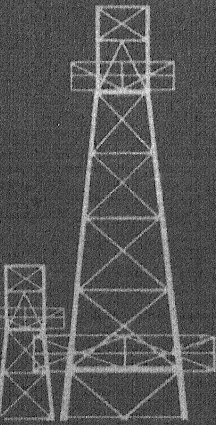
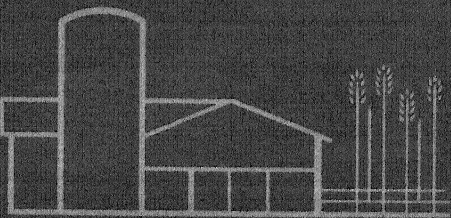


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NORTH CENTRAL
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BULLETIN 186

DIFFUSION RESEARCH NEEDS

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Preface

This publication is the third in a series of bulletins by the Subcommittee for the Study of Diffusion of Farm Practices. This group is a part of the North Central Rural Sociology Committee, sponsored by the Farm Foundation, Chicago, Ill., and the Association of Land-Grant Colleges and Universities.

North Central Regional Extension Publication No. 1, *How Farm People Accept New Ideas*, received widespread interest. Over 80,000 copies were distributed in the first four years of its publication. The second entitled *Adopters of New Farm Ideas, Characteristics and Communicative Behavior* (North Central Regional Extension Publication No. 13) was intended to

complement the first and to present findings of additional research.

This publication is designed to stimulate thought regarding diffusion research needs and possibilities for extending such research substantively and methodologically.

*Subcommittee for the Study of
Diffusion of Farm Practices*

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DIFFUSION RESEARCH



NEEDS

Introduction

Diffusion research in agriculture originated out of a need to facilitate the flow of scientific farm information from research agencies to farmers and other clientele. Understandably, the first diffusion research was done by the Cooperative Agricultural Extension Service, the agency charged with the responsibility of disseminating farm information. Beginning with state and national extension service studies of farm practice adoption and reasons for adoption during the midtwenties¹ and later by rural sociologists,² no less than 400 diffusion investigations have been published in the United States. Most have been of recent date.³ Such studies also have been conducted in at least a dozen countries outside the United States and have been directed increasingly to non-agricultural innovations and information.

Diffusion studies have been defined as those concerned with "(a) *acceptance*, (b) *over time*, (c) of some specific *item*—an idea or practice, (d) by individuals, groups or other *adopting units*, linked (e) to specific *channels* of communication, (f) to a *social structure*, and (g) to a given system of values, or *culture* (95)."

Although agricultural diffusion studies have been concerned with almost all of these aspects, the adoption of

¹Numbers outside of parentheses are used throughout this publication to indicate footnotes; numbers within parentheses to indicate listings in the alphabetical bibliography at the end of the bulletin. Footnote "1" thus reads, "For a number of those studies see Smith and Wilson (178)."

²For two classic studies that marked the advent of rural sociologists into the diffusion research field see (173) and (81).

³For a recent comprehensive bibliography of diffusion studies see (168). This bibliography is periodically revised and made available for limited free distribution by the publisher.

practices by individuals, factors associated with adoption, and channels of communication used in arriving at adoption decisions have been studied most. This has been one of the fastest growing, widely known areas of research in which rural sociologists have been engaged. Findings have been summarized in two books⁴ and a number of papers.⁵ Suggested applications have been made, either orally or in writing, for public health, education, business, industry, marketing, advertising, family planning, and agricultural development in developing countries.⁶

Many of the generalizations from agricultural diffusion research studies have been corroborated by findings from other diffusion research traditions quite independent of the one in rural sociology and generally later in point of time (95; 159, pp. 19-56). Interest and concern with diffusion research continue unabated. Although the research has netted a body of reasonably well verified knowledge, deficiencies exist in theory, method, and subject matter content, as has been suggested elsewhere.⁷ The Diffusion Subcommittee does not presume to offer a systematic assessment of the strengths and weaknesses of the research done to date. Rather, the purpose of this effort is to offer suggestions for extending the frontiers of diffusion research, findings, methods, and theory.⁸

The lack of a commonly accepted theoretical framework within which various views about diffusion research needs can be interpreted makes it difficult to formulate a composite statement of research needs. And those who wish

to benefit appreciably from such a statement, must become involved in extended creative activity that transcends mere reading and response to a document such as this one. For these reasons, it is felt that a variety of ideas might produce more creative individual thought than a single statement in which the views of individual researchers are tempered in the interest of including them in a single document.

Consequently, each researcher has offered his suggestions for extending the frontiers of diffusion research findings, method, and theory. The focus of each is sufficiently different to avoid extensive duplication. No attempt has been made, however, to preclude duplication of suggestions and recommendations. It is hoped that the readers may be stimulated by the study of these four perspectives, their differences, and their underlying agreement, as were the authors in preparing this document. If so, the purpose of this effort will have been served.

Coughenour is primarily concerned with the clarification of certain concepts (e.g., innovation, technology, etc.) and with the development of a general framework for the consideration and the relation of diverse findings in diffusion research. Although much research has dealt with macro-system analysis of individual adopters and the structures in which adoption decisions are made, Coughenour focuses on the macro-system involved in the communication and preparation of ideas for presentation to adopters. He suggests the need for research on problems that specify the conditions under which individual adopters make decisions and sources of support for their actions in using new ideas.

Bohlen, in his section, attempts to show the historical development of one of the adoption models and makes suggestions for research to expand the knowledge about theories of adoption-diffusion.

Lionberger is primarily concerned with interpersonal communication and influence. He has written on research needs related to such facets as conceptualization of functions performed by individuals in the individual adoption process, role expectations in relation thereto, factors that structure interpersonal communication and influence, and the manner in which the interacting people are articulated with outside sources of scientific farm information.

Rogers, primarily interested in the diffusion of innovations in developing societies, directs an investigation on this subject for Michigan State University in Brazil, Nigeria, and India. His paper sets forth a number of priority topics for future diffusion research in developing countries as well as in the United States. Among the investigation needs, Rogers stresses concepts for communication research that have not been studied in a diffusion context.

⁴For an early summary of research findings relating only to diffusion studies in agriculture, see (103); for a later and more comprehensive treatment see (159).

⁵For one such paper see (19).

⁶For some examples of attempted application of diffusion research findings to non-agricultural action efforts see (106; 107; 114; 162).

⁷The utility of the 5-stage individual adoption process has been questioned by Hassinger (77) and Mason (126); the atomistic approach to explain farm practice adoptions by Benvenuti (14), the lack of theory by Anderson (5) and the limitation of applicability by Campbell (30), to mention a few.

⁸The reader may wish to examine a critical treatment of the stage formulations of the individual adoption process independently published by Rex R. Campbell (30).

in Diffusion

From the Perspective of the Theory of Social Action

C. Milton Coughenour⁹

THEORETICAL CONSIDERATIONS

Most of the studies of diffusion completed in the last two decades have been conducted within the framework of a socio-psychological model. The principal components of this model are: (a) the *innovation* being diffused, (b) the *person or source* of information about the innovation, (c) the *person who receives* information and *adopts* the innovation, (d) the *media, channel, or structure* through which information is transmitted, (e) the *situation(s)* in which information is transmitted and adoption occurs, and (f) the *time span* during which the diffusion of information and its adoption occur (95; 156; 197).

The six components of the model are general concepts that orient the investigator to problems of research and to the organization and analysis of data.¹⁰ The concept of innovation is a broad one. The innovation may be of any type, i.e., there is no restriction as to its properties.

Similarly, the person, as a source of information or as an adopter, may be described by a variety of personal attributes, such as his knowledge, attitudes, and psychological properties (e.g., age), and by his social characteristics, such as status, role, and information seeking and transmitting behavior. Each attribute is viewed as a variable between individuals and for each person over time. In most research studies, the knowledge, attitude, and behavior of a person presumably change as the innovation is accepted, but the innovation itself presumably does not. This assumption of the constancy of the innovation presents a problem that has not been adequately dealt with.

The model imposes no restriction as to the sources from which information emanates or the mechanisms by which it is transmitted to receivers. Sources and trans-

mitting mechanisms also are describable in terms of various properties—personal, impersonal, institutionalized, etc.

The concept of the situation in which diffusion and adoption occur includes three main components, not including the adopter and the source of information (33; 44): (a) The adopter's enterprise, which may be described as to scale, type, etc.; (b) the group(s) to which the adopter and/or the source belong and the occasions when group activity occurs; and (c) the culture, including the values and norms relevant to both the contacts between potential sources of information and the acceptance of innovations in general, as well as to the particular innovation being diffused. Another important component of culture is the set of items functionally related to the innovation; i.e., other techniques, expressive symbols, and modes of organizing behavior.

In diffusion considered as a process, time is a key control variable. It enables the investigator to separate different states of the knowledge-attitude-behavior of the adopter and to view these as functions of other personal and situational variables.¹¹ For example, the change over time from non-use to use of an innovation among members of a population can be described in terms of the origin, rate, and equilibrium of diffusion. Variation in each of these components of the diffusion curve can be analyzed in terms of a variety of group factors.

The usefulness of the socio-psychological model is indicated, for instance, by the more than 50 generalizations listed by Rogers¹² that have emerged from research based on this scheme. In another list of 51 general propositions of socio-cultural change, the components of 39 are contained in the socio-psychological approach (100).

⁹Professor, Sociology Department, University of Kentucky.

¹⁰A number of attempts have been made to build hypothetical models of adoption: (42; 56; 63; 202).

¹¹There is a rapidly growing literature on causal analysis in survey and other types of non-experimental research: (16; 28; 29; 144).

¹²(159, pp. 311-314). In the list of 52 generalizations, there is only one (number 13) whose elements are not contained in the socio-psychological model.

