of "within" and "between" variance. One can visualize more homogeneity in human behavior within social systems than between social systems. Besides ecological reasons (such as the similarity of climate, soil, heredity, and so forth), it is interpersonal communication, the informal exchange of information and ideas, that brings greater homogeneity among system members over time. Thus, if a system has a greater proportion of individuals who are literate, exposure to print mass media is facilitated, and one would expect a substantial amount of information exchange in the system as compared to the system in which there are very few individuals who are literate. Transactions of messages about innovation decision and reinforcement of systemic norm will undoubtedly form an important part of this information exchange.

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

1. Education of the Respondent. Education can enable

farmers to perceive the relative advantages of innovations more readily and can assist in breaking traditionalism. It is expected that education of the respondent will be positively associated with innovativeness. In a recent compilation of studies found in the Diffusion Document Center of Michigan State University, Rogers and Stanfield (1968) found that more than three-fourth of 193 publications indicated a positive relationship of education with innovativeness.

2. Value of Agricultural Products Sold. This index is a measure of farm operation size, which takes into account differences in the value of crops. These ranged widely in our sample from a very low return per acre of pulses to a high return of sugar cane and cotton. Roy and others (1968) computed six different measures of farm size and found that this index of value of agricultural products was the most direct and reliable measure, and that it was highly related to innovativeness.

3. Credit Orientation. Borrowing credit for commercial purposes presupposes an ability to have confidence in the future. This orientation becomes more important in a traditional subsistence system where decisions for agricultural alternatives are based not on monetary gains, but rather on the protection of one's livelihood. We, therefore, expect a positive relationship between credit orientation and innovativeness. This index was measured by responses given to the questions "Did you

use any credit for farm purposes last year?" and "Would you have used some more had it been available at reasonable interest?"

4. Social Participation. Individuals who more actively participate in the activities of the social system are more likely to be innovative. We expected that membership and office-holding in formal organizations would relate positively with innovativeness. Roy and others (1968) found that holding office in a formal organization was conducive to higher levels of innovativeness.

5. Urban Contact. This variable is an operational measure of one's cosmopoliteness, defined as one's orientation to the larger society which lies beyond one's immediate surroundings. To measure this concept respondents were asked whether they had previously lived in another place, and also how frequently they visited any town or city in the past year. Ryan and Gross (1943) found that hybrid corn innovators travelled more often to urban centers such as Des Moines than did average farmers. Menzel and Katz (1955) confirmed this finding among the more innovative medical doctors. Thus, we expect that urban contact will be positively associated with innovativeness.

6. Urban Pull. One's motivation to migrate to a city indicates that one's reference group is no longer only his village. We call this motivation to migrate to a city "urban pull." We measured this concept by responses given

to the question, "If you were offered a job in a city with double your present income, would you go?" The economic incentive mentioned in the question was deliberately used in order to balance the higher cost of living in cities.

7. Educational Aspiration. Educational aspirations are defined as the level of education desired by parents for their children. In the Indian settings, education is a dubious venture as it cuts down on the family labor and is most often associated with out-migration to cities. However, it reflects a more modern outlook, and hence, it is believed to be positively related to innovativeness.

8. Deferred Gratification. Deferred gratification is defined as the postponement of immediate satisfaction in anticipation of future rewards (Rogers, 1965). We expect, the greater postponement of immediate satisfaction accompanies greater innovativeness. This concept was measured by an open-end question, "Suppose that your cash returns from the farm last year had been twice your actual income, what would you do with the extra money?" The responses were scored depending on the nature of the gratification exhibited in the response.

9. Extension Contact. Contact with change agencies has been found to be positively related to innovativeness. Rogers and Stanfield (1968) found that over 90 percent of the 136 studies dealing with the relationship between extension contact and innovativeness was positive. We used four measures of extension contact. They are: (1) the

number of times talked with the block development officer, (2) times talked with village level worker, (3) times seen a block film, and (4) times seen a demonstration. The codes for these measures were summed to form an index of extension contact.

10. Level of Living. As indirect measures of wealth, we constructed indices of material possessions and housing, and then summed these two into what we call a level of living index. We expect a positive relationship between level of living and innovativeness.

11. Political Knowledge. Political knowledge was measured by an informal knowledge test asking the respondent to identify by name (1) the prime minister of India; (2) the chief minister of the state; (3) the elected representative to the state legislature from that area. Since political knowledge is one manifestation of the respondent's participation in the body politic of the larger society, we expect a positive relationship between political knowledge and innovativeness.

12. Secular Orientation. Secular orientation was measured by a set of questions with paired alternative answers, one favoring tradition and the other non-tradition. Of ten such questions, only eight were retained in the final index. The items retained refer to two most important elements of the village society, the caste system and norms surrounding the cow.

13. Empathy. Empathy was defined by Lerner (1958) by

various descriptive terms such as ability to take others' roles, the capacity for rearranging the self-system on short notice, psychic mobility, etc. We measured it by a set of questions in the form, "If you were ... then what would you do ...?" The roles suggested were those of the district administrative officer, the block development officer, village president, and a day laborer.

14. Caste Rank. Caste rankings were obtained by asking knowledgeable respondents in each village to rank photographs of people at work in caste occupations in terms of ritual status for that village. Ritual status is defined on the basis of interdining and sharing of water. It is expected that higher caste status would be related to higher innovativeness.

15. Mass Media Exposure. Four separate measures of mass media exposure were used. Two of them related to radio listening; one for respondent listening, and the other for family listening. The third measure was the number of commercial films seen in the past year. The fourth measure was whether newspapers were either read by the respondent or were read to him. We combined these four measures into a mass media exposure index. We expected a positive relationship between mass media exposure and innovativeness.

The Present Plan of Analysis

In the foregoing discussion it was pointed out that past analyses of the diffusion of innovations lacked

attention to social system variables as explainers of differences in individuals' innovativeness behavior. We, therefore, conceptualized a farmer's innovative behavior, the dependent variable, as explained by two types of independent variables: (1) the individual's social, psychological and personality variables; and (2) the characteristics of the system, or village properties, in which the individual lives. The first class of variables are individual, the second are system. Thus, there may be four possible typologies of analyses, as depicted in Figure 5.

Unit of Analysis	Unit of Response: Individual Variable	Unit of Response: System Variable
Individual Variable	1	2
System Variable	3	4

Figure 5. Typologies of Analyses on the Basis of Unit of Response and Unit of Analysis.

1. Individual-Individual -- When data are gathered from individuals as the units of response, and the unit of analysis is the individual also.

2. System-Individual -- When data are gathered from the social system as the unit of response, and the individual is treated as the unit of analysis.

3. Individual-System -- When data are gathered from the

individual as the unit of response, and the social system is used as the unit of analysis.

4. System-System -- When both the unit of response and the unit of analysis are systems.

Type 1 is the most frequently-used approach in diffusion research. The Phase II study of the Diffusion Project represents this typology. Over 95 percent of the diffusion studies found in the Diffusion Document Center* used this type of analysis. Type 2 and 3 are neither very common nor encouraging because of the possible fallacies associated with them. When using system variables (aggregate data) in the Type 2 approach, and if one infers about individuals, he commits the "ecological fallacy" by assuming the individual regression slope and the aggregate regression slope (or their analogies) are equal (Robinson, 1950). If Type 2 is subject to the "ecological fallacy," Type 3 is exposed to the "system fallacy" in that the individual relationship is incorrectly assumed to hold up for all social systems (e.g., modern and traditional systems). There are not very many studies that fall in Type 4. Most of the studies in the anthropology diffusion research tradition and the Phase I study of the Diffusion Research Project represent this typology.

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*The Diffusion Documents Center, located in the Department of Communication, Michigan State University, contains studies, both empirical and non-empirical, devoted to the diffusion of innovations. At present the DDC contains over 1,500 such studies.

In the present study we propose a combination of Types 1 and 2, i.e., the independent variables will include both individual-level variables and system-level variables. Thus, the plan of analysis of the present study proceeds in four stages.

1. Use of zero-order and first-order partial correlations.
2. Use of multiple correlation techniques.
3. Formulation of typologies of innovativeness based on both individual and system variables.
4. Hypothesis testing concerning the innovativeness of balanced and imbalanced conditions.

1. Use of zero-order and first-order partial correlations: First of all, zero-order correlations will be computed between innovativeness and all other independent variables (both individual and system). Then, first-order partial correlations between the dependent variable (innovativeness) and each of the individual variables will be computed, keeping constant the effects of their respective system variables, and vice-versa. The partial correlations thus obtained for individual-level and system-level measures will be compared for each of the variables to assess the relative contribution of each in explaining innovativeness.

2. Use of multiple correlation techniques: Only those independent variables that have been found to be the best predictors of innovativeness will be included in a multiple

correlation analysis. An aggregate measure of individual scores by using the village mean on that variable will be used to represent the system variable. Thus, each of the independent variables will be included in the multiple correlation analysis as follows:

$$\bar{Y}_{ij} = a + b_i X_{ij} + r_i \bar{X}_{ij}$$

where $\bar{Y}_{ij}$ is the innovative behavior of ith individual in jth community, X_{ij} is the score of the ith individual in the jth community on individual variable X, $\bar{X}_{ij}$ is the score of the ith individual in the jth community on community variable $\bar{X}$, a is constant, and b_i and r_i are coefficients.

Thus, the amount of variance in Y (the dependent variable, innovativeness), explained by X and $\bar{X}$ (the individual and system independent variables, respectively), will be attributable to individual and system effects, respectively. The variance explained jointly by both the individual and system variables will be the combined contribution of both $(X + \bar{X})$, plus their interaction effect, if any.

3. Formulation of the typologies of innovativeness: This approach is similar to the graphic presentation used by Davis and others (1961) in demonstrating the typology of compositional effects (as shown in Figure 5). These authors classified different types of effects on the basis of: (1) their linearity or non-linearity, (2) whether such effects have a direct or indirect relationship with the

individual-level dependent variable, and (3) their positive or negative direction as indicated by the sign of the regression coefficients.

Thus, Type III A (in Figure 6) and our example of the regression equation (cited just previously) indicate that $\bar{Y}$ can be explained by an individual level variable X ($b_i \neq 0$) and, additionally by $\bar{X}$, the system variable ($r_i \neq 0$) and also that these variables affect the dependent variable in the same direction, since b_i and r_i have the same positive signs. If these signs would have been different, the individual-level and system-level variables would affect the dependent variable in an opposite direction (either Type III B, or any other relationship in Type IV). Similarly, if $b_i = 0$ and $r_i \neq 0$, only the system variable will affect the dependent variable (Type II); if $b_i \neq 0$ and $r_i = 0$, only individual-level (Type I) will affect the dependent variable.