Despite this measure of satisfactory utility, limitations of this model have become increasingly evident. Chief among these are the difficulties encountered in a strict application of the model to cases of adoption of an innovation by an organized group; e.g., a school board, corporation, city council, or neighborhood group (91). A related problem is encountered in studying communication networks where the question concerns the comparative efficiencies of the networks rather than the influence of each type of network on individual adopters or the roles of individuals in different positions in the network. Network communication efficiency can be conceptualized easily as a property of the network as a whole, but the conceptual problem becomes more complex when it is viewed as a composite property of the individual members.¹³

Approach Tends to Oversimplify

In recent years, the socio-psychological approach has been refined to distinguish between diffusion per se—and adoption. Although diffusion is viewed primarily as the communication of information about the innovation, adoption is the mental process through which an individual passes in deciding to use it (159, pp. 13-17; 183). The adoption has been conceptualized as a series of five stages (159, pp. 79-86; 125; 111). This separation of transmission processes from those of adoption recognizes that a wider range of phenomena is relevant to diffusion than was first supposed and that behavior is organized with reference to different functional problems.

Even so, research on diffusion and on other substantive problems indicates that significant detail is being ignored or glossed over in the overly simplified approach engendered by the socio-psychological approach. In the first place, it is apparent that *adoption* should be conceptualized as a complex set of processes rather than as a single or unitary one. Current approaches suggest at least two general processes: The decision—or choice making process and the acquisition of means of using the innovation; i.e., implementation.

These master processes may occur at either the social or psychological levels or at both. If the relevant adopting unit is a group, there are group processes of decision as well as of implementation. The latter include processes of acquisition and allocation of materials for the innovation, and the coordination of productive operations. Meanwhile, of course, a variety of decisions may be made at the psychological level.

On the other hand, where the decision to use an innovation is controlled primarily by a single person, both the decision and its implementation are largely socio-psychological phenomena. Implementation in this case includes both the learning of new skills and the acquisition

of means for putting the innovation in practice.

For many purposes, of course, it is necessary to deal with the learning of new skills and acquisition of means as separate processes. The entire area of adoption is badly in need of careful reformulation. This is much too large a task to be dealt with adequately in the space of this paper, and, for this reason, I will have little further to say about it here.

Secondly, in dealing with the communication of information from senders (sources) to receivers (adopters), researchers have conveniently assumed that the cognitive, or perceived, and cathectic aspects of the innovative idea remain constant. This is indicated in that neither the model of the diffusion curve nor the model of the adoption process allows for change in the innovative item. However, as any practicing communicator knows, members of an audience rarely possess identical knowledge of the message transmitted. Moreover, the longer the interpersonal chain of transmission, the more different from the original the idea becomes (4; 9; 86). The assumption of innovation constancy is not necessary to the socio-psychological model but, thus far, alternative formulations have not been attempted.

Modification Occurs

In modern societies the modification of ideas during diffusion is especially evident in the translation of symbolic content from that used by the scientist-innovator to that of the practitioner, whether the latter is a farmer or a corporation manager (187). Much more is involved, however, than the mere use of less abstract concepts to express the same idea. Modification of the idea inevitably occurs. Indeed, this is essential if the innovation is to become a part of the technology the practitioner uses in his enterprise.

The modification (specification) of an innovation, which occurs in the process of diffusion, presents a paradox. How is it possible for an innovation to change and yet retain an identity as the same innovation? This raises a question as to what an innovation is in a theoretical sense.

There are many related questions; such as, what is the source of the innovation? What modifies or specifies the innovation in the process of diffusion? To deal with these issues satisfactorily, it seems necessary to construct a somewhat different conceptual framework than the socio-psychological scheme we have been using. Many of these problems can be dealt with more satisfactorily, I think, by using an approach consistent with the theory of action,¹⁴

In the proposed approach, technology is regarded as a system of social action containing values, norms, sentiments or attitudes, and facilities as basic elements. These elements tend to be differentiated into four functional complexes or subsystems, each of which tends to have certain specialized activities: (a) The innovative subsystem that functions in modern societies to produce new technology; (b) the

¹³The conceptual problem involved is analogous to that of attempting to conceptualize a group goal as a property of the individual members of the group. See (34; pp. 347-352).

¹⁴This theory has been made most familiar through the work of Talcott Parsons. For a recent formulation see (142, I, pp. 30-79; II, pp. 963-993).

practitioner, either a group or a single person, who uses the innovation; (c) the subsystem of practitioners, i.e., the collective grouping of practitioners that contributes to the adaptation of the innovation to local conditions and legitimizes it as part of the local working technology; and (d) the communicative subsystem that links the innovation subsystem and individual practitioners as well as the subsystem of practitioners. From the standpoint of society these four subsystems function to institutionalize new cultural elements. They may be considered either as analytical or as concrete subsystems.

Diffusion a Social Process

Diffusion refers to the primary social processes involved in institutionalization per se, and it has reference chiefly to the analytical subsystems of communicators and practitioners. Adoption, on the other hand, has reference primarily to the individual practitioner and his relationship to the subsystem of practitioners. Although diffusion, rather than adoption, is the main concern of this paper, only the broad outlines of this approach to a theory of diffusion can be presented (45). Moreover, for brevity I will omit the prefix "sub" when referring to the four subsystems and present the main ideas in an evocative style, although I recognize that many of the ideas presented are tentative and need further refinement.

Technology. Technology as a socio-cultural phenomenon has been largely ignored by sociologists and cultural anthropologists. It is even more difficult to find technology discussed in terms consistent with general social theory. This is so, perhaps, because most researchers regard technology either as primarily the concern of the physical sciences or as material culture, which is a part of the environment in which social systems function (137). In any event, technology is rarely dealt with as an integral element of socio-cultural systems.¹⁵

With characteristic insight, however, Weber saw that, analytically, the principal technological problem was in the choice of the most *effective* and *efficient* means of attaining a given end (193, pp. 160-2). An item of technology, therefore, is a component of social action that specifies the means of attaining desired ends. (The ends may be either social or economic, and in this sense, there is social as well as economic technology.) A single item of technology (technique) rarely, if ever, exists by itself but is related to other techniques in a functional system (102, pp. 397-8). In turn, each technological system is functionally related to other systems that comprise the technological order of society. For example, the technique of milking is a functional part of the system of milk production, and the latter is a functional component of the technology of food production, processing, and distribution.

A technique is perhaps best regarded as a system composed of certain inputs, internal processes, and outputs.

¹⁵Exceptions to this are to be found in (26; 35; 36; 49; 80; 140; 177; 193).

When considering technology in production of utility in the economic sense, the most generally useful categories of input are land, labor, and capital. Viewed in these terms, a technique is not the material artifact, the ideas describing its use, or the two combined. The essence of a technique is the blueprint it provides for using certain human *and* material components to attain a predetermined end.

The technical blueprint that the scientist initially provides, however, is too general to be of immediate use to practitioners. The manifold consequences of its use under particular field conditions must be assessed. This is part of the process of modification and institutionalization to which reference has already been made (142, II, p. 978; 140, pp. 326-359).

It seems advisable to examine this process a little more closely. In diffusion, the content of a message is typically both simplified and elaborated. Besides the psychological studies mentioned earlier, studies of the effects of communications have done much to clarify this process (83; 96). These have been supplemented by laboratory and field studies of rumor (14; 50; 98; 150; 174). And, from anthropological studies have come descriptions of changes in meaning and even the form of innovation in the process of diffusion (7, pp. 330-32; 59; 180).

Parsons and Smelzer refer to the modification of a technical innovation in these respects as the process of specification (141, pp. 138-139; 177, pp. 40-42). Specification involves moral, social and economic considerations. On the social side, the crucial variables are the integration and legitimation of the innovation as part of the technological order of the using or practitioner group. In other words, the innovation must be fitted into the current design for human technical activity, and it must be evaluated as a "practical," if not also a correct and proper means of attaining desired ends. On the economic side, the implications of the innovation must be specified for the technological system into which it fits. For example, tentative plans must be developed for providing the additional labor, capital funds, etc., required in its use and for handling the increased output (45).

Changes in the symbolic aspects of the innovation often require modification of the practitioner's blueprint of the over-all technological order. This may occur as an addition of alternative means, substitution of a new means for an old one, or as a complex series of changes among the factors of production.¹⁶ The process of specification also may lead to a rejection (negative evaluation) of the innovation and the reconfirmation of the existing order.

Following this mode of thought, it is evident that the process of institutionalization, which accompanies diffu-

¹⁶It may subsequently result in changes in the social order, e.g., in the system of family, neighboring, or kin relationships of the practitioner. Consider, for example, the manifold changes in the social order that resulted when the general-purpose combine replaced the binder and threshing machine or when the automobile replaced the horse and buggy.

sion, results not so much in a single monolithic technological order as a series of technological orders. This is depicted in Figure 1. Note that an innovation is visualized as occurring midway in the scale of specificity, at which point the demands of a particular institutional sector, e.g., food production, are brought together with applied scientific theory.¹⁷ Further creative specification of the innovation is necessary, however, before it is usable by practitioners.

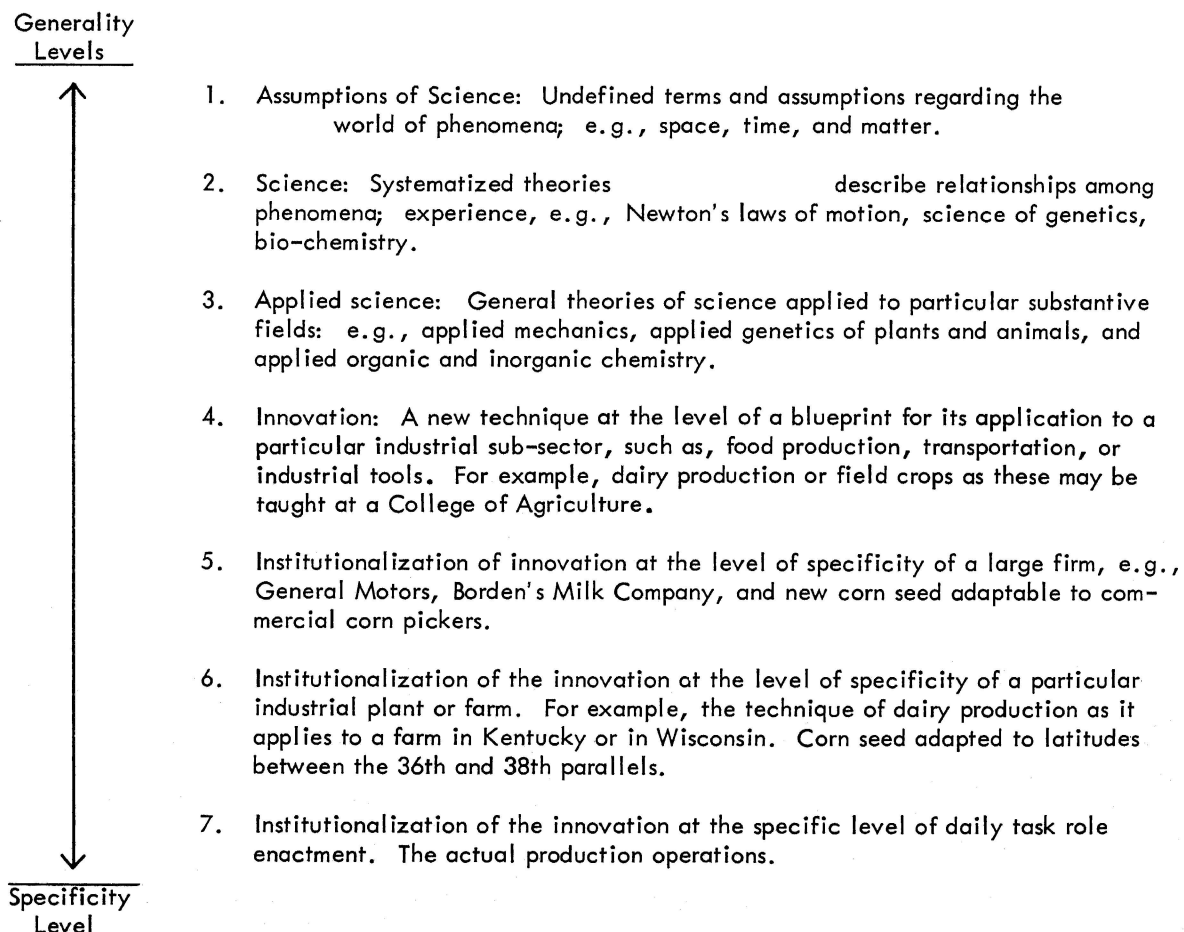
Innovation and institutionalization do not occur in a vacuum. They are products of societal subsystems, including systems of innovators, communicators, and practitioners. Before discussing these systems that are primarily responsible for the innovation and diffusion process, however, a discussion of innovation itself may help clarify the problem of how an innovation may retain its identity while changing in the institutionalization process.

¹⁷The model herein described obviously applies best to the technological order and change processes. In other areas, (e.g. law, education, and religion), the concept of an innovative system based on applied science is questionable, although a variety of structures perform similar functions.

Innovation. Innovation and invention have been variously defined. Space does not permit a thorough discussion of all the definitions. For Ogburn and his associates, an invention was a new combination of cultural elements (71, pp. 5-6; 3, pp. 47-8; 88, pp. 33-4). The illustrations of inventions most often used are mechanical, which can be regarded primarily as a new organization of material elements. In an effort to distinguish between inventions that in some sense introduce a new era, e.g., the automobile, airplane, or atomic energy, earlier authors introduced the concepts of basic and derived or elaborating inventions. But, the latter distinction has been severely criticized for its subjectivity and the ad hoc reasoning on which the distinction is based (7, pp. 7-9). More satisfactory is the distinction between innovations on the basis of the extent to which they represent a "breakthrough" in the mode of organization of elements for attaining a given end.

As Barnett has suggested, however, an innovation in this sense is less a matter of the quantity of elements brought together than the particular pattern or mode of their organization (8). The addition or subtraction of a wheel, for example, does not so much produce an auto-

Figure 1. Levels of Generality - Specificity of Techniques



motive innovation as does its placement and arrangement with others in the support and propulsion of the machine. It is in this respect that an innovation may be defined as a qualitatively new (different) mode of organization of cultural elements. Moreover, the forms of the cultural elements themselves may be qualitatively new, as in the case of an atomic reactor. (Many innovations, of course, do not involve material forms at all.) In any event, it is not the organization of material elements in the innovation that is the critical issue, but the organization and nature of the ideas in the blueprint of its use.¹⁸ As I have previously suggested the idea sources for an innovation in this sense are applied science, on the one hand, and the needs of particular institutions, on the other.

Barnett's distinction between the intrinsic and extrinsic characteristics of an innovation is a useful starting point for the analysis of the properties that remain the same and those that change during diffusion (7, p. 329). Intrinsic characteristics are those qualities of the innovation, i.e., its mode of organization of elements, that are "inherent" and maintain its cultural identity. The extrinsic characteristics are determined by or through the innovation's functional relationships to other traits and complexes in the larger technological system.

From this stand-point, it is the extrinsic characteristics, primarily, that are elaborated in the process of specification. For example, imagine some of the meanings that a farmer associated with a tractor as he considered whether to adopt it in place of the team of horses to which he was sentimentally attached. Can my horse-drawn equipment be adapted to tractor motive power? How will other farmers regard my taking such a risky step, obligating myself to buy gas, oil, and repairs? How can I maintain the supply of cash necessary to buy these supplies?

On the other hand, certain characteristics are relatively invariant. Besides its physical dimensions, to continue the same example, a tractor has certain input requirements of gas, oil, repairs, and a "skilled" operator. Its output is in terms of various types of motive power.

It is evident that the extrinsic characteristics vary according to the particular "situation" of the potential acceptor. Three bases of evaluation are important in the institutionalization of new technology: The technological and economic, the social and moral, and the sentimental. In other words, the technical innovation must be specified with reference to the technology and economic systems into which it fits, the social relationship system of the acceptor, and the personal feelings and attitudes of the user or adopter.

¹⁸In identifying and describing an innovation, much confusion arises from failure to keep in mind the technological system of which it is a part. Thus, for example, the invention of the airplane was of two different orders. One involved a series of innovations in its production and the other an innovation in the mode of transportation.

The adopter is not the only source of modification of an innovation. Extrinsic characteristics may be added or changed by anyone engaged in the communication process, from the inventor to the ultimate user. In the field of agricultural innovations, the modification may be brought about by agricultural specialists, extension workers, and local opinion leaders. The development of extrinsic characteristics thus is primarily a social product. An important research question concerns what groups perform this function, and for whom and how efficiently they do it.

Less apparent may be the fact that the intrinsic characteristics of an innovation also are a social product. One immediately recognizes this in considering how the innovation was developed in the first place. Modern scientific technology is itself an industry in which many participate. In this sense almost all new techniques are products of highly developed and specialized organizations. More significant for our interest in diffusion, however, is the point that, at each step in the chain of diffusion, the intrinsic, no less than the extrinsic, characteristics must be given meaning in terms of the sub-culture of the person or group involved in the step. An accepting group thus may ignore or misinterpret certain intrinsic characteristics of an innovation while emphasizing others. For instance, the old order Amish in effect modified the intrinsic characteristics of the tractor when they accepted it for transportation and for belt power, but not for drawbar power (120, pp. 215-16, 220). Moreover, the distinction between intrinsic and extrinsic characteristics is itself relative to the person or group drawing the distinction. Extrinsic properties of an innovation developed by one group may be regarded by the next as intrinsic.

Before the feeling becomes overpowering that the distinction between intrinsic and extrinsic characteristics is too relative and ambiguous to be of use in analyzing innovation and diffusion, I would like to introduce two definitions.

First, an innovation is a social product of an innovating unit. That is, whether or not a given item bears the symbol of innovation depends on the consensus of those in a social position to make such cultural judgments.¹⁹

Second, an innovating unit is a social system which, with reference to the social and cultural systems to which it is oriented, discovers or develops a new mode of organizing cultural elements.²⁰

¹⁹The debates in the history of science over whether "X" is "really" an innovation is dramatic testimony to both the social character of an innovation and to those whose judgment counts in such cases.

²⁰The distinction, which Smelzer makes, between science and technology seems useful in distinguishing between innovations in science and technology. (See 177, pp. 40-42.) We are, of course, interested in the latter. A technological innovation, from this standpoint, is a "marriage" of general science principles and the general requirements of an economic institutional system. For an illustration see (47, p. 10), Figure 1.

From this it follows that, whenever there is group acceptance of the idea that a new organization of intrinsic characteristics has occurred, an innovation has been created. It matters not whether the physical form remains the same or is changed. On the other hand, if in the course of diffusion, some intrinsic characteristics are added or subtracted, but the pattern otherwise remains the same, the innovation has been modified or specified; but it remains the same innovation. The addition, subtraction, or change in extrinsic characteristics is a consequence of institutionalization in the diffusion process, but is not in this sense an innovation.

It seems obvious that much of what has been described heretofore as cross-cultural diffusion is, from this standpoint, better described as first, a process of change in the environment that stimulates innovation within the host society and, second, as a process of diffusion.

Where the cultures of the originating and receiving systems differ markedly, innovation in some degree seems inevitable before an item can be used within the context of its particular culture. For diffusion alone to occur there must be a considerable measure of parallelism between the value, norm, and empirical world-views of the innovative and receiving systems. Otherwise, it will be difficult, if not impossible, to transmit the intrinsic characteristic of the innovation from one subculture to the other.

Systems of Innovators, Communicators, and Practitioners. Typically, the act of using an innovation has been taken by researchers as evidence both of diffusion and adoption. The principal difficulty, heretofore recognized, has been uncertainty over whether to regard the initial use of an innovation or its "full" use as a measure of adoption and diffusion. Initial use of divisible innovations, such as new varieties of seed, does not necessarily imply a commitment to future use, but such commitment has been regarded as the primary indicator of adoption.

Where the practitioner is an individual, commitment plus actual use appears to be an operational indicator of adoption that is consistent with theory. Where a group is the adopting unit, a somewhat different operational definition would be necessary, although the basic principle would remain the same.

It seems clear that current use and present commitment to future use of an innovation is related to diffusion but not a satisfactory indicator of it. If diffusion is regarded as a socio-cultural process, it must refer to a shared orientation to objects. Therefore, we must use as an indicator of diffusion an operational definition that reflects accomplishment of a change in the technological order rather than change in the personal system of the practitioner.

Evidence of diffusion thus is contained in the belief that the innovation is a useful and legitimate blueprint for technological behavior of one's fellow practitioners, as well as one's own behavior, and is regarded as such by them. The opposite is also evidence of diffusion; namely, that in-

dividual practitioners believe their colleagues share with them a belief in the inadequacy of a particular innovation.