However, our typologies of innovativeness are different from the typologies of system effects presented by Davis and others (1961) in that these authors classified variables while we propose to classify individuals considering system effects on them.

We propose to use sequential interaction analysis for establishing typologies of innovativeness. In these typologies, we will take into account both individual and system variables, i.e., how the system and individuals stand in relation to each other.

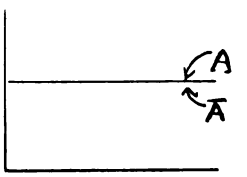
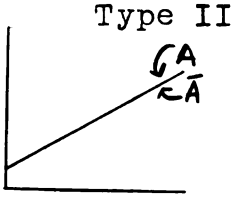
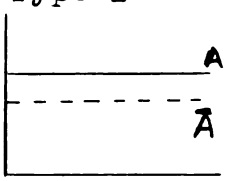
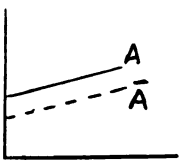
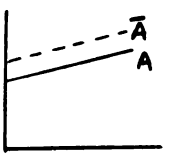
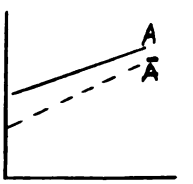
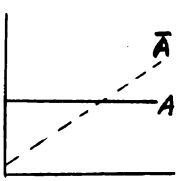
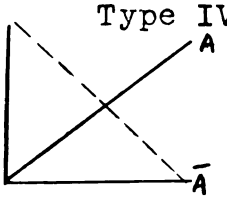
Individual Level Effect	Inter-Action	System Level Effect: No	System Level Effect: Yes
No	No	Type 0 	Type II 
Yes	No	Type I 	Type IIIA  Type IIIB 
Yes	Yes	Logically impossible	Type IVA  Type IVB  Type IVC 

Figure 6. Typologies of System Effects.*

*Adopted from Davis and others (1961).

4. Hypothesis testing. Hypothesis testing regarding variation in system effects will be accomplished by a two-way analysis of variance design, wherein differences among individuals and systems correspond to the differences in rows and columns. Further tests for the significance of the difference in innovativeness in different systems will be accomplished by use of the test for difference in means.

In drawing conclusion from the results of these procedures, multiple correlation techniques will be used to explain variance in the dependent variable (innovativeness) attributable to a set of linearly-related independent variables, both individual and system. Partial correlation will be used to explain variance in the dependent variable attributable to system variables, controlling the effects of individual variables, and vice-versa.

From the results obtained from sequential interaction analysis, certain typologies of innovativeness will be formulated considering both individual and system variables and their interaction. It is through the analysis of variance design that hypothesis testing concerning the variation in system effects on differing systems (balanced and imbalanced) will be put to test.

The unique contribution of the present research is in advancing a more adequate and refined conceptualization and methodology to predict system effects on individual's innovativeness in adopting farm innovations. This research is not primarily a methodological study but refinement in

the methodology is unavoidable in providing answers to the research problem at hand.

CHAPTER IV

FINDINGS

As stated earlier, the dependent variable in the present study is innovativeness, defined as "the degree to which an individual is relatively earlier in adopting new ideas than the other members of his social system" (Rogers, 1962, p. 20). An individual's innovativeness score is the total of his responses regarding time of first use of ten agricultural innovations investigated in the present research.

Fifteen independent variables were selected as possible correlates of innovativeness. Two measures of each independent variable are used to predict individuals' innovativeness; one involves individual-level measurement of variables based on the communication, social, and psychological behavior of the individual; the other involves system-level measurement of the same independent variables which are meant to represent the characteristics of the systems. The former are termed individual variables, the latter as system variables. The system-level measures are designated as the norms of the systems and are computed as the central tendency for each system on the individual-level measures. Accordingly, every individual in a social system is assigned the same score for the system variables, but these scores differ from system to system depending upon the

central tendency of these systems on individual-level measures. The relationship between the independent variables and the dependent variable will be examined in this chapter.

It should be noted that while stating the problem of this thesis, we assumed that the eight social systems under considerations are marked by different norms which will exert varying amounts of influence on the individual's innovativeness.* It is on the basis of this assumption that we expect system effects on the individual's innovativeness.

Objective 1

Presence of System Effects

Our first specific objective is to ascertain the degree to which system variables affect the innovativeness of individual members of a system. Evidence bearing on this objective is developed by means of a series of zero-order correlations.

The correlation coefficients between 15 independent variables and the dependent variable are presented in Table 1. These coefficients are Pearsonian product-moment correlations, which measure the association between two variables. Inspection of Table 1 indicates that the zero-order correlations of all individual variables with innovativeness are significantly different from zero at the 5 percent level except those with credit orientation and of

*There is variation in the aggregate means on our eight independent variables, although the variance is quite restricted in the case of education.

deferred gratification. Similarly, the zero-order correlations of all system variables with innovativeness are significantly different from zero at the 5 percent level except that with caste rank.

In general, both individual and system variables are related to innovativeness as shown in Table 1. In the case of mass media exposure, secular orientation and social participation, the t-values for the differences between the correlations of individual variables and of system variables with innovativeness are not significant at the 5 percent level. Thus, the individual and system measures of these three variables are about equally related to innovativeness. The system-level measures of value of agricultural products, credit orientation, urban pull, educational aspiration, deferred gratification, and empathy explain more variability in innovativeness than their individual-level measures.* However, individual measures of such variables as education, urban contact, extension contact, level of living, political knowledge, and caste rank explain more variance in innovativeness than the corresponding system-level measures.**

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*The t values for all of these six variables are significant at the 5 percent level.

**The t values for all of these six variables are significant at the 5 percent level.

The pattern of significant, zero-order correlations of independent variables with innovativeness suggests a three-fold categorization of independent variables:

1. Those whose individual and system levels are both related to innovativeness, i.e., all except the three named below (in #2 and #3).
2. Those whose individual levels are so related i.e., caste rank.
3. Those whose system levels are so related, i.e., credit orientation and deferred gratification.

Objective 2

System Effects Beyond Individual Effects

Our second objective is to determine the extent to which system independent variables affect individual innovativeness when the effects of individual independent variables are controlled.

Partial correlation: We expect, within the second objective, that system effects make a unique contribution to explaining individual innovativeness. This notion is examined by comparing the first-order partial correlations with the zero-order correlations. Such comparisons indicate the extent to which each independent system variable exerts influence on the dependent variable, independent of the corresponding individual variable. The partial correlations are given in Column 5 of Table 1. The difference between Columns 3 and 5 indicates how much of the relationship between each system independent variable and the dependent variable is due to the influence of variance in

Table 1. Correlations of Individual and System Variables with Innovativeness.

Independent Variables	Correlation With Innovativeness: Zero-order Correlations: Individual Variables	Correlation With Innovativeness: Zero-order Correlations: System Variables	Correlation With Innovativeness: First-order Partial Correlations: Individual Variables Partialing the Effects of System Variables	Correlation With Innovativeness: First-order Partial Correlations: System Variables Partialing the Effects of Individual Variables	Multiple Correlation of Individual and System Variables with Innovativeness	t-Value for Difference between Correlations (Column # 2 and 3)**
1	2	3	4	5	6	7
1. Education	.36*	.25*	.31*	.18*	.39*	2.53*
2. Value Agricultural Product	.43*	.55*	.28*	.47*	.60*	3.53*
3. Credit Orientation	.13	.41*	.02	.39*	.41*	6.61*
4. Social Participation	.24*	.18*	.21*	.14*	.27*	1.28
5. Urban Contact	.30*	.20*	.24*	.08	.31*	2.54*
6. Urban Pull	.19*	.55*	.04	.52*	.55*	9.48*
7. Educational Aspiration	.14*	-.23*	.17*	-.26*	.29*	7.76*
8. Deferred Gratification	-.02	-.56*	.17*	-.58*	.58*	15.57*
9. Extension Contact	.49*	.42*	.37*	.27*	.54*	2.03*
10. Level of Living	.59*	.53*	.45*	.35*	.66*	2.02*
11. Political Knowledge	.37*	.25*	.33*	.18*	.41*	2.79*
12. Secular Orientation	.27*	.32*	.12	.22*	.34*	1.43
13. Empathy	.14*	-.28*	.18*	-.30*	.33*	8.78*
14. Caste Rank	.26*	.11	.23*	.02	.26*	3.63*
15. Mass Media Index	.50*	.46*	.37*	.31*	.56*	1.19

*Significant at the 5 percent level.

**Since the correlations in Columns # 2 and 3 are based on the sample of 680 cases, the successive samples are not independently distributed, but correlated and hence a special procedure is used to calculate t which is different from the usual procedure used to compare the significance of two independent correlations. For a general description of the present procedure, see McNemar (1965, p. 140).

the individual independent variable.

Obviously, if the control variable (whose effect is partialled out) is unrelated to the two variables being correlated, the partial correlation will equal the zero-order correlations; if either of these two variables is negatively correlated with the control variable but positively related to the other variable, partialling out will raise the zero-order correlation.

After partialling out individual-level effects, all partial correlations are significantly different from zero except those with systemic urban contact and caste rank.

In general, the partial correlations of the systemic independent variables with innovativeness, controlling on the corresponding individual independent variables, support the notion of a unique contribution of system effects.

Multiple Correlation: We also expect, within the second objective, that more variance in individual innovativeness can be explained by simultaneous consideration of individual and system variables than by considering only individual variables alone.

Multiple correlations of the individual and systemic measures for each of the 15 variables were computed.* These multiple correlations are presented in Column 6 of Table 1. A comparison of the multiple correlation with

*In every instance, these multiple correlations were run with two independent variables, the individual and system measures of the same concept. They are not to be confused with the eight-variable multiple correlations to be discussed later.

the corresponding zero-order correlation of the individual and systemic variables with the dependent variable (Columns 2 and 3) indicates that the multiple correlation of each independent variable is larger than the zero-order correlation of either its individual or system variable. Thus, more variance in the dependent variable can be explained by considering simultaneously both the individual and system level measures of each variable. This effect occurs because the individual-level effects are not entirely independent of system effects.

Even clearer evidence of system effects beyond individual effects is provided when several independent variables (both individual and system variables) are combined in the multiple correlation. The selection of variables for the multiple correlational analysis was necessarily limited to eight variables.* While selecting these variables, two main criteria were considered: only those independent variables (both individual and system) were included (1) that are highly related with the dependent variable and less related among themselves on the basis of their zero-order correlations, and (2) whose highest-order

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*The restriction on the number of system variables that can go in a multiple correlation equation was guided by the number of systems under study. Since we studied only eight villages, there could be only eight meaningful observations and hence the number of variables could not exceed eight. Mathematically, if more than eight system variables are used, the system will be over-defined. We therefore selected 8 of the 15 independent variables and concentrated mostly on these variables throughout the study. These variables are: education, value of agricultural products sold, credit orientation, urban pull, deferred gratification, extension contact, level of living, and mass media exposure.

partial correlations (between each of the 15 independent variables and innovativeness, controlling on the other 14 independent variables) were higher. The results of the multiple correlational analyses are presented in Table 2.