Diffusion thus is a collective response signified by a change in the technological order. Adoption is an individual (person or group) response signified by the actual use of an innovation. In this sense diffusion may occur even though adoption does not.

An innovation may or may not be considered imperative. That is, one may believe that an innovation *must* be used if successful adaptation is to occur (e.g., bulk milk tanks in a milk shed where this is a requirement) or that the innovation *may* be used (e.g., the use of one of several equally recommended varieties of seed).

In any event it is the *belief*, rather than the actual *use* or a commitment to use that signifies diffusion. The belief may be a factor in commitment to future use, but it may not. Clearly, adoption leaders develop a commitment to future use or nonuse of an innovation before the completion of diffusion among their fellow workers. This raises a question as to whether consensus must be achieved within a group before diffusion may be regarded as complete. And, consideration of the latter question raises a further issue of the nature of the group in which diffusion occurs. This I have referred to as the system of practitioners, and I will discuss it briefly before considering the question of consensus in diffusion.

The *system of practitioners*, like any other social system, is an interrelated set of status-roles organized with reference to a broad range of institutional problems. In agriculture this might be the production and marketing of agricultural products, but the general concept also applies to organizations of teachers, doctors, retailers, processors, and others.

The mode of organization of a system of practitioners varies from the kinds of loose, fluid arrangements based on shared orientations found among farmers in a locality to the more highly structured arrangements of formal organizations, e.g., teachers in a school. The practitioner system may vary in size, depending on the basis of shared interest, from a small group of three or four to several thousand spread over several counties. The essential points are that (1) it is organized with adoption leaders, systems of communicators, etc., and (2) it includes a shared orientation to the problem of adapting innovations for use in the attainment of the system's institutional goals. The shared orientation in question normally will not be the primary basis of organization among practitioners. Usually, the evaluation of new technology is a latent, rather than a manifest, function of practitioner groups.

The system of practitioners to which an individual is related is primarily concerned with two functional problems—legitimization of the new technology and its adaptation to the input-output requirements of the technical system. These functions are, in other terms, outputs of the system to individual practitioners.

Legitimization is used here to refer to a variety of supportive activities of systems of practitioners. These activities range from emotional support by others who have made a similar decision to activities that carry a definite moral overtone of the correctness or propriety of adopting a given innovation (109). The legitimizing function is not performed by the system of practitioners alone. Innovators, communicators, and change agents also are involved in establishing the legitimacy of an innovation. However, the fact that the practitioner may actually use what he transmits lends a special significance to his message that a change agent or innovator cannot convey. No one is better acquainted with the situational conditions under which an innovation must be used than one's colleagues or fellow workers. Often, only they possess the actual knowledge of the input requirements and output rewards of an innovation under local conditions. Moreover, in the absence of perfect knowledge, the consensus of a group is the "safest" guide to decision and action.²¹ For these reasons the system of practitioners performs a most important function for the practitioner in developing a practical, "working" blueprint of the innovation. Although the practitioner must ordinarily take the final step of applying the practice himself, fellow practitioners can come closer, if necessary, to specifying the implications of an innovation for him than anyone else. The extent to which this is necessary varies with the ability of the practitioner to do this for himself (e.g., adoption leaders are more able to do this than "laggards"), the efforts of innovators and communicators in this respect, and the intrinsic characteristics of the innovation, i.e., its divisibility.

Theoretically, the adaptation of an innovation to a specific use, as previously outlined, may be regarded as an output of the system of practitioners to individual users (practitioners). This output is in the form of social approval of an innovation and clarification of its implications for farming operations. One can easily conceive of these as variables which change over time and are related to the norms, structure, and other properties and processes of the system of practitioners.

In studies of public opinion formation, opinion in a community (or whatever the relevant "public" happens to be) is thought of as changing from an "uncrystallized" state, when the issue is first introduced, to a "crystallized" state or condition (27, pp. 3-4, 203). A crystallized condition is attained when a relatively stable pro or con orientation toward a proposed course of action has been developed.

The crystallization of opinion expresses a condition which is close to the idea of completed diffusion of an innovation in a system of practitioners. It may be regarded as the mutual recognition of a shared orientation to the "practical" utility or lack of it of the innovation. This does not necessarily mean consensus. Rather, it is more likely

²¹There is considerable experimental research with small groups that supports this conclusion. For a recent summary, see (75, p. 352).

that majority and minority views exist as to the innovation's efficacy. Regardless of the particular division of opinion, however, the establishment of a relatively stable orientation (with reference to a prior state of instability) is evidence of diffusion accomplished. It may be hypothesized that the quickness or speed with which such stability is attained, as well as the degree of consensus achieved, is a function of properties of the system of practitioners and its inputs of information and motivation.

The *system of innovators*, or innovative system, refers to the organized groupings of applied scientists whose specific purpose is to innovate. Systems of this kind have become an increasingly important part of modern industrial society, specializing in the "innovative" function, apart from the structures that utilize the technologies. The agricultural experiment stations, technical research institutes, and industrial research laboratories are prime examples of innovative systems.²²

Innovative systems have values, norms, and roles peculiar to their particular function. Inputs of the system include money, scientific talent, or competence, capital, information, supporting staff, organization, etc., and the outputs are: (a) innovations, concepts, and ideas that may be communicated to other scientists, (b) blueprints of innovations that are communicated to producers of the material, artifactual component of the technique, and (c) general blueprints of how the technique is to be used by practitioners.²³ The latter is what enters into the diffusion process described herein. It is possible also to describe and analyze the communication, if not the diffusion, of the other two types of outputs.

Although the innovative function may be paramount in a given system, obviously, the system also may perform functions of communicating and specifying the innovation to practitioners. This is the case typically of agricultural experiment stations. Rarely do the boundaries or functions of concrete organizations conform to the analytical distinctions of theoretical models. Identification of an innovative system thus must be in terms of its "primary" rather than total function.

The third major type of system involved in the diffusion process in modern societies is a *system of communicators*.²⁴ The label may be somewhat misleading in at least two respects. First, the variation in communicative organizations is such that together they may be considered as a system in only a very general sense. The different

²²Studies of innovative systems have become increasingly popular. See (70; 89; 138; 153; 192).

²³For an input-output model of an innovative system see (121, pp. 178-182).

²⁴Elsewhere, I have called this the linking system, referring to its primary function vis-a-vis the innovative and practitioner systems. See (45).

concrete, formally organized systems—mass media, extension services, sales organizations, etc.—comprise a loosely coordinated, sometimes conflicting, system for distributing and transmitting information. Second, a good deal more than the sheer transmission of information is involved, although this is an important function. Communicators never transmit all the information that they receive, and what they do transmit is rarely the same as what they received. In the process the communicator effectively filters and modifies information in terms of the presumed interests and attitudes of the audience. More often than not, especially when an innovation is involved, the purpose is to persuade the would-be practitioner to adopt it.

The growth of systems of communicators parallels the functional differentiation of *innovating* activity and *practicing* activity.²⁵ The separation is not merely functional; it exists in terms of space and time. The linking of innovative and practitioner systems is a two-way street. It is no less important for the innovative system to receive feedback on its innovations and information about the needs of practitioners than for practitioners to obtain information about the innovations.

The system of communicators can be described as an input-output system with values, norms, and roles peculiar to it. "Freedom of the press" is a value that applies in some degree to all would-be communicators. Contacts both with innovators and practitioners must be kept open and maintained. Audiences often must be cultivated, enticed, and rewarded.

The purpose of the communicator is to communicate, and this requires a differentiated system of roles devoted to the collection, processing, and transmission of information.

The model of innovation and of the diffusion process as conceived in this paper is depicted schematically in Figure 2. As can be seen in this figure, the actual activities of concrete social systems are rarely, if ever, confined to any one particular analytical level on the scale of specificity. In actual cases, innovative systems also are likely to be concerned with institutionalization in diffusion. Systems of practitioners, on the other hand, contribute to the institutionalization of innovations at several levels, but mainly at levels six and seven. Systems of communicators, not only join innovative and practitioner systems at all levels of specificity, but they also have the capacity to transform knowledge received at one level of specificity to a lower level before transmitting it to practitioners.

The lines with arrows joining positions at different levels signify an interaction relationship. Dotted lines suggest that individual persons have the ability to specify the implications of new ideas at different levels. Some persons (e.g., adoption leaders) are relatively more able to do this than others. The opinion leader communicates on the level of his follower's capacity to understand, but he is receptive

²⁵The general problem of functional differentiation, specialization and the growth of linking systems has been dealt with by many authors. Only a few can be mentioned here: (60; 120; 139, pp. 266-279; 148; 201).

to more general ideas. In traditional communities, present research indicates, opinion leaders are unable or unwilling to perform this function; their influence is exercised in the maintenance of "good farming practice."

Needed Research

1. One of the major hypotheses on which the theory rests is developmental: As societies develop economically, specialization occurs in the inventive, communicative, and productive functions. In view of historical developments in western societies, as well as the current efforts to advance agriculture in many underdeveloped countries, the validity of the hypothesis seems obvious; yet, it warrants closer examination. It is based on the further hypothesis that technological change is most efficiently and effectively accomplished through the development of an integrated system of groups or organizations (subsystems) that are specialized in these functions.²⁶

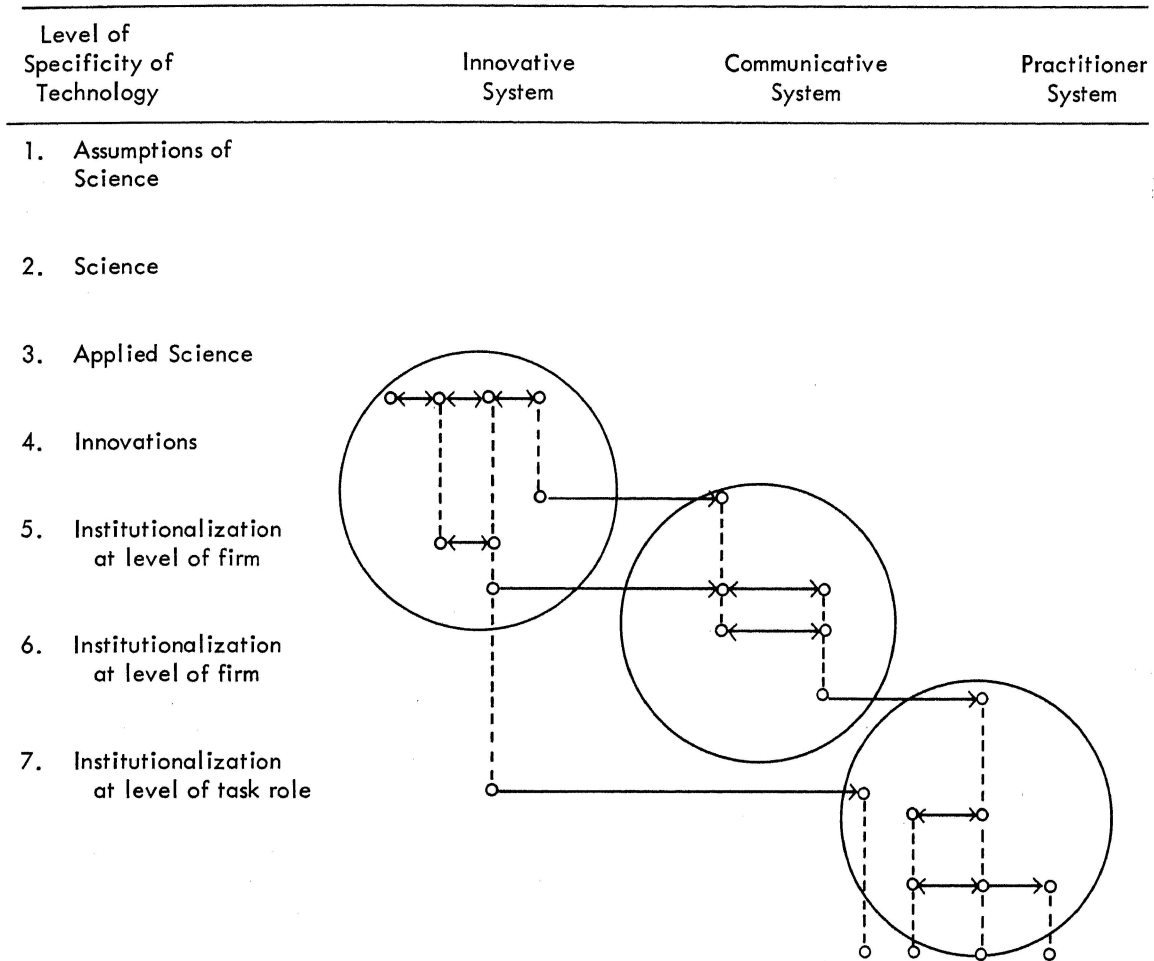
Certainly, there should be little doubt that the latter hypothesis merits further research. In this general form, even if true, its value is limited unless one knows the conditions for specialization; the basis of, and conditions for, integration of the several subsystems; the relationship of particular structures to the speed of diffusion, etc. These questions take us beyond a consideration of the hypothetical model itself to consideration of its relationships to the political, legal, religious, family, and other economic institutions of society. Clearly, a technological change system is imbedded and interwoven with other institutions from which it receives support and to which it contributes. Studies of these relationships will require comparative research both within and between different cultures.

2. In diffusion, as noted earlier, the central problem is *not* behavioral use of an innovation, but rather a collectively developed belief in its utility or disutility. Thus, diffusion is measured with reference to collective group action of some kind. One may be interested either in the process by which a practitioner system establishes a belief, or in differences among practitioner systems in the speed and final outcome of the process. In each case there are measurement problems for which new operational tools must be developed.

Inasmuch as the belief may change during diffusion, the device used to show the progress of diffusion should reflect the change in attitudes toward the innovation and its alternatives. The simple relationship between time and a frequency distribution of a particular kind of belief is not sufficient. The description of change in the source of diffusion thus adds a third dimension to the familiar growth

²⁶Theodore W. Schultz has recently presented much the same idea from an economist's viewpoint. See (176, Ch. 9, 10; 175). The idea is implicit in a wide variety of other studies, see especially (14; 65). A model quite similar to the one advanced here has been developed by Kenneth Benne to explain the flow of applied science knowledge in American industry.

Figure 2. Model Showing Levels of Specificity of Technology in Innovative, Communicative, and Practitioner Systems



curve,²⁷ Although the problem is not insoluble, the description of the content dimensions of innovations and the development of devices for showing change over time requires further research. It is a prerequisite to further development of explanatory empirical theory.

3. It is obvious that the supply of technical knowledge in both its quantitative and qualitative aspects is affected by communication systems. In broad terms, the quantity of information supplied to practitioner systems is (hypothetically) a function both of the output of innovative systems and the efficiency with which communicators pick it up, process it, and transmit it to practitioners. The supply of information made available by innovative

system in problem selection. (2) Communicative systems often stimulate the innovative system to prepare information for distribution that otherwise might not be made available. Although this is generally known, there has been little or no research on the roles, structures, etc., that promote efficient and effective output-input relationships between innovative and communicative systems. For example, what is the relationship between different types of linkages and qualifications of personnel, organizational objectives, size of clientele, etc., and optimum output-input rates for these two systems?

Thus far, diffusion researchers have been little concerned with the question of what communicative systems do, or fail to do, with information received from scientists and other innovators. That communicative systems select and modify such information before transmitting it is patent, but the relationship between these operations and effective communications has not been integrated in a general theory of diffusion. It seems almost to be assumed that communicative systems function with equal efficiency in this regard, but it would be surprising if this were the

²⁷It is altogether likely that the content of a belief has several dimensions, each of which might be shown graphically in the conventional way.

case. The operation of the communicative system as a system is no less important than that of the practitioner system, but to date the latter has received most of the attention by those interested in diffusion research.²⁸

Diffusion researchers have been more concerned with the types of relationships or linkages between communicative and practitioner systems that facilitate effective communication. The hypothesis of the two-step flow of influence is a classic in this area.²⁹ Yet, there seem to be many information flow structures that do not conform to this model. Why? Two factors seem crucial in the establishment of effective communication relationships: The value-orientations of the communicator and communicatee and their perceptions of each other's roles. More is perhaps known about the parameters of interpersonal role relationships in effective communications than about the importance of congruity and complementarity in value-orientations. However, research on both problems is needed.

The difficulties encountered in establishing communication between the scientist and the practitioner in traditional societies is a widely recognized problem. Difficulties in modern societies in building effective communication systems for subordinate enterprises (e.g., hogs) in areas dominated by another type of enterprise (e.g., beef cattle) are no less severe. That an efficient communication system has been established for one type of enterprise does not mean that it serves all enterprises equally well. Indeed, it may inhibit the use of resources—financial and human—to establish the kinds of communication support necessary for successful development of alternative enterprises. The study of communication structures for dominant and subordinate institutions or forms of organization and of their relationships to the diffusion of technology is badly needed.

4. In the earlier discussion it was suggested that the system of practitioners legitimizes, modifies (specifies), and communicates an innovation to individual practitioners. This, of course, constitutes a hypothesis about the relation between practitioner systems and individual practitioners, which is only partially supported at present. In addition to research needed to clarify the extent and conditions under which these functions are performed, there are three other

problem areas needing such attention.

One is studies of the internal processes of practitioner systems and the origin, rate, and equilibrium of diffusion. The studies of medical doctors and new drugs are especially suggestive in this respect, (40; 41; 129) but similar kinds of studies of various practitioner groups are needed. Comparative studies of practitioner systems are needed to uncover the relationships between process changes in interaction patterns, intrinsic and extrinsic characteristics of innovations, and group characteristics and variation in the diffusion rate over time.

A second problem area is the need for comparative studies of a wide variety of practitioner system properties (social structure, membership characteristics, value-orientations, mechanisms of practitioner system control of deviants, etc.) which affect the origin, average rate, and equilibrium of diffusion. A start in this direction has been made in studies of the adoption of hybrid corn seed, as well as of other kinds of practices (23; 24; 47; 68; 143; 171; 191). There are, however, many unresolved questions, especially in respect to the relationship between practitioner system factors and diffusion per se.

The third area of concern includes a variety of factors external to the practitioner system that affect diffusion. As technology almost invariably involves a material object of some kind, the economic factors that determine its availability constitute important determinants of both diffusion and adoption, (73; 123) a matter which sociologists have too long neglected. The practitioner himself is the locus of an analytically separate system of action which affects the diffusion process.

To my knowledge there has been little or no research that helps clarify the relationship between *adoption*, as applied to the use of an innovation, and *diffusion*, referring to the establishment of a collective belief. Is the belief established prior to complete adoption among practitioners, or subsequently? This is obviously part of the general problem of the relationship between systems of belief and behavior. Sometimes belief and behavior correspond, sometimes they do not.³⁰

In this paper there have been numerous references to the importance of values in the diffusion process, but nothing has been said about motivation. From the standpoint of the theory of action, motivation is an element of the personality system and in this context affects the behavior of individual communicators, inventors, and practitioners. Studies of the achievement motive and entrepreneurial activity lead us to suppose that this is related to adoption and thus to diffusion (127; 134; 135; 167). In addition to motivation, research indicates intelligence, managerial ability, enterprise goals, and other factors influence adoption and, presumably, diffusion. Many questions are left unanswered for enterprising researcher investigators of the diffusion process.

²⁸The interests of communications and diffusion researchers overlap at this point as at many others, but an interest in the diffusion process differs from the broad interest in communications in at least three respects: (a) a selective interest in the transmission of a particular kind of new information; (b) an interest in the structures or patterns of information flow (rather than with particular channels or media), and (c) an interest in the origin, rate, and equilibrium in the spread or adoption of an idea. There has been considerable research on the aspects of communications systems relevant to diffusion, but it is beyond the scope of the present paper to attempt a summary of it. For relevant summaries see the references cited in footnote 22.

²⁹(See 93; 94; 108; 159; pp. 211-214). It is well to remember in this regard that the two-step-flow hypothesis pertains to adoption behavior rather than to the development of a collective belief, and in the absence of empirical verification, there is no certainty that the same structure serves both purposes.

³⁰There is, of course, a vast literature bearing on this topic, and the references cited are only suggestive: (48; 61; 122; 132; 140; pp. 872-75; 152; 194; 205).