TABLE 2. Multiple Correlations of the Eight Individual-Level and System-Level Variables with Innovativeness

Independent Variables	Multiple Correlation	Percent Variance Explained in Innovativeness
I Individual variables	.69	48
II System variables	.64	41
III Combined Individual and system variables	.79	62

The eight individual variables included in the multiple correlational analysis account for 48 percent of the variance in innovativeness (r = .69). Similarly, the system-level measures of the same eight variables explain 41 percent of the variance (r = .64). But combining both individual and system-level measures of the eight variables in a multiple correlational analysis accounts for 62 percent of the variance (r = .79). Thus, simultaneous consideration of both individual and system variables is marked by an increase in explained variance of 14 and 21 percent respectively over that explained by individual and system variables.

Linearity of Relationships

Two major factors that affect a multiple correlation are (1) linearity of relationships between the dependent variables and the independent variables, and (2) the interaction of the dependent variable with various levels of the independent variables. The linearity of relationships between the dependent variable and the independent variables was tested by a procedure that provides a rough estimation. This procedure calls for the comparison of the squares of zero-order correlations of each independent variable with its eta^2.* If the difference between the zero-order correlation and eta is small, a linear relationship may be assumed. Table 3 shows the results of such comparisons.

Perusal of Table 3 reveals that the relationship of all the individual variables with the dependent variable may safely be assumed to be linear except for credit orientation and deferred gratification. Those two variables show no significant relationship with innovativeness insofar as their zero-order correlations are concerned.

Contrarily, all the system variables seem to have curvilinear relationships with the dependent variable.

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*Although there is an appropriate statistical procedure to test linearity, for the reason of simplicity we used this method of comparison. The end-products of the two methods are comparable.

TABLE 3. Testing for the Linearity of Relationships Between the Dependent Variable and the Independent Variables.

Independent Variables	r^{2**}	eta^2	Conclusion
I Individual Variables			
1. Education	.13	.13	Linear
2. Value Agricultural Product	.15	.16	Linear
3. Credit Orientation	.02*	.02*	No Relationship
4. Urban Pull	.03	.03	Linear
5. Deferred Gratification	.00*	.02*	No Relationship
6. Extension Contact	.25	.27	Linear
7. Level of Living	.35	.37	Linear
8. Mass Media Index	.25	.26	Linear
II System Variables			
9. Education	.06	.40	Curvilinear
10. Value of Agricultural Product	.30	.41	Curvilinear
11. Credit Orientation	.17	.40	Curvilinear
12. Urban Pull	.30	.41	Curvilinear
13. Deferred Gratification	.32	.41	Curvilinear
14. Extension Contact	.18	.41	Curvilinear
15. Level of Living	.29	.41	Curvilinear
16. Mass Media Index	.21	.41	Curvilinear

*Not significant at the 5 percent level

**These correlation coefficients are computed by regarding the independent variable as a category variable (rather than as a continuous variable), and hence they are slightly different from those reported in Table 1.

TABLE 4: Mean Levels of Innovativeness and Independent System Variables by Villages.

Variables	Possible range	V1*	V2	V3	V4	V5	V6	V7	V8
Innovativeness	1-10	6.5	7.3	6.7	3.2	2.6	4.1	3.2	4.3
Education	0-3	1.3	1.8	1.7	0.9	1.6	1.1	1.3	1.3
Value of Agricultural products	0-20	9.4	10.9	7.6	2.5	3.2	1.7	1.2	1.9
Credit Orientation	0-2	1.4	1.6	1.4	1.0	0.9	1.5	1.5	1.1
Urban Pull	0-2	0.7	1.0	0.8	0.4	0.2	0.7	0.3	0.2
Deferred Gratification	0-9	3.2	3.5	2.7	4.1	4.4	4.2	3.7	4.0
Extension Contact	0-10	5.3	6.0	5.3	3.5	3.3	0.9	0.9	3.0
Level of Living	0-16	10.1	11.6	9.4	4.2	6.4	6.1	8.1	7.6
Mass Media Exposure	0-8	4.7	5.5	5.3	3.3	3.7	2.3	2.2	2.7

*V stands for village. The selected villages are: Manchili (V1), Kanchumarru (V2), Polamuru (V3), all in Andhra Pradesh; Pophali (V4), and Mulawa (V5), in Maharashtra; Amdole (V6), Laxmi-Danga (V8), and Harishpur (V7), in West Bengal.

From Table 4 it appears that the relationships of all the independent system variables with innovativeness is non-linear with a "take-off" occurring at different points depending on the variable in question. There is one

exception, however, with respect to education.*

Objective 3

System Effects and Interaction Among Variables

Our third objective is to understand the way in which system variables affect individual innovativeness under specified situations when interactions among independent variables are controlled. This objective is examined by means of sequential analysis and two-way analysis of variance.

Sequential Interaction Analysis: In an attempt to determine the conjunctive effects of the individual and system variables upon the dependent variable, the data were analyzed, using the technique of sequential interaction analysis (Sonquist and Morgan, 1964). This technique provides a configuration of variables organized in such a way as to demonstrate how variables combine to maximally explain variation in the dependent variable. In addition, it is the only multivariate analysis that does not impose the assumption of additivity (linearity) and is free of confounding interaction effects. Further, it allows for more than one stage in the causal process, i.e., a set of

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*The range of variation in mean educational levels for the eight systems under consideration (Table 4) is very restricted. Further, these levels of education are far less than the "take-off" point found by Tumin and Feldman (1956) in Puerto Rico and Briones and Waisanen (1966) in Chile (at about five years of schooling).

variables is introduced first, and whatever variation they do not explain is analyzed against a second set of variables.

Three such analyses were done. In the first run only individual variables were subjected to configurational analysis (Figure 7). In the second run only system variables were included (Figure 8). The final analysis (Figure 9) combined the individual and system variables to provide a configuration that will explain maximum variation in the dependent variable and will also demonstrate the interaction between the individual and system variables.

It is apparent from Figure 7 that the sample initially splits on the value of agricultural products (VAP) and secondarily on the level of living (LOL) in attempting to explain variation in individual's innovativeness with the help of individual variables only. At each split, the higher levels of the independent variable are associated with higher level of innovativeness. This result indicates that the greater the VAP and the higher LOL of an individual, the greater is his innovativeness. Among those who had high VAP but low LOL, however, credit orientation (CR) was another strong indicator of innovativeness. Similarly, among those who had low VAP but high LOL, extension contact (EXT) was a strong predictor of innovativeness.

Among the system variables (Figure 8), the first split again occurs on the VAP. For those with higher VAP, no further splitting occurs, but the second split of lower VAP produces a further split on VAP. The third split concerns

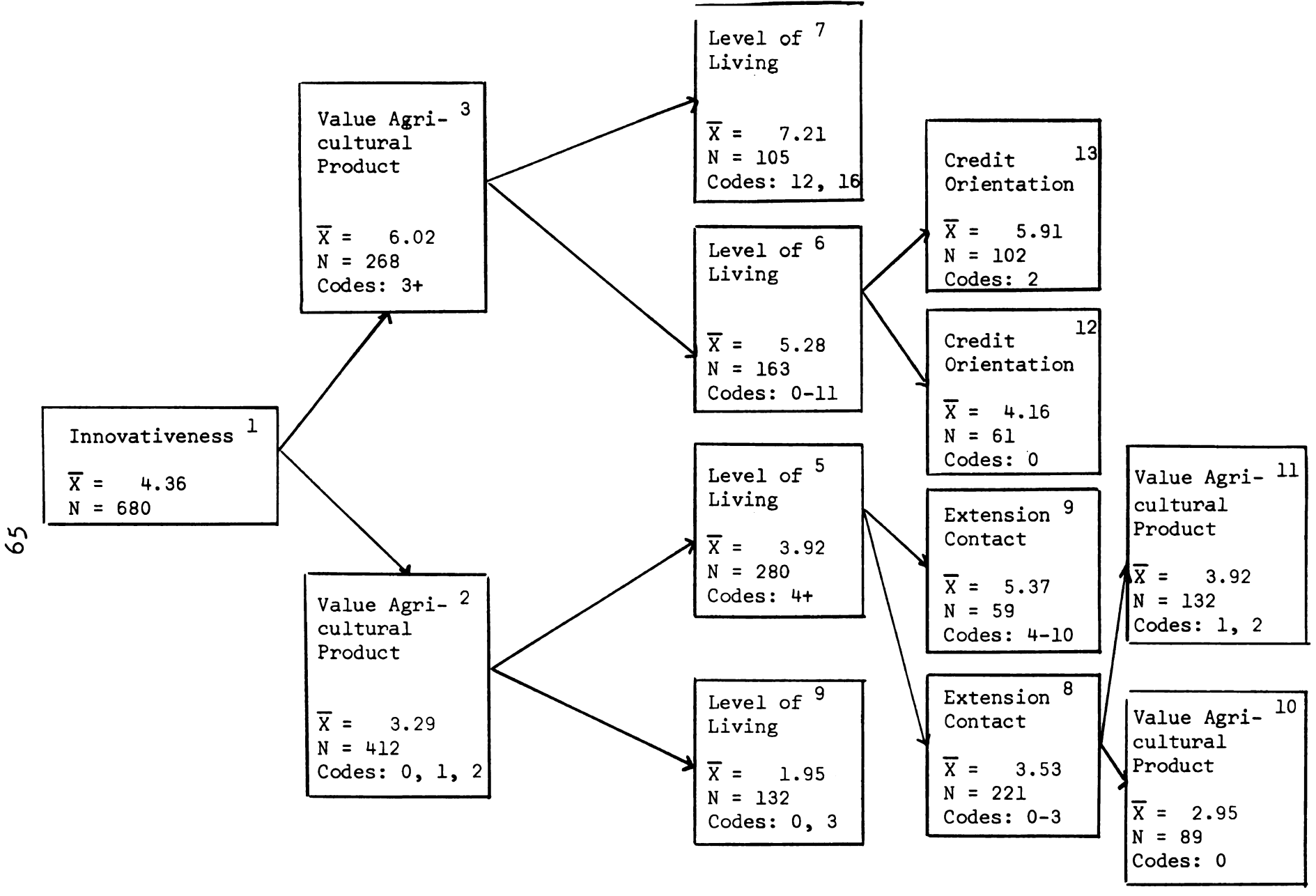

Figure 7. Configurational Analysis of Prediction of Individual's Innovativeness With Individual Variables.