Research Needed

on

Adoption Models³¹

*Joe M. Bohlen*³²

This paper has a narrow focus within the broad context of research of adoption and diffusion of ideas. Its purpose is to explore some of the research needs on the models of adoption which are used most widely.

The paper is divided into two parts. The first is devoted to an explanation of the logic involved in the development of one of the models. This is presented in some detail because most of the recommendations for research in the latter part of this chapter flow from these logical assumptions.

One of the widely known research models in the area of adoption-diffusion research is the 5-stage model of adoption first proposed by this author in the protocol of the publication that became known as "How Farm People Accept New Ideas (184)." Since that time, it has appeared as the basic model in books by Lionberger (103) and Rogers (159) and publications by other authors in a number of countries.³³

Needs Refinement

The heuristic model was validated first by empirical research and reported in the journal of the Rural Sociological Society in 1957 (12). Since that time, much research has gone on which indicates a need to make refinements in this basic model.

To suggest directions for these refinements and research related to them, it may be fruitful to review the assumptions behind the model and the process by which it was derived.

This model contains assumptions about the process by which the human personality develops and about how man responds to stimuli when he receives them. These assumptions were published in a paper delivered at the Symposium on Capital and Credit Needs in a Changing Agriculture,³⁴ sponsored by the Tennessee Valley Authority and held in Knoxville during April, 1960. Essentially, these are the basic assumptions:

1. Man is a telic being
2. Man is an acting being
3. Man is an organizing being.

Man does not respond to stimuli in a simple reflex arc, SR.

Man is born into the world with certain biologically determined potentialities (intelligence, physical size, resistance or susceptibility to certain bodily ills, physiognomy, etc.). He is also born with a predisposition to act, or to sustain, physical activity. Because of the unique nature of his intelligence, he is inclined to place all the phenomena which he perceives into patterns of meaningful interrelationships. Man is an organizing being. He organizes the world around him into cause-effect relationships which appear rational to him. In many instances, he does this without taking into consideration all the data which are known or available to know. Hence, he sometimes assigns relationships between and among phenomena in the universe which are spurious from the point of view of empirically verifiable truth claims.

³¹Much of the content of this paper appeared as a working paper for the Ad Hoc European Committee on adoption which met in conjunction with the Fifth Congress of the European Society for Rural Sociology which met at Mynooth College, Mynooth, Ireland, August 21-26, 1966.

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³³"How Farm People Accept New Ideas" and "The Diffusion Process" by George M. Beal and Joe M. Bohlen, Special Report No. 18, Agricultural Extension Service, Iowa State College, March, 1957, are known to have been translated into Spanish, Portuguese, German and Dutch. These publications are widely used in the Agricultural Institutes of India in the training of Extension workers.

³⁴This in revised form is Chapter 20, "Sociological and Social Psychological Factors" by Joe M. Bohlen and George M. Beal. Capital and Credit Needs in a Changing Agriculture. Editors E. L. Baum and others, Iowa State University Press, 1961.

Man is able to go through the process of perceiving interrelationships because he has the ability to think in terms of abstractions. In other words, he can create symbols—including words, numbers, pictures—in his mind which have their referents in the universe empirically known to mankind. This frees him of the necessity of being in immediate sensory contact with phenomena in order to respond to them or act in relationship to them. This faculty, unique to man, allows him to respond to stimuli, taking into consideration not only his own past experiences, but also those of other men who met similar situations in other places and at other times.

Because man has this ability to cope with abstractions and communicate via the exchange of meaningful symbols, he has another uniqueness. Man is the only form of life faced with the necessity of making distinctions between those things which are real and those things which are possible. All life forms other than man (and possibly the higher primates) must have immediate sensory contact with phenomena in order to respond to them. Creatures who do not create symbols do not perceive a future since the future is an abstraction. Alternative future relationships which an entity wishes to establish between himself and other phenomena are available only to creatures who use symbols to conceptualize the relationships that could exist between phenomena with which they have immediate sensory contact. Since other life forms respond more or less directly to stimuli, their behavior patterns are predicted much more easily than are the actions of men.

Man Does Not Respond Directly

Man never responds to a stimulus directly. Whenever a human being is faced with a stimulus (a problem), he responds not to it, but to the interpretation he places upon this stimulus in his experience world, which includes his past experiences, his future expectancies or goals (ends and means), and his perceived relationships of this stimulus to both. He concerns himself, not only with the realities of the situation as perceived through his sense organs, but also with the possible outcomes resulting from choice of alternative responses he might make. Since he thinks in symbols, he can project himself into the future and choose the alternative in which his judgment will help him to maximize his satisfactions.

Since man is this kind of being, his personality (i.e., the bundle of beliefs, feelings, values, and attitudes unique to him) is a result of the hereditary package with which he was born and the unique experiences he has had since then.

When man acts in relation to a stimulus, two residues remain: (a) the change in physical nature resulting from the action (change in muscle tonus, fatigue, organic changes, etc.) and (b) the memory of the experience. The memory of the experience is composed of the recall of the details of his actions and interactions and a judgment about the experience. Man tends to assign a normative factor to each experience; i.e., it was good or bad, satisfactory or unsatisfactory, pleasant or unpleasant, rewarding or unrewarding.

As a result of this intellectualizing about experiences, man develops a set of values; beliefs about *what should be* the relationships between phenomena in the universe and how he as a unique phenomenon *should* relate himself to the rest of this universe.

Reflects on His Experience

It follows from the above premises that, whenever man receives a stimulus, he tries to recall whether or not he has ever received a similar stimulus in the past. If he did, he attempts to reconstruct his actions in relationship to this previously received stimulus. He recalls also the judgments he had about the outcomes of the actions he took; this is done both in terms of the ends or goals he chose and the means or methods he chose to attain the ends. Man relates his past to the future by asking himself if he still desires the same goals as he did when he acted in relation to these similar stimuli in the past. If he decides that his desires have changed, he asks himself what different ends and means are possible for him and, of these, which is most desirable.

The personality of man is molded by the series of events that are part of his experience world. When he receives a similar stimulus repeatedly and each time responds in a similar manner, one which gives him satisfaction, he gradually changes the procedure of response. At first, much thought may go into the interpretation before he makes a response; as each additional interpretation is made and the results are satisfying, man puts less and less thought into interpreting the stimulus. He reaches a point where after only cursory scrutiny of the stimulus, he responds in a pattern which brought satisfaction in the past. When this has taken place, an individual has formed a *habit*, a convention by which he copes with relatively similar and familiar stimuli with a minimum of intellectual effort. This allows the individual to do many routine things very quickly and to utilize time for interpretation of new or unique stimuli. It usually takes a major change in the stimuli that affect a response that has become a habit before a person will discard this response and think through another. When an individual has developed a habitual response to a recurrent stimulus, frequently he neglects to notice that circumstances surrounding it have changed after a period of time so much that he is responding to a stimulus pattern in a manner which is no longer rational.

Builds Experience World

As indicated previously, man, the acting being, builds up his experience world and makes judgments about each experience as he has it. He judges experiences in terms of the relative satisfactions gained. He judges them to be good, bad, or indifferent. The patterning of these judgments about one's past experiences forms what is commonly called one's value system. This value system is the basis of a set of tendencies to act in given directions vis-a-vis various categories of stimuli. These tendencies to act, or attitudes, are major influences in the determination of man's behavior. Since man is not a UNIVAC, frequently he holds conflicting

values and attitudes without serious deleterious mental consequences. In many instances, man segments his total attitude pattern. He may act rationally and consistently within a given area of values, even though these actions may be in conflict with another area of values.

As a man receives stimuli and contemplates alternative responses, he takes both ends and means into consideration. Part of man's value system is the tendency to organize both ends and means into hierarchies of favorableness to himself as an individual. He then places these in juxtaposition when making his choices of alternatives. In this process, a lower level or less favorable *end* may be selected because the *means* of attaining the higher level or more favorable *end* are too unsatisfactory to be acceptable. When a given *end* exists with alternative *means* of attaining it, man inevitably (unless he is mentally ill) chooses the mean which he considers most consistent with his value system, i.e., the one which is most satisfactory.

Five Adoption Process Stages

The five stages of the adoption process as they currently appear in the literature were created as a heuristic tool from the logically derived stages listed below. These stages were derived within the assumptions previously stated.

Awareness: *This is the stage at which the individual becomes cognizant of a stimulus he may or may not wish to relate to the phenomena which make up the universe he has organized into a meaningful whole—his subjective universe.*

Information: *This is the period or stage during which the individual is gathering data about the range of relationships which exist or might be made to exist between the new phenomenon and the other phenomena in his subjective universe.*

Application (Evaluation): *This is the stage during which the individual views, through a normative frame of reference, the various relationships possible between the new phenomenon and the meaningful phenomena of his subjective universe. He applies his value system to these various alternative relationships and makes two decisions in sequence: (a) Whether or not to attempt to incorporate this phenomenon into his subjective universe in some juxtaposition to the other phenomena there and (b) the choice of means or ways in which the new phenomenon will be incorporated if he makes an affirmative decision in (a).*

Trial: *This is the stage during which the individual transfers the phenomenon from its symbolic existence in his subjective universe into an empirical reality. At this stage, he transfers his relationship with the phenomenon from symbols to the realities for which they stand. He, in essence, is validating his symbols through sensory experience with the empirical phenomenon itself.*

Adoption: *This is the stage at which the individual has had enough experience with the phenomenon and its possible relationships to other phenomena to have habituated his behavior in relationship to it.*

From these logically derived stages, the operational definitions of these stages were created much as they appear in common usage today and as outlined here:

Operational Definitions

Awareness: *This is the stage at which the individual knows of the existence of an idea or practice, but lacks details concerning its intrinsic nature and use. Awareness may begin as an involuntary act, a discovery by accident.*

Information: *In this stage the individual becomes interested in the idea. He seeks further basic information of a general nature regarding it. He wants to know why and how it works, how much it costs, and how it compares with other ideas or practices purported to perform the same or similar functions. He is concerned with knowing the conditions of use and the resources necessary to get optimum benefits from its use.*

Evaluation: *The individual takes the knowledge he has about the idea and weighs the alternatives in terms of his own use. He considers his own resources of land, labor, capital, and management ability and decides whether or not he has the necessary resources to adopt the idea. He also evaluates the idea in terms of the alternatives available and of his over-all goal structure. He considers whether or not the adoption of the idea will help him maximize his goal and objectives. If he thinks it will, in most cases, he makes the decision to give the idea or practice a physical trial.*

Trial: *At this stage the individual has the empirical experience of observing the idea in use. The trial stage is characteristically one of small-scale use by the potential adopter or his observation of use under conditions which simulate those of his own situation. At this stage, the individual is concerned with the specifics of application and use and the mechanics and actions related to how to use the idea.*

Adoption: *At this stage the individual uses the idea on a full-scale basis in his operations and is satisfied with it. He is no longer trying to decide whether or not the idea is good for him in his operations but has accepted it as an integral part of the particular operation into which he has incorporated it.*

I do not wish to leave the impression that the adoption process is composed of stages through which the adopter passes in an irrevocable manner and that he passes through each stage completely prior to entering the next stage. The process is portrayed in stages for heuristic purposes and those not deeply involved in the empirical research frequently conclude that the actual process duplicates the heuristic. Such conclusions are not warranted by the data.

The first stage, *awareness*, is obviously a point in time for each individual adopter. Once one has been made aware of the existence of a specific idea or practice, he cannot have this particular experience again.

The exact lines of demarcation between the other stages of the process are not nearly so amenable to empirical validation. Research efforts to measure the process seem to indicate that the *information* stage begins when the individual assumes any initiative for gathering further information about the idea or practice.

The individual is in the *evaluation* stage when he is attempting to relate the general information which he has gathered to his own individual situation to determine whether or not the idea will further the attainment of his goals and whether or not he has the means—land, labor, capital, and management ability—to accept this idea as a feasible alternative for goal maximization.

Under circumstances that are part of the individual's daily routine, most people tend to begin evaluating as soon as they possess any facts. In the temporal sequence of events, therefore, an individual seeks general information, attempts to evaluate the idea on the basis of his present state of knowledge, decides that he needs more information, and reverts to gathering further general information. Any given individual may, in this manner, go back and forth between the *information stage* and the *evaluation stage* many times. However, he ultimately reaches a point at which he arrives at the conclusion that he has all the information he desires to make a decision about the applicability of the idea to his own circumstances. At this point, he decides to either implement the idea on some empirical basis or to reject it.

Studies have indicated that, whenever the idea or practice is adapted to small-scale use, individuals go through what is called the *trial stage* (195; 172; 10; 19). At this stage, the individual is seeking empirical evidence through personal experimentation to support (or reject) the idea which he considered worth trying. He is verifying the usefulness of the practice in his own situation. There is evidence that a large percentage of farmers do go through a trial before adopting an idea on a full-scale basis.

The evidence indicates that many of the earliest adopters do not need to go through a trial on their own farms to evaluate the idea or a practice. Some individuals who have high abilities in dealing with abstractions apparently tend to skip the trial stage and go directly from the evaluation stage to adoption.

The *adoption stage* for any individual on any given practice is that point at which he accepts an idea or practice as a part of his behavior. He has become habituated to the idea. The mental set toward critical evaluation has changed to one of satisfaction with the idea or practice. This does not imply that the adopter has ceased to look for a better alternative, however. It means that, at this given point in time, this practice is the most feasible alternative from the actor's subjective point of view.

Experience Affects Complexity of Ideas

These ideas range in complexity from simple ones with empirical referents that have a high degree of visibility to those of a complicated and abstract nature.

The complexity of any idea and the practices related to it are function of the amount of mental activity required to relate the idea to the experience world of the individual.

Other factors equated, the more complex any idea is, the more slowly it tends to be adopted. The complexity of ideas may be classified on a continuum from the most simple to the most complex. The following classification has been used to analyze the degree of complexity of any given practice:

A Simple Change in Materials and Equipment: This type of change would take the least amount of mental activity. It is a change wherein basic concepts have already been accepted. This level of complexity involves variations in accepted behavior patterns. It involves a minimal amount of change in attitudes.

An Improved Practice: The improved practice is one in which the adopter has to deal with two or more variables simultaneously. These variations take place within the general framework of his values and attitudes concerning the behavior complex within which he is making changes. The acceptance of the practice does not involve major changes in existing activities.

An example of the adoption of an improved practice is a farmer's change from broadcasting fertilizer to side dressing fertilizer on his corn crop. He has to consider amounts, analyses, placement, and equipment, but he doesn't have to change basic values regarding the worth of commercial fertilizer to do so.

An Innovation: This type of change involves not only dealing with many variables at the same time, but also a change in values and attitudes toward the whole behavior complex. An innovation is a change which involves re-orientation of individual value structure. To adopt an innovation, an individual must alter some of his attitudes and beliefs and substitute others before he can adopt an idea of this complexity.

Hybrid seed corn was an innovation. Under the open-pollinated seed-corn system, farmers had established patterns of attitudes and values in regard to sources of seed supply and the basis upon which seed should be chosen. Neighbors and friends provided seed, and the seed was chosen on a phenotypic basis. Certain individual farmers who were usually known on a primary-group basis were the ones who did the choosing for those who did not select their own seed.

To adopt hybrid seed corn, an individual had to realign his values in regard to the source of seed supply and the appearance of the seed, and he had to understand that hybrid seed was being selected on the basis of its genotypic characteristics rather than its phenotypic attributes.

Once the idea of hybrids was established with corn, however, the acceptance of hybridization of other crops moved more rapidly. The history of the rapid adoption of other hybrids after farmers had accepted the concept of hybridization is well known.

There are other characteristics of practices or products, too, which affect the rate at which they are adopted.

The *visibility* of the results of a practice affects adoption in varying degrees. People who have a low ability to visualize abstract ideas tend to be more reluctant than others to adopt practices which do not produce highly visible outcomes (42; 161). Other factors equated, practices whose results can be readily observed are adopted more rapidly than those whose results cannot.

This results from the fact that many people must be able to experience results in order to determine the suitability of a practice in their own situations. This may partially explain the observation that weed killers which destroyed weeds after they were standing above ground and growing were adopted more rapidly than were pre-emergent weed killers. Obviously, if the pre-emergent killers work perfectly, there are no empirical referents in the form of dead weeds.

This factor of visibility may have its impact in more subtle ways. If the visible results from application of an idea vary with the conditions under which it is used, the user may attribute the variations to the variability of practice outcome rather than to the circumstances of use over which he has control. For example, a farmer might attribute the differences in response to the same application of fertilizer on two different fields to variation in quality of fertilizer rather than the fact one field was lower in plant nutrients to start with. As fields approach the optimum in plant nutrients, the impact of any given application of fertilizer becomes decreasingly visible.

Visibility is a function of the frame of reference which an individual has toward a phenomenon. If he understands all of the criteria for measuring the results, he is more likely to use the idea at its optimum level, although the results are not dramatic at that level. The importance of an adequate frame of reference for making judgments cannot be overemphasized as a prerequisite of adoption.

The level at which individuals are capable of dealing with abstractions influences the extent to which they need empirical referents in order to establish a frame of reference for the use of any given practice. This will be discussed later in this chapter.

The *divisibility* of the product or practice is an important factor in determining the rate at which it will be adopted. This factor is most important for the majority of farmers who desire to try the new idea on a small-scale basis in their own situations before adopting it on a large scale. Highly divisible products can be tried on a small scale with little capital, labor, and management investment. Also, the consequences of a failure are reduced by the small-scale trial.

The economics of the practice are certainly a factor in the rate at which a practice or idea is adopted. A number of studies have measured the effects of profitability of a practice on the rate at which the practice is adopted. Practices which have a high marginal return tend to be

adopted more rapidly than practices that yield low marginal returns on the investment. However, there is some evidence that large expenditures, regardless of the marginal return, will be adopted slowly by a large number of farmers because of internal capital rationing. Practices which give their economic returns in a given crop year or in an animal life cycle will be adopted more rapidly than those which require a longer period. This may be partially explained by the fact that many farmers are operating from capital positions which necessitate immediate returns on their production capital. It also may be related to the fact that many of the farmers are operating farms or parts of their farms on short-term leases. Under this circumstance, practices applied to the farm will benefit the adopter only if the returns accrue in the short run (79; 73; 69).

Another factor limiting adoption of practices which return satisfactions over a long period of time is the short planning horizons of many farmers. More research is needed in this area.

Studies Needed to Refine Model

During the 12 years since this model was first introduced, the Iowa State University Rural Sociology Research Team, led by Dr. George M. Beal and the author, has done several studies on adoption of various ideas.³⁵ This work and the work of others have shown that the basic model is still valid (11; 97; 20). These research works suggest some cogent areas for further study to refine the model and make it applicable to a wider range of specific situations. This may include consideration of the applicability of the model depending on the degree to which adoption decision are impulsive or deliberately rational or whether they are essentially problem or innovation oriented as Campbell has suggested (30).

There are still innumerable unanswered questions regarding the adoption process. The major purpose of the author in writing this chapter was to set down the ideas which from a subjective point of view are important ones to be pursued in future research. It is intended as a working paper, a point of departure for discussion.

This chapter contains little or no reference to research needs relative to development of methodological problems relevant to adoption-diffusion research. The limitations of time and space would not permit it. Such omission should not be construed to mean that methods are considered to be of minor importance.

One of the major limitations of the basic operational model is the fact that it is too general for use in certain empirical situations. The model fits best those situations where the new idea is one which involves a major investment of time, energy, or capital resources. When the individual is contemplating the adoption of an idea which demands such major investments he will go through a

³⁵Nine individual reports based on Iowa Agricultural Experiment Station Projects. 1320, 1420, 1422, 1492, and 1493. Project co-leaders—Joe M. Bohlen and George M. Beal.

period of fact gathering and evaluation which may take long periods of time before the idea is tried. If the practice is tried on a small scale and the results of use are highly visible, the following may better describe the sequence. (The operational definitions used are essentially the same as outlined previously.)

General
Specific
 Awareness Information Trial Information Evaluation Adoption

When a farmer becomes aware of new insecticide and has enough general information to know where and when to use it, he may purchase a very small amount and try it in his garden rather than a field. The trial provides him with specific information about the idea and gives him the total data needed to adopt on a larger scale. The model above also fits the so-called "impulse buy" of certain products, such as a new toothpaste, a new shaving cream, or a different brand of cigarettes.