Note: Means represent the subgroup's mean value on the dependent variable, N stands for the number of cases in the subgroup, and codes refer to the value of the independent variable.

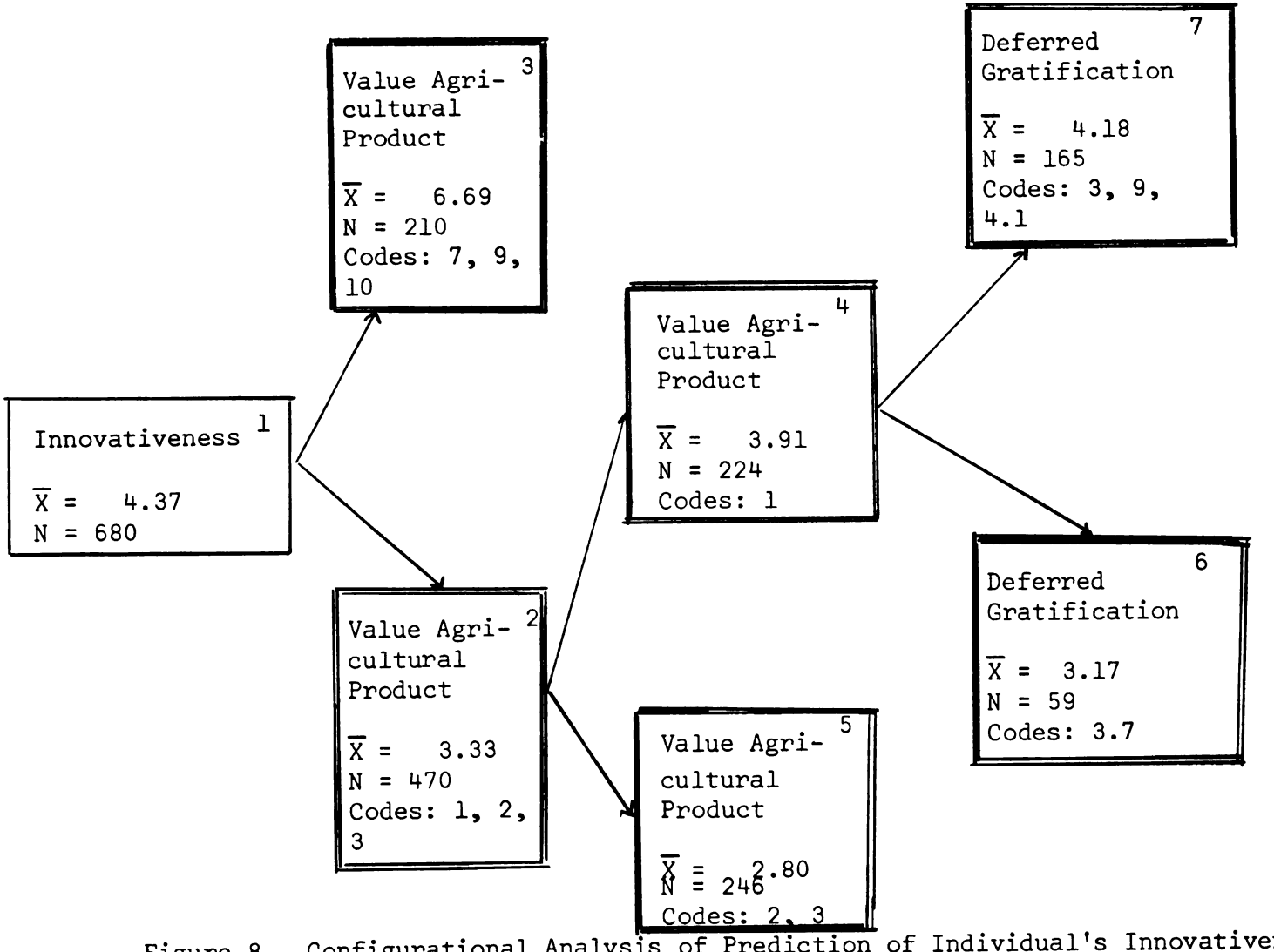

Figure 8. Configurational Analysis of Prediction of Individual's Innovativeness With System Variables.

Note: Means represent the subgroup's mean value on the dependent variable, N stands for the number of cases in the subgroup, and codes refer to the value of the independent variable.

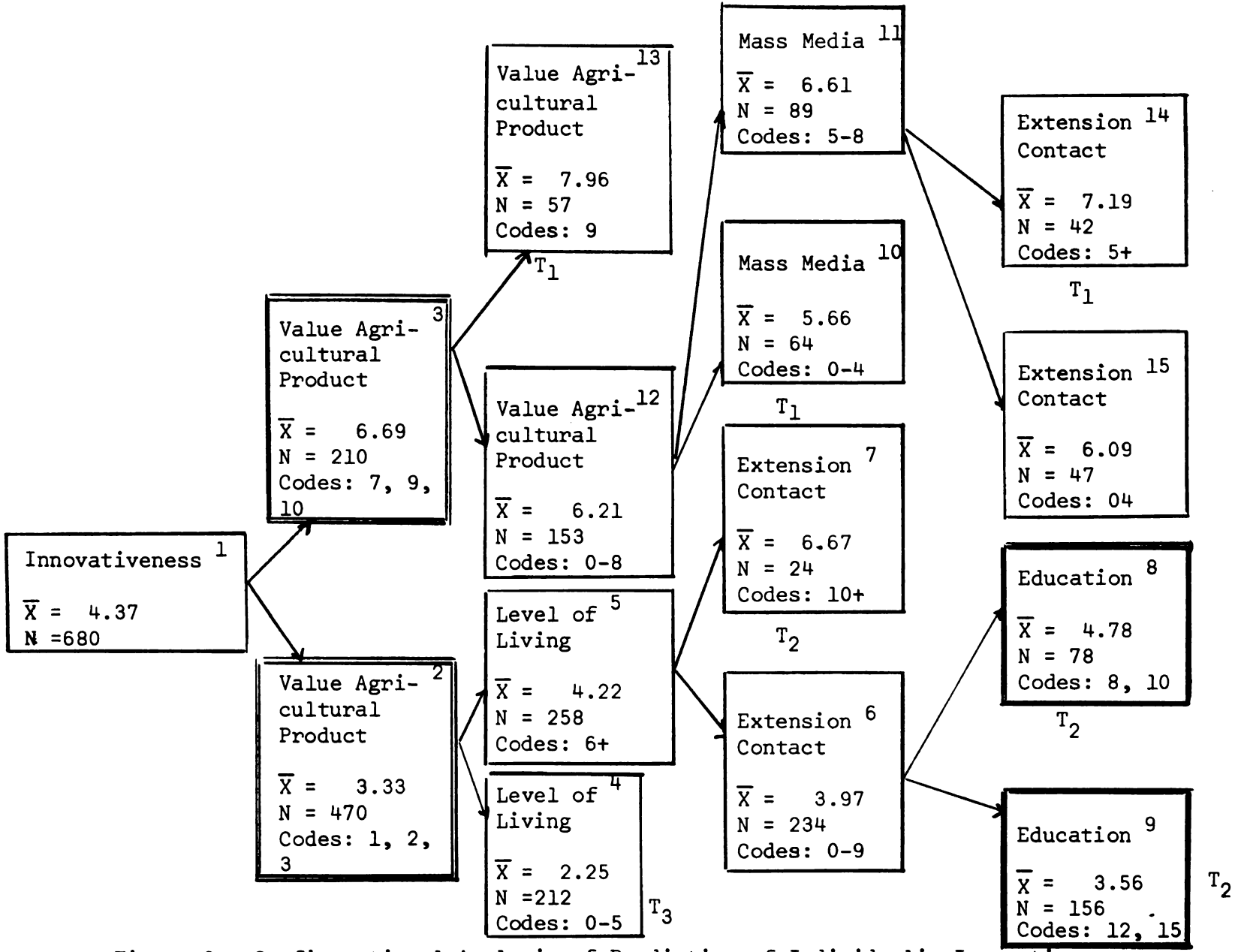

Figure 9. Configurational Analysis of Prediction of Individual's Innovativeness When Both Individual and System Variables Are Combined.

Note: [1]Means represent the subgroup's mean value on the dependent variable, N stands for the number of cases in the subgroup, and codes refer to the value of the independent variable.

[2]Boxes with single and double lines are individual and system variables, respectively.

only the higher VAP's from Split 2, this time on deferred gratification (DF). Thus, in systems with high value of agricultural products, the higher the VAP, the higher the innovativeness. However, among systems with low VAP, the lower the VAP and the higher the DF, the higher the innovativeness.

Why are only two system variables important as explanatory variables? Unlike multiple correlational analysis, the interaction-detecting process is, in most cases, not affected by intercorrelations among the independent variables. The process operates sequentially and uses only the predictor which is the most powerful, and drops the others. Only two system variables, namely VAP and education of the system (ED), enter into the configuration because they are highly correlated with the remaining system variables and thus account for most of their variance.

When both individual and system variables are considered (Figure 9), the sample initially splits on the system variable VAP in attempting to explain variation in individuals' innovativeness. In general, the greater the VAP of the system, the greater the innovativeness of the individuals. Further conjunctive effects of the individual and system variables are presented as follows.

1. Besides the value of agricultural product of the system, the individual value of agricultural products is also associated with innovativeness. Thus, the greater the VAP of the individual and also of the system, the greater

the innovativeness of the individual. Among the individuals with lower VAP who live in the system of higher VAP, those with frequent contact with extension personnel and higher mass media exposure (MM) are more innovative than their counterparts.

2. Among the individuals who live in a system characterized by lower VAP, those with a higher level of living are more innovative than individuals with a low LOL. Further, among the higher level of living group, either of two variables is associated with relatively higher innovativeness: a higher score on individual extension contact, or a lower educational attainment of the system.

3. In terms of the differences in the patterns of configuration in Figure 9, compared with those in Figure 7 or 8, it is apparent that not much interaction with system variables is detected for high VAP's after the first split of the sample on the value of agricultural product of the system. But for lower VAP's, interaction with systemic education is prominent. Individual levels of living become irrelevant for higher VAP's which is the most discriminating attribute for low VAP's. At either level (individual or system), education is not an important discriminator, but when both individual and system variables are involved, education becomes one of the best explanatory variables.

In addition to demonstrating the manner in which individual and system variables interact, sequential interaction analysis allows us to formulate typologies of

individuals such that people are highly homogeneous within a typology and highly heterogeneous between typologies. Any gain in homogeneity within and heterogeneity between will yield imporvement in predicting innovativeness. Our assumption is that inclusion of the system variables allows us to formulate more homogeneous typologies and increase the accuracy of prediction. The findings are reported in Table 5.

From Table 5, it can be seen that inclusion of system variables provides, with no exception, a greater range of means and a much reduced standard deviation around the means for all the typologies of the individuals than when either of the two sets of variables (individual or system variables) are considered separately. When system variables are included, the mean value of innovativeness between the typologies ranges from 2.25 to 7.96 and the standard deviation around these mean values ranges from 1.28 to 1.91 within these typologies. Considering the typologies based on either the individual variables or the system variables, the mean values are quite narrow (1.95 to 7.21 for individual variables, and 2.80 to 6.69 for system variables) with a wide range of standard deviations (1.74 to 2.33 for individual variables and 1.64 to 2.36 for system variables).

From Figure 9 three possible typologies emerge. Those who are generally most innovative ($\bar{X}$ = 6.69, N = 210) are typified by a high value of agricultural products (N=57), or by a low value of agricultural products, with a high mass

Table 5. Configurational Typologies of Innovativeness.

Type					Standard Deviation	Mean	Number of Cases	
I	With System and Individual Variables							
	1. Hi Value Ag(S)*	Hi Value Ag(I)**			1.43	7.96	57	
		Lo Value Ag(I)	Lo Media Exp(I)		1.50	5.66	64	
			Hi Media Exp(I)	Hi Ex Cont(I)	1.79	7.19	42	T_1***
				Lo Ex Cont(I)	1.41	6.09	47	
	2. Lo Value Ag(S)	Hi Living(I)	Hi Ex Cont(I)		1.28	6.67	24	
			Lo Ex Cont(I)	Lo Educ (S)	1.73	4.78	78	T_2***
				Hi Educ (S)	1.77	3.56	156	
	3. Lo Value Ag(S)	Lo Living(I)			1.91	2.25	212	T_3***
II	With Individual Variables							
	1. Hi Value Ag	Hi Living			1.84	7.21	105	
		Lo Living	Hi Cr.Orient		1.74	5.91	102	
			Lo Cr.Orient		2.33	4.16	61	
	2. Lo Value Ag	Hi Living	Hi Ex Cont		1.89	5.37	59	
			Lo Ex Cont	Lo Value Ag	1.74	2.95	89	
				Hi Value Ag	1.98	3.92	132	
	3. Lo Value Ag	Lo Living			1.77	1.95	132	
III	With System Variables							
	1. Hi Value Ag				1.80	6.69	210	
	Lo Value Ag	Hi Value Ag			2.36	2.80	264	
		Lo Value Ag	Hi Def Grat		1.75	4.18	165	
			Lo Def Grat		1.64	3.17	59	

*(S) indicates system variables

**(I) indicates individual variables

***T_1, T_2, and T_3 are the typologies of innovativeness obtained when both individual and system variables were subject to configurational analysis. These are the typologies to be discussed later as most, moderate, and least innovative, respectively.

media exposure and frequent contact with extension personnel (N=42). Of these 210 respondents in T_1 (Table 5) with high VAP, about half are low on the three aforementioned variables but are still innovative because of the systemic influences on them. This description generally fits the four subgroups highest on systemic VAP (found in the system with a high value of agricultural products).

A second type (T_2) are those who are moderately innovative on the average, ($\bar{X}$=4.22, N=258). These respondents are found in the system that has a low value of agricultural product and more than 90 percent of them have low systemic education. These respondents are typified by a high level of living. Only one-fourth of them have high or moderate extension contact.

The third type (T_3) is the least innovative group on the average, ($\bar{X}$=2.25, N=212). These respondents have a low level of living and are found in a system that has a low value of agricultural products.

Still another purpose of using sequential interaction analysis is to demonstrate the degree of increase in prediction by simultaneous consideration of both individual and system variables over and above the variance in innovativeness explained when either individual or system variables are considered alone. Such a simultaneous consideration results in explaining 65 percent of the variance in innovativeness, and is marked by an increase of 10 and 25 percent more variance over that explained by individual and system variables, respectively.

Two-Way Analysis of Variance: One of the concerns of the present thesis was to view the individual in the context of the system of which he is a member. A two-way analysis of variance is utilized to accomplish this objective wherein differences between rows represent differences in the characteristics of the individual, while differences between columns correspond to the differences in the characteristics of the system. This technique is considered appropriate (1) to determine whether differences among individual and system characteristics and interaction of the two are significant, and if so, (2) to determine the conditions under which individual variables will predominate over systemic variables and viceversa.

For an analysis within a balance theory framework, the dichotomization of individual and system variables into high and low levels was used to construct four typologies of farmers. High levels for either farmers or social systems were considered to represent "modern" and low levels to suggest "traditional". These typologies are: (I) traditional individuals living in a traditional system, (2) traditional individuals living in a modern system, (3) modern individuals living in a traditional system, and (4) modern individuals living in a modern system.

Within each of these typologies, three types of pressures on individuals are assumed to operate. One is internal social system pressure to innovate or to resist change, depending on the norms of the system. The second is an individual,

psychological pressure to innovate or reject innovations, depending on whether the individual is modern or traditional. The third is pressure to innovate from a source external to the system, e.g., from a change agent.

These typologies and balance theory considerations led us to anticipate that the innovativeness of individuals would be higher when both the individual and system are modern than when both of them are traditional ($\bar{X}$ of Cell 4 > $\bar{X}$ of Cell I). This notion is examined by a comparison of means in Tables 6-13.

Tables 6-13 show the means for the four conditions on innovativeness, the F-value for differences between the means and their interaction. In general, we find that differences across the individual level variable are significant for all eight variables except credit orientation and urban pull. Education is the only variable for which differences across the system level variables are not significant. The interaction between the individual and system level variables is significant for all the eight variables except for the value of agricultural product and urban pull.

The data provide support for the anticipated relationship. The t-value for the difference between means in Cells I and 4 is significant at the 5 percent level for all eight variables. As mentioned in Chapter I, both situations are balanced in that the overt behavior of the individuals demanded by the system is in line with their individual behavior on the same variable. Innovativeness of Cell 4

TABLE 6. Mean Innovativeness Scores Across Individual and System Measures of Education.

Individual's Education	Systemic Education: Low	Systemic Education: High
Low 1	$\bar{X}$ = 3.73 (N = 267)	2 $\bar{X}$ = 3.32 (N = 119)
High 3	$\bar{X}$ = 5.19 (N = 135)	$\bar{X}$ = 5.53 (N = 159) 4

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 1.53
3, 4 = 1.19
2, 3 = 6.21*
1, 3 = 6.39*
2, 4 = 6.57*
1, 4 = 7.36*

F Value Across Individual Level Variable (I) =158.81*
F Value Across System Level Variable (S) = 0.23
F Value for Interaction (IxS) = 70.20*

*Significant at the 5 percent level.

TABLE 7. Mean Innovativeness Scores Across Individual and System Measures of the Value of Agricultural Products Sold.

Individual's Value of Agr. Product	Systemic Value of Agr. Product: Low	Systemic Value of Agr. Product: High
Low 1	$\bar{X}$ = 3.05 (N = 401)	2 $\bar{X}$ = 6.05 (N = 101)
High 3	$\bar{X}$ = 4.94 (N = 69)	$\bar{X}$ = 7.28 (N = 109) 4

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 13.79*
1, 3 = 7.02*
2, 3 = 3.55*
3, 4 = 7.65*
2, 4 = 5.24*
1, 4 = 20.14*

F Value Across Individual Level Variable(I) = 244.35*
F Value Across System Level Variable(S) = 71.87*
F Value for Interaction (I x S) = 2.99

* Significant at the 5 percent level.

TABLE 8. Mean Innovativeness Scores Across Individual and System Measures of Credit Orientation.

Individual's Credit Orientation	Systemic Credit Orientation: Low	Systemic Credit Orientation: High
Low 1	$\bar{X}$ = 2.87 (N = 162)	$\bar{X}$ = 5.72 2 (N = 98)
High 3	$\bar{X}$ = 3.36 (N = 146)	$\bar{X}$ = 5.30 (N = 274) 4

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 9.74*
3, 4 = 8.17*
2, 3 = 7.77*
1, 3 = 1.87
2, 4 = 1.54
1, 4 =10.71*

F Value Across Individual Level Variable (I) = 0.07
F Value Across System Level Variable (S) = 154.15*
F Value for Interaction (I x S) = 5.87*

*Significant at the 5 percent level.

TABLE 9. Mean Innovativeness Scores Across Individual and System Measures of Urban Pull.

Individual's Urban Pull	Systemic Urban Pull: Low	Systemic Urban Pull: High
Low 1	$\bar{X}$ = 3.10 (N = 312)	$\bar{X}$ = 5.67 2 (N = 193)
High 3	$\bar{X}$ = 3.18 (N = 55)	$\bar{X}$ = 6.1 (N = 120) 4

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 12.48*
3, 4 = 8.84*
2, 3 = 6.78*
1, 3 = 0.25
2, 4 = 1.70
1, 4 = 13.46*

F Value Across Individual Level Variable (I) = 2.19
F Value Across System Level Variable (S) = 227.83*
F Value for Interaction (I x S) = 0.99

*Significant at the 5 percent level.

TABLE 10. Mean Innovativeness Scores Across Individual and System Measures of Deferred Gratification.

Individual's Deferred Gratification	Systemic Deferred Gratification: Low	Systemic Deferred Gratification: High
Low 1	$\bar{X}$ = 5.92 (N = 117)	2 $\bar{X}$ = 2.69 (N = 81)
3	$\bar{X}$ = 5.91 (N = 152)	4 $\bar{X}$ = 3.52 (N = 330)

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 10.82*
3, 4 = 10.53*
2, 3 = 10.29*
1, 3 = 0.03
2, 4 = 3.01*
1, 4 = 9.98*

F Value Across Individual Level Variables (I)=50.62*
F Value Across System Level Variables(S) = 4.18*
F Value for Interaction (I x S) = 4.53*

*Significant at the 5 percent level.

TABLE 11. Mean Innovativeness Scores Across Individual and System Measures of Extension Contact.

Individual's Extension Contact	Systemic Extension Contact: Low	Systemic Extension Contact: High
Low 1	$\bar{X}$ = 2.99 (N = 292)	2 $\bar{X}$ = 4.58 (N = 151)
High 3	$\bar{X}$ = 4.85 (N = 78)	4 $\bar{X}$ = 6.47 (N = 159)

t Value for Difference Between Cell $\bar{X}$'S
1, 2 = 7.30*
3, 4 = 5.22*
2, 3 = 0.81
1, 3 = 7.40*
2, 4 = 6.83*
1, 4 =16.96*

F Value Across Individual Level Variable (I) = 56.68*
F Value Across System Level Variable (S) = 77.59*
F Value for Interaction (I x S) = 24.15*

*Significant at the 5 percent level.

TABLE 12. Mean Innovativeness Scores Across Individual and System Measures of Level of Living.

Individual's Level of Living	Systemic Level of Living: Low	Systemic Level of Living: High	
Low 1	$\bar{X}$ = 2.47 (N = 235)	$\bar{X}$ = 4.73 (N = 120) 2	t Value for Difference Between Cell $\bar{X}$'S 1, 2 = 9.80* 3, 4 = 5.83* 2, 3 = 0.29 1, 3 = 9.27* 2, 4 = 5.63* 1, 4 =18.25*
High 3	$\bar{X}$ = 4.65 (N = 114)	$\bar{X}$ = 6.12 (N = 211) 4	
			F Value Across Individual Level Variable (I)=121.28* F Value Across System Level Variable (S)= 82.68* F Value for Interaction (I x S) = 32.43*

*Significant at the 5 percent level.

TABLE 13. Mean Innovativeness Scores Across Individual and System Measures of Mass Media Exposure.

Individual's Mass Media Exposure	Systemic Mass Media Exposure: Low	Systemic Mass Media Exposure: High	
Low 1	$\bar{X}$ = 3.28 (N = 215)	$\bar{X}$ = 3.28 (N = 127) 2	t Value for Difference Between Cell X'S 1, 2 = 00 3, 4 = 5.65* 2, 3 = 3.69* 1, 3 = 5.08* 2, 4 = 9.47* 1, 4 =12.75*
High 3	$\bar{X}$ = 4.44 (N = 110)	$\bar{X}$ = 5.96 (N = 228) 4	
			F Value Across Individual Level Variable(I) = 15.99* F Value Across System Level Variable(S) =112.88* F Value for Interaction (I x S) = 16.78*

*Significant at the 5 percent level.

is greater than that of Cell 1 because the individuals in Cell 4 have both internal and external pressures to maintain changed condition while the individuals in Cell 1 are balanced until the external pressure to change is felt. However, one would expect the greatest rate of change over time in Cell 1, provided the external pressure to change is strong and enduring and is felt by the members of Cell 1.

Within the third objective, we also expected that traditional individuals living in a modern system would be more innovative than modern individuals living in a traditional system ($\bar{X}$ of Cell 2 > $\bar{X}$ of Cell 3). This expectation is also supported by the data for all eight variables except education and mass media.* In general, individuals in Cell 2 are more innovative than those in Cell 3. This is understandable because individuals in Cell 2 are experiencing a double pressure to move to Cell 4; one from the majority of the members of the social system (Cell 4) to move to Cell 4 (internal pressure), and the other from outside the social system (such as from change agents) is also being brought to bear upon the minority members in Cell 2 to move to Cell 4 (external pressure). Cell 3 members, on the other hand, have already accepted some change and experience pressure from the external sources to

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*In the case of these exceptions, either the differences among individuals or among systems are not significant, i.e., the range of variation is restricted.

maintain the changed condition. They will continue to accept more change, but probably at a slower rate than members of Cell 2.

Finally, we also expected that individual innovativeness would be affected more by system than by individual variable ($\bar{X}$ of Cell 2 - 1 > 3 - 1, and 4-3 > 4 - 2). Again, this expectation is supported by all eight variables in the analysis except education and mass media exposure. System effects seem to make a bigger difference than differences in individual levels of the variable. Emerging from this hypothesis is another proposition which suggests that even if an individual is low on a variable but lives in a system that is high on that variable, he will be more innovative than someone who is high on the variable but lives in a system that is low on that variable, given that the variable under consideration is related to innovativeness.

CHAPTER V

SUMMARY AND DISCUSSION

Summary

The present study focussed on the simultaneous and systematic consideration of individual variables and system variables in accounting for more variance in individual innovativeness than when either individual or system variables are considered alone. Individual variables were related to communication, social and psychological behavior of the individual. System variables were the aggregate measures of individual variables for each system.

Innovativeness in the present study was defined as "the degree to which an individual is relatively earlier in adopting new ideas than the other members of his social system" (Rogers, 1962, p. 20). We operationalized innovativeness as having ever used (or tried) an innovation regardless of when it was adopted and whether its use was continued. As such, an individual's innovativeness score is the total score based on his response regarding all ten agricultural innovations investigated in the present research. The scalability of the ten innovations was determined by Guttman scaling and factor analysis.

The social systems in the study were eight Indian villages from the states of Maharashtra, Andhra Pradesh, and West Bengal. Within certain restrictions, these villages were selected randomly to represent the range in village modernization. The sample of 680 farmers was also drawn randomly.

The major objectives of the study were threefold:

(1) To ascertain the degree to which system variables affect the innovativeness of individual members of a system.

(2) To determine the extent to which system independent variables affect individual innovativeness when the effects of individual independent variables are controlled.

(3) To understand the way in which system variables affect individual innovativeness under specified situations when interactions among the independent variables are controlled.

In order to achieve these objectives, we raised a series of logical questions. These questions are:

(1) Are there system effects? Do the properties of systems affect individual innovativeness? How much influence does the system exert over the individual's behavior?

(2) Are there system effects beyond individual effects (differences among individuals)? What is the nature of the relationship of individual and system

variables with innovativeness and with each other? Can these relationships of system effects on innovativeness be regarded as linear?

(3) Does the strength of system effects vary with different combinations and levels of independent system variables and independent individual variables? Do system effects tend to predominate in these combinations?

Presence of System Effects

System effects are the influence of systemic structure and/or composition on the behavior of the members of a social system. One of the objectives of this study was to "ascertain the degree to which system variables affect the innovativeness of individual members of a system." Our analysis produced correlations of 14 of the 15 system variables with innovativeness which were significantly different from zero at the 5 percent level. Further analysis indicated that correlations of all but two of the 15 individual variables were significantly different from zero at the 5 percent level. The exceptions were credit orientation and deferred gratification.

In the case of mass media exposure, secular orientation, and social participation, the "t" values for the difference between the correlations of an individual independent variable and a system independent variable, respectively, with innovativeness were not significant, and hence the individual and system level measures of these variables

were equally good predictors of individual innovativeness. In most cases the "t" values for the difference between the correlations of individual independent variables and the system independent variables were significant; in six cases system variables predict innovativeness better, and in another six, individual variables predict better.

The pattern of significant, zero-order correlations of independent variables with innovativeness suggests a threefold categorization of independent variables:

1. Those 12 variables whose individual and system levels are both related to innovativeness, i.e., all except the three named below (in #2 and #3).

2. Those whose individual but not system levels are so related, i.e., caste rank.

3. Those whose system but not individual levels are so related, i.e., credit orientation and deferred gratification.

We conclude, on the basis of the zero-order correlations, that the system-level variables are related to innovativeness.

System Effects Beyond Individual Effects

Our second objective was "to determine the extent to which system independent variables affect individual innovativeness when the effects of individual independent variables are controlled." Within this objective we had expected that system effects make a unique contribution

beyond individual effects in explaining innovativeness. In general, the partial correlations of the system variables (when the individual independent variables are controlled) showed a significant relationship with innovativeness.

We also had expected, within the second objective, that more variance in individual innovativeness would be explained by simultaneous consideration of both individual and system independent variables than by considering only individual-level variables. Multiple correlations of innovativeness with both individual and system measures of the same attribute were run. A comparison of these multiple correlations with the zero-order correlations of system variables with innovativeness indicated that the former were larger for all 15 variables.

Even clearer evidence of system effects beyond individual effects was provided when eight independent variables, both individual and system measures, were combined in a series of multiple correlations. A multiple correlation of individual measures resulted in explaining 48 percent of the variance in innovativeness. The equation involving system level measures explained 41 percent of the variance in innovativeness. But computing both individual and system-level measures in a multiple correlational equation accounted for 62 percent of the variance.

Our expectation was that the relationship between individual and system variables with innovativeness could be regarded as linear without sacrificing much of the

explanatory power of the correlation coefficients. The results showed that the relationship of all the individual variables with innovativeness may safely be assumed to be linear except for credit orientation and deferred gratification, for which there was no significant relationship insofar as the zero-order correlations were concerned. Contrarily, all the system variables were found to be curvilinearly related with innovativeness.

System Effects and Interaction Among Variables

Our third objective was "to understand the way in which system variables affect individual innovativeness under specified situations when interactions among independent variables are controlled." This objective was examined by means of sequential interaction analysis and two-way analysis of variance.

Three sequential interaction analyses were performed. In the first, only individual variables were subjected to configurational analysis in order to predict innovativeness. In general, the greater the value of agricultural product sold, and the higher the level of living of an individual, the greater his innovativeness.

The second run was concerned only with system variables in predicting innovativeness. We found that the greater the value of agricultural products sold in the system, the greater the innovativeness of the individual. However, for those systems with a lower value of agricultural products

sold, deferred gratification tended to discriminate the individual's innovativeness.

In the third run, both individual and system variables were included in the configurational analysis. The sample initially split on the systemic value of agricultural products sold, followed by the individual value of agricultural products sold, indicating that higher innovativeness is associated with both individual and systemic value of agricultural products sold. Further, among the individuals with low value of agricultural products but who live in a system that has a high value of agricultural products sold, those with frequent contact with extension personnel and high mass media exposure were more innovative than their counterparts.

Similarly, among the individuals who lived in a system characterized by a low value of agricultural products sold, those with a high level of living were more innovative. Further, among the higher level of living category, high innovativeness was associated with a high score on extension contact or a low educational attainment of the system.

Thus, sequential interaction analysis provided us with a configuration of variables organized in such a way as to demonstrate how variables combine to maximally explain variation in innovativeness. We were thus able to characterize three typologies of innovativeness: (1) the generally most innovative; (2) the moderately innovative; and (3) the least innovative respondents.

Another finding, and perhaps the most important, from the simultaneous consideration of both individual and system variables in sequential interaction analysis was that the configurations so obtained were more homogeneous than those configurations obtained by considering only individual or system variables alone. Such simultaneous consideration provided a greater range of means across typologies and a much reduced standard deviation within the typologies than when either individual or system variables were considered separately.

Interaction effects between the individual and system variables were also found to be significant in most cases when the data were analyzed by a two-way analysis of variance with system and individual variables dichotomized into high and low categories. The analysis showed that differences across individual level variables were significant for all the variables except credit orientation and urban pull. Education was the only variable for which differences across system level variables were not significant. The interaction between the individual and system variables was significant for all the variables except for the value of agricultural products sold and urban pull.

For an analysis within a balance theory framework, the dichotomization of individual and system variables into high and low levels were used to construct four typologies of farmers. High levels of either farmers or social systems were considered to represent modern and low levels to suggest traditional. Within each of these typologies,

three types of pressure on individuals were assumed to be operative. One was internal social system pressures to innovate or to resist change, depending on the norms of the system. The second was an individual, psychological pressure to innovate or to reject innovations, depending on whether the individual was "modern" or "traditional." The third was pressure to innovate from a source external to the system, e.g., from a professional change agent. Four typologies of farmers were conceived as:

I Modern individuals living in a modern system.

II Modern individuals living in a traditional system.

III Traditional individuals living in a modern system.

IV Traditional individuals living in a traditional system.

These typologies and balance theory considerations led us to anticipate that the innovativeness of individuals would be higher when both the individual and system are modern than when both of them are traditional. Our data provided support for the anticipated relationship.

Another exception was that traditional individuals living in a modern system would be more innovative than modern individuals living in a traditional system. This expectation was supported by the data for all eight variables except education and mass media.

Still another expectation was that individual innovativeness would be affected more by system than by individual

variables. Again, this expectation was supported by all eight variables in the analysis except education and mass media exposure.

Discussion

As mentioned earlier, two types of variables were conceptualized as possible explanatory variables of an individual's innovativeness. They are: (1) individual's variables, which relate to communication, social and psychological behavior of the individual, and (2) system variables, which signify systemic norms on individual variables. These two types are based on the assumption that the characteristics of the social system, as well as individual characteristics, facilitate or retard the process of adoption of new ideas.

Both types of variables, in general, were found equally effective in predicting an individual's innovativeness. In some cases, individual variables explained more variance in individual's innovativeness; in other cases, system variables are more explanatory. This finding accords well with the finding of van den Ban (1960), who studied the effects of traditional and modern norms on the innovativeness of farmers in Wisconsin townships. He found that although some characteristics of farmers such as education, size of farm, etc., were positively related to their innovativeness, township norms were even better predictors of farmer innovativeness. A similar finding is reported

by Qadir (1966), who analyzed data from the Philippines.

Marsh and Coleman (1954), van den Ban (1960), and Qadir (1966) recognized the influence of social system norms on farmer innovativeness. However, none of them focussed on the simultaneous and systematic consideration of both individual and system variables in accounting for more variance in individual innovativeness than that possible by considering either individual or system variables alone. Both Rogers (1961) and Flinn (1961 and 1963) included a system variable to improve the prediction of innovativeness, but their studies lacked two major considerations: (1) consideration of system variables, i.e., the system level measures of all independent variables were not included, and (2) the measure of systemic norm was not an independent measure, but rather derived from the measure of innovativeness, their dependent variable.

In the present study we focussed on the simultaneous and systematic consideration of both individual and system variables. Our results show that such consideration results in explaining 14 to 21 percent more variance in individual innovativeness than when either individual or system variables are considered alone.

Even more variance in innovativeness may be explained by system variables if the nature of the relationships of these variables is understood. In an attempt to determine the relationship of independent variables with innovativeness, we found that all the individual variables may be

assumed to have linear relationships with innovativeness, while all system variables seem to have a curvilinear relationship with innovativeness. Putting system variables in a multiple correlational analysis assumes linearity of the relationships, and the violation of that assumption depresses the multiple correlation coefficient. Thus, the explanatory power of the system variables was reduced and could be improved by using more sophisticated statistical tools that do not impose the assumption of linearity.

Not only do the system variables have curvilinear relationships with innovativeness, they are highly interrelated among themselves. It is because of their high interrelatedness that the explanatory power of one system variable is essentially the same as for any other.*

An examination of the nature of the curvilinearity of system variables showed that their relationships with innovativeness can be expressed as an "S" curve, with a point of "take-off" occurring at different points depending on the variable in question. In a sense, this take-off signifies a system phenomenon analogous to the psychological threshold notion. Possibly, it is at this take-off stage that a variable becomes a significant social object (norm) and, as such, generates an atmosphere in favor of innovativeness. The S curve held for all system variables except education. This exception is perhaps explained by

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*Among the relationships between each of the system variable and individual innovativeness, eta^2 varies only from .40 to .41.

the fact (1) that the eight social systems under investigation do not differ much from each other in respect to their level of education, and (2) that their present levels of education vary from a little less than a year to about two years of schooling. These levels are far lower than the take-off stage as found in two studies. Tumin and Feldman (1956) suggest the notion of a "modernization take-off" occurring at 4 to 6 years of formal schooling for their Puerto Rican respondents. Briones and Waisanen (1966) present similar findings from Chilean data.

Discussion of the interrelatedness of system variables bring us close to introducing the concept of complexity of system. Any system, especially a social system, is a configuration of relationships in which the properties of the system are confounded and are not attributable to one variable or the other, but are really the effects of all the variables. Selvin and Hagstrom (1963) criticize the work of Durkheim, Blau, and Davis for ignoring the interrelatedness of system variables. Selvin and Hagstrom use factor analysis to reduce the dimensions along which each system may be classified to a manageable number. These authors also advocate that use of aggressive system variables reduces errors of response and perception much more effectively than is possible with individual-level variables. The result claimed is that fewer factors are needed to describe a set of systems.

In our sequential interaction analysis, we obtained

many fewer configurations (predicting innovativeness) of system variables than of individual variables. We also found that farmers who are generally most innovative are typically high on value of agricultural products sold, considered both as an individual and system variable. The next most innovative configurations are low for the individual value of agricultural products sold, but high on individual mass media exposure and frequency of extension contact, and are found in a system that has a high value on agricultural products sold. This finding is supported by Qadir (1966), who concludes that the composition of more innovative village systems shows a concentration of individual households with high education, modern orientation, media contact, material possessions, and communication facilities, which together generate a social climate in favor of the adoption of modern ideas.

Our sequential interaction analysis also revealed a substantial degree of interaction between individual and system variables. This is conspicuous in the configurational analysis, especially in the case of less innovative categories. Interaction effects between the individual and system variables are also significant in most cases when the data are analyzed in a two-way analysis of variance design by dichotomizing system and individual variables into high and low categories. The results pose an interesting and, perhaps, theoretically significant concern with the process by which social systems generate dissonance in individuals.

We found that farmers high on both individual and system variables are high on innovativeness. However, a strong interaction is evident in the innovativeness of farmers who are high on one type of variable and low on the other, e.g., high on an individual variable but low on a system variable. In such imbalanced situations, system effects seem to predominate over individual effects, and the dominance is greater when individual effects are lower.

These findings are in accord with the general conclusion of Qadir (1966), and van den Ban (1960), although their research designs did not allow a direct test of these propositions about balanced and imbalanced situations. Qadir found that in a high innovative system, even individuals lacking much education, mass media exposure, or a modern orientation acted in an innovative manner. In his study of a sample of Wisconsin townships, van den Ban also concluded that a farmer with a high net worth, but residing in a township with traditional norms, adopted fewer farm innovations than if he were to farm in a township where the norms were modern.

The present findings regarding the influence of the social system on an individual's innovativeness agrees with previous findings relative to system effects but provide considerably more rigor. Most of the previous findings were speculative, not tested systematically, nor supported by theoretical underpinnings. Hopefully, the present study augurs the beginning of research designs which

simultaneously and systematically consider both individual and system variables in predicting individual innovativeness and provide a rationale for the existence of system effects.

Implications

Implications for Research

The present study was successful in explaining a rather substantial amount of the variance in innovativeness of farmers via a simultaneous, systematic consideration of both individual and social system characteristics. Further, it was unique in treating those characteristics in analogous pairs, i.e., an individual measurement and a social system measurement of a single variable.

We suggest then that this approach holds promise for future researchers, possibly with other variables or the same variables more precisely measured. It could well lend itself, as Kendall and Lazarsfeld (1950) contend, to avoidance of the "ecological fallacy" (Robinson, 1950), "psychologistic and sociologistic fallacies" (Riley, 1963), and "individualistic and group fallacies" (Scheuch, 1965).

This approach appears fruitful for the simultaneous, systematic study of individual and system variables, utilizing different social systems or a wider range of social systems than in the present study. Extending the scope of inquiry to cross-cultural settings might well

contribute to building a more adequate theory of system effects.*

Additional variables that should be considered include indicants of the political, economic, religious, institutional development of the systems, and an index of the amount of interpersonal communication or linkages in the village (e.g., village size may be one indirect indicator of interaction and composition of the social system). All of these variables tend to vary across systems, and are integral properties of systems. We did not consider integral properties of the systems, having only confined our eight system variables to aggregative properties of the systems. We did so for certain reasons. One was that we wanted to treat the variables in analogous pairs (i.e., an individual-level measurement and a social system-level measurement of the same variable). The other was that our choice of system variables was limited to only eight because we studied only eight social systems. We would have included some system variables representing the integral property of the system had our sample included more systems. Our expectations, however, are that integral variables should yield more explained variance or at least shed more light on the complex interrelationships of systemic concepts related to individual innovativeness. Further research might employ criterion other than the village for

*A companion study (Davis, 1968) completed in the Department of Communication, Michigan State University, indicated that system effects, while present, are not as strong in the context of Nigerian farmers as in the case of Indian farmers.

defining the boundaries of the system (such as small groups based on sociometric choices or leadership within the village).

The present study also supports the importance of the notion of threshold or "triggering" levels of system variables. In both theoretical and applied fields, we need answers to such questions as: How many years of schooling are necessary before education becomes a social object (norm) for a social system and tends to bring the system into a self-propelling stage in educational development? Tumin and Feldman (1956) and Briones and Waisanen (1966) suggested a minimum of 4 to 6 years. Does this level hold generally in India and elsewhere? Lerner (1958) proposed an optimum level of 10 percent for his national urbanization variable before literacy rates were effected. What is the optimum level and under what conditions is it optimal for the many other variables related to innovativeness? Separate studies are needed to attack these questions.

The balance theory approach utilized in a portion of the present study was successful within the constraints of the data and analytic techniques, but was more suggestive than conclusive. Future efforts might well be addressed to a more precise measurement and analysis of individual and system variables treated here dichotomously. They might thus achieve a wider range of explanation and theoretical generalizability.

Further, in studying the balance notion, we assumed

the pressures bearing on the balance-imbalance of a system were at the ordinal level of measurement at best. (i.e., high and low pressure). One pressure, that from external sources, was assumed to be constant. Our results suggest that independent system variables tend to dominate in predicting the dependent variable, rather than individual variables. Future investigations would do well to examine the degree of pressures applied and their relative intensity. And in so doing, a wide range of levels of external pressure should be considered.

Finally, we must add our voice to those recommending more attention to matters of cause and effect. The present study was subject to certain methodological limitations. One concerns the nature of the relationship between the independent variables and innovativeness. We could not determine the causal nature of these relationships. We attempted to overcome most of the problems* for which Tannenbaum and Bachman (1964) criticized the methodology of Blau (1957) and Davis and others (1961), in detecting system effects. But the basic problem of cause and effect remains untouched by our predominately correlational analysis. A first step toward a frontal attack on the problem might fruitfully involve the general approach used in the present study within a field experimental design to allow manipulation of the dependent and independent variables.

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*Most of these problems are concerned with the contamination of individual variables with system variables. A detailed description of these problems was given in Chapter II.

Implications for Action

Results of the present research underline the importance of system effects on individual innovativeness. The results show direct implications for a change agency desirous of introducing innovations in villages. These implications might provide guidelines for change agencies in mapping strategies for change.

One implication is that a change agency must pay attention to both characteristics of individuals and of social systems when selecting prime targets of change. The agency could then decide what programs of change might be best introduced where and for what type of individuals to yield maximum returns with minimum input of resources. Thus, a change agency might better decide where to emphasize agency contact, where the mass media facilities are most needed, or what type of individuals most deserve educational facilities. In these allocation decisions, the change agency should consider system, as well as individual, variables.

Another implication is concerned with the notion of thresholds. Our results indicate that all system variables have curvilinear relationships with individual innovativeness. Such relationships can be expressed as an "S" curve, with a point of "take-off" occurring at different points depending on the variable in question. As such, a social system may have reached the threshold level in one variable but not in others. It may, therefore, be necessary to

concentrate efforts on those variables that have not yet reached the threshold level and pay less attention to those variables that have reached a transitional point. Similarly, much more effort and inputs may be necessary for certain communities that are far behind the take-off stage in almost all variables.

Still another implication is concerned with an integrated approach to development. By an integrated approach we mean that the modernization program should be comprehensive in that all related aspects must be tackled simultaneously. Our study indicates that all system variables are highly interrelated. Their high interrelatedness denotes that aspects of modernization are interrelated and that no lasting results may be achieved if unique aspects are dealt with in isolation. This does not mean that particular problems should not be given prominence, but the plans for them should be integrated with others.

Finally, while most programs of change reach the more modern, they may miss that part of the target population which has the greatest need for change. In order to ensure a continued effective program of change, a change agency might do well in separating systems (or subgroups within a system) that are balanced or imbalanced with respect to systemic and individual orientations towards change. In doing so, it will be relatively facile for the change agency to decide (1) which systems need more attention, (2) which systems will change more over time, and (3) which specific

inputs in their individual and system form will be required for each system. Our results suggest that in imbalanced situations, system effects seem to predominate. Thus, for imbalanced situations, systemic inputs, such as educational facilities for the whole community, may be the best approach. However, attempt to change a norm of the system may have unforeseen consequences which should be considered well in advance.

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APPENDIX

National Institute of Community Development

Hyderabad - 30

Diffusion of Innovations Research Project

PHASE II - QUESTIONNAIRE

1. STATE A.P. M. W.B. Subject No.

2. VILLAGE Interviewer

3. NAME OF RESPONDENT Date of Interview

Caste Time began

4. (Fill in without asking if the answer is obvious) Time ended

Time elapsed

What is your caste

Religion Tribe

Education of the Respondent

(Interviewer write actual grade, matriculate, 1st year college, B.A., M.A., etc. If no formal education write 'None'.)

Secular Orientation

16. When your bullocks become too old and feeble to work what do you do, sell them or keep them?

0 - Keep them; 1 - DK; 2 - Sell them

17. Do you think most people would be in favor of keeping up a goshala in the village to feed old and useless cattle?

18. Do you feel that non-Hindu and lower-caste Hindus should be allowed to eat whatever meat they wish?

Value of Agricultural Products

7. How many acres of land did you cultivate last year?

Acres

(INTERVIEWER: If the number of acres is less than 2.5 then stop the interview here. If it is 2.5 and above then go on to the next question.)

14. What were the main crops grown in this land this past year?

A. How many acres .....did you grow the past year?

B. What was your total production of ..... on this area?

C. About how much of this .....did you sell?

19. What yield did you get on your irrigated, (or having assured water supply), main paddy crop last year (1966)?

1 - DK; Mds./Acre 9 - NA

20. What yield do you get in a normal year on your irrigated (or having assured water supply) main paddy crop?

1 - DK Mds./Acre 9 - NA

21. What yield do most other farmers in this area get on irrigated (or having assured water supply), main paddy crop in a normal year?

1 - DK; Mds./Acre 9 - NA

22. What do you think is a really top yield for irrigated (or having assured water supply), main paddy crop in this area?

1 - DK; Mds./Acre 9 - NS

Innovativeness

28. Have you ever tried ..... in 1966?

	No	Yes
1. High yielding varieties - rice	0	2
2. Jawar, Bazra, Maize	0	2

35. Have you ever used .....?

1. Fertilizers - Am. sulphate	0	2
2. Superphosphate	0	2
3. Mixtures	0	2
4. Insecticides for plant protection	0	2
5. Green manure	0	2
6. Cultivator or weeder	0	2
7. Improved breeding of cattle	0	2
8. Animal innoculation	0	2
9. Rat poison	0	2

Credit Orientation

41. Did you use credit for farm purposes in 1966?

0 - No; 1 - DK; 2 - Yes

42. Would you have used (some/some more) had it been available at reasonable interest?

0 - No; 1 - DK; 2 - Yes

Extension Contact

45. Last year (1966) did you:

	Exposure			How many times
	No	DK	Yes	
Talk with BDO	0	1	2	
Talk with VLW	0	1	2	
See an agricultural demonstration	0	1	2	
See a block film on agriculture	0	1	2	
Talk with the Block Doctor	0	1	2	
Talk with a family planning worker	0	1	2	

Deferred Gratification

46. Suppose that your cash returns from the farm last year had been twice your actual income, what would you do with the extra money?

Social Participation

50. Do you hold any position(s), including membership, in any formal organizations?

0 - No; 1 - DK; 2 - Yes

51. What are they? 0 - NA

Office/Membership	Organizations
.....	.....

52. Where is your home?

Circle 0 - This village; 2 - Another place (Name.....)

53. When did you come to this village to stay? 9 NA

Urban Contact

54. Have you ever lived away from this village for more than one year?

Circle 0 - No; 1 - DK; 2 - Yes

55. If yes, where, how long and for what purposes? (Probe for military service).

	Name of place	Duration	Purpose of Stay
Another village			
Town (less than 100,000)			
City (100,000)			

56. How many times have you visited the following places last year?

	No. of visits
Town (less than 100,000)	
City (100,000)	

Urban Pull

57. If you are offered a job in a city with double your present income, will you go?

Circle 0 - No, 1 - DK; 2 - Yes 9 - NA

Mass Media Exposure

58. Do you listen to radio?

Circle 0 - No, 1 - DK; 2 - Yes

59. What programs do you listen to?

1 - DK 2 - Check appropriate categories below

60. Do other members of your family listen to radio?

Circle 0 - No, 1 - DK, 2 - Yes

61. What programs do they listen to?

1 - DK 2 - Check appropriate categories below 9 NA

Type of program	Respondent	Family
Songs and recreational programs		
News		
RRF and other farm programs		
Other		

62. Did you see any cinema films during 1966? (Reference is to commercial films, not to those shown by the Block)

Circle 0 - No, 1 - DK, 2 - Yes

63. How many?

1 - DK; 9 - NA

64. Can you read a newspaper?

Circle 0 - No, can't read 1 - DK 2 - Yes

65. Can you write a letter?

Circle 0 - No; 1 - DK, 2 - Yes

66. Did you read (did anyone read to you) any newspapers in the past week? How many?

Circle 0 - No papers read/read to him
1 - Can't read, but had papers read to him (No._____)
2 - Can read, and read one or more papers (No._____)

Educational Aspirations

76. How much schooling would you like your youngest son to have?

Circle 0 - None; 1 - DK, 2 - Some(No. of years____)
9 - NA

77. Do you think this will be possible?

Circle 0 - No; 1 - DK; 2 - Yes; 9 - NA

82. Can evil eye cause disease?

0 - No 1 - DK 2 - Yes

83. Have you made an offering or sacrifice to prevent sickness?

0 - No 1 - DK 2 - Yes

84. Should Harijans be allowed to draw water from all common wells in the village?

0 - No 1 - DK 2 - Yes

85. Should Harijans and other children take meals together in schools.

0 - No 1 - DK 2 - Yes

86. If your son wanted to marry a lower caste girl would you allow it?

0 - No 1 - DK 2 - Yes

87. Do you think Harijans should be allowed to enter and worship in all temples of the village?

0 - No 1 - DK 2 - Yes

88. In your opinion, is an illiterate village Brahmin superior to a lower caste B.A. or M.A.?

0 - No 1 - DK 2 - Yes

Empathy

Let me now ask your opinion about a different subject. There are ups and downs in everybody's life. One can achieve a high position. On the other hand those who are at present very well placed could go down. Please tell us what you would do if you found yourself in the following positions. Please don't think that we are making fun of you.

89. If you were the B.D.O. of this block, what program of agriculture would you make or conduct?

90. (Don't ask if the respondent is the Panchayat president)

If you were President of the Panchayat here in your village what would you do in the next year?

91. If you were a day laborer, what would you do to own some land?

92. If you were District Collector what would you do to solve some of the major problems of this area?

Political Knowledge	Incorrect	Correct
98. Who is the Prime Minister of India?	0	1
99. Who is the Chief Minister of your state?	0	1
100. Who is the M.L.A. of your area	0	1

Level of Living

127a. I have mentioned before that one of the major purposes of this investigation is to find out about the general conditions of living in our villages. This is important because the government can take steps or suggest steps for improvement only when they have a correct idea of the general living conditions of our village people. To get this information, we are asking everybody about their income, expenditure, indebtedness, things they possess and housing conditions. Let me ask you the same questions which I have asked others and have received full cooperation.

127b. Do you own the following things?

Circle	No	Yes
Good dress to wear for attending fairs, weddings, etc.	0	2
Shoes	0	2
Gold Jewelry	0	2
Wrist watch or clock	0	2
Torch light	0	2
Wooden/metal furniture	0	2
Mosquito nets	0	2
Bicycle	0	2

128. HOUSING

'0' for None and '2' for Yes. If listed items are present in combination with non-listed items then Circle '2'.

		No	Yes
1.	Brick or stone walls	0	2
2.	Windows with shutters	0	2
3.	Cement or stone floor	0	2
4.	Tiled/tin/asbestos/cement roof	0	2
5.	No. of rooms (Write actual number)	0	2
6.	Separate sitting	0	2
7.	Own well/tubewell	0	2
8.	Separate bathroom/latrine	0	2
9.	Two storied house	0	2

129 How much money (including food) does your family need per month to live comfortably in this village?

Rs._____

130. How much tax did you pay last year?

No tax _____

Rs. _____