Another type of adoption which does not fit neatly into the older model is the adoption of a non-material idea of position; for example, the adoption of a given individual's position regarding his country's entry into the Common Market or any other political or social action. Some research has been done on this type of adoption. Much more needs to be done (97).

The research to date has placed much emphasis on the evidence of continued use as evidence of adoption. This obscures the significance of optimum adoption and the study of factors related thereto. Much more work needs to be done on determining the factors related to optimum or correct use of an idea. Such research might bring into clearer focus the differences in adopters.

More needs to be known about the kinds of criteria used by potential adopters in determining (a) whether or not to adopt the practice and (b) if the practice can be used in varying intensities, in determining the intensity and extent of practice use.

More research related to the trial stage and the purpose of trial might be fruitful. For instance, work at Iowa State University has indicated that personal and social characteristics of the potential adopters are highly related to the use of trial.³⁶ This work infers that people with higher abilities for dealing with abstract symbols skip small-scale trials and go directly to full-scale use.

Ability to cope with abstract symbols may be only one aspect of intelligence that is related to rapidity of adoption. More work needs to be done on the development of measures which can be used under field conditions to get at these intelligence factors of respondents.

In the past, research has analyzed adoption and the various stages prior to it on the basis of empirical evidence of the use of the practice and in further analyses relating personal and social characteristics to the adoption. Results of these efforts have not always shown clear-cut relation-

ships. It could be that there are many young, highly intelligent farmers showing up as late adopters who are ahead of others in mental adoption but prevented from actual adoption by limitations of capital, lease arrangements, or parental control in management. More work needs to be done on these factors.

More research also needs to be done on the relationship between the conditions under which respondents carried out their "trials" and ultimate adoption. Every adoption researcher can produce anecdotes from interview experiences which seem to imply that many ideas get rejected, not because the idea wasn't good, but because the person carrying out the trial didn't follow directions or in some other way failed to use the idea as recommended.

Another aspect of trial upon which more research is needed is that of the relationship of the frame of reference of the potential adopter towards the idea and his ultimate adoption or rejection of this idea. There is some evidence that some ideas are rejected, not because the idea is bad, but because the potential user did not have a realistic frame of reference for outcomes. In one Iowa study, 20 percent of the farmers who had tried a specific *grass killer* said that they were not going to use it again because it did not kill *broadleaved weeds*.³⁷

At all of the stages, more research is needed to determine the relationship between personal attributes of potential adopters and their choices of information sources.

Further studies of the role of one-way two-way communications in helping people to adopt new ideas also are needed.

Differences in use of information sources due to stage and personal characteristics of potential users need to be pursued further. Little is known about meaningful impact via mass media devices of commercial advertising compared to editorial copy or commentary.

Habit probably plays an important role in resistance to new ideas. Much more research needs to be done to determine the impact of the desire to continue known ways of doing things to which the user can assign some probability statements in regard to outcomes.

The difference between risk, to which one can assign probability statements, and uncertainty, to which one cannot, is frequently the difference in knowledge. Thus, one might hypothesize that the kinds of beliefs (knowledge) which individuals have about possible relationships of new ideas will be related highly to their actions in regard to these ideas. In this research area only beginnings have been made.

This approach assumes that habit is ramified not only by satisfaction with the known, tried alternatives but also by fears about the new and untried.

There is some evidence to date that those who are the first to adopt new practices may prefer different kinds

³⁶Same as footnote 35.

³⁷Same as footnote 35.

of information at *all* of the adoption stages. Some preliminary work at Iowa indicates that these earliest adopters have higher levels of ability to cope with abstract symbols and prefer factual, intensive definitions and ideas, whereas the late adopters prefer more of the how-to-do-it type of information.³⁸ These late adopters tend to seek out evidences of success in use. The "success story" in the farm magazine, or by word of mouth from a neighbor provides the bolstering of judgment needed to make a decision.

More work is needed in the development of scales and other measures of attitudes. Scales are now extant which provide tools to measure the relationships between idea adoption and risk aversion, independence, attitudes toward science, traditionalism, and other traits. There is a need to improve these scales and to go beyond them seeking the data which will help to understand why these attitudes are held.

More needs to be known about the relationship between subjective security and adoption. Some evidence exists that the earliest adopters have a greater belief in their capacity to be masters of their own destinies and in being able to cope with exigencies as these arise.

Little has been done by university researchers to determine the factors involved in choosing one alternative means rather than another after an individual has chosen a new idea as a goal. Not much is known about the intellectual process which a farmer goes through in choosing a given brand of combine after he has decided that harvesting should be done with this type of machine. The easy generalization that he chooses within a framework of economic rationality has been refuted so frequently in related areas of adoption research that its validity is open to suspicion in this one.

Another area of research which has not had much attention from workers in the field has been the non-adopters of new ideas. Some work has been done in Minnesota and, currently, work is underway in Ireland attempting to determine why farmers have not adopted practices which have been demonstrated useful in agriculture.

More needs to be done in placing the theories and findings of adoption research within the concept of overall social action and social change.

The few people in the world engaged in this research area have a great challenge, and are in no immediate danger of working themselves out of problems to study.

³⁸Same as footnote 35.

Needed Research on the Structures of Interpersonal Communication and Influence³⁹

*Herbert F. Lionberger*⁴⁰

INTRODUCTION

This chapter is primarily concerned with research needs related to the structure of interpersonal communication and influence, a phenomenon that persists in the face of modern means of communication. Even with farm information available from many sources, including mass communication channels, farmers continue to rely on close associates for information and advice about farming matters. The multiplying effect of people on people in learning about and accepting innovations has been demonstrated for farm and non-farm people, even those with a high abstracting ability (58; 41; 92). It often appears that the adoption momentum developed by interpersonal communication and influence early in the process is sufficient to continue without communicative effort or support from "outside" sources (58; 159, pp. 215-19).

If such a momentum can develop with high literacy rates, educated clientele, and highly developed information dissemination systems, how much more crucial it must be where literacy rates are low, reading materials scarce, radios and television lacking, and where most human energy must be directed to providing the necessities of life.

Even though fellow farmers perform different information disseminating functions at different stages in a postulated 5-stage adoption process (43; 200) and they serve as accelerators of change in successful adoptions, there are functions that cannot be performed acceptably for many farmers by anyone but certain trusted associates. This is illustrated by the unwillingness that some farmers

have to try new farm practices, however well validated they may be, or by whatever means until they are tried locally.

THE PROBLEM

As pointed out, in information seeking, heavy reliance is placed on associates as communicators, as demonstrators of local adaptability, and as legitimators of decisions. Environmental conditions structure these interpersonal communicative-influence processes through their influence on individuals involved. Thus, the articulation or contact of interacting individuals with outside sources of information and influence become important considerations for action agents and communications researchers. From an action standpoint, the problem is largely one of activating existing channels of interpersonal communication and influence and of facilitating related processes. For the researcher, the problem is conceptualizing functions performed in the individual adoption process, determining the factors that condition the performance of these functions, and understanding the relevant processes. In an action-oriented setting there is the additional responsibility of interpreting research findings to change agents who are charged with the responsibility of promoting projected change.

This chapter concentrates on the research aspects of the problem and is specifically concerned with research related to:

1. The definition or conceptualization of functions performed by individuals in the adoption processes.

³⁹Adapted from a paper read at the First Inter-American Research Symposium on the Role of Communications in Agricultural Development, Mexico City, Hotel Vasco do Quiroga, October 5-13, 1964. Contribution from the Missouri Agricultural Experiment Station. Journal Series Number 2822. Approved: September 16, 1964.

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2. The characteristics of special functionaries pertinent to the performance of their functions and the roles expected of them by those who "use their services."
3. The manner in which special functionaries articulate with communication channels in the larger society, particularly research sources, and the way they are integrated into communicative and influence structures at the local level.
4. The structural aspects of communication and influence patterns ranging from the elemental information seeker-sought dyad and attendant aggregates to the more rigid locality, clique, and formal groups that characterize rural society.
5. The manner in which personal attributes and special features of social groups condition the interpersonal flow of information and message impact.

No comprehensive review of research findings is possible or contemplated, nor is any recommendation of research priorities intended. The major objective is to point out types of research possible and, in some cases, the likely utility of such research. Studies are cited for the primary purpose of contributing to these general ends.

FUNCTIONS PERFORMED BY INDIVIDUALS

Certainly the last word has not been spoken on conceptualized functions performed by individuals in the individual adoption process. However, innovation, communication, and legitimation (or the exercise of influence) have been distinguished, (117) and reinforcement has been suggested. It is an easy step from the function to the functionary: innovator, communicator, and legitimator or influential.

Innovation

Although in the broad sense, innovation refers to a departure from prevailing practices or situations, it has been functionally referred to in agricultural "diffusion" research as the introduction of new ideas or practices into the immediate locality (159, pp. 159-165; 103, p. 53; 143). The practices introduced are usually those tried and tested by reputable agricultural or industrial research agencies and perhaps also tried elsewhere under conditions similar to those in the immediate locality.

A distinction is sometimes made between the actual first people to try the practice and those thought to be first. If the two are different, it is the latter who are likely to serve as the innovator referents of potential adopters.

Although more research is needed to determine the role of innovators in the adoption process, some aspects of roles are evident. Where most farmers want to see a new farm practice tried locally before they adopt it themselves, which is often the case, innovators serve a "demonstration of local adaptability" function. In a sense, they do for others what there is no local precedent for doing. Where

thorough objective testing of results is not done by special agencies and where most people are skeptical of new developments, they assume financial and status risks that others are not willing to take. Perhaps, they also perform a refinement, modifying, and perfecting function for innovations in farming after original development by others. It has been further suggested that they may cause change agents to promote innovations that might otherwise be neglected (164).

Legitimation

Legitimation may be defined as the process by which fears are dispelled and a favorable disposition leading to the acceptance of innovations is achieved. It might be called the process of becoming convinced (92). This very closely coincides with the evaluation stage in a postulated individual farm practice adoption process (10; 183). At this stage an individual carefully weighs the pros and cons of a new idea or practice before trying it.

Role expectations for legitimators or influentials are probably better known than those for other functionaries. First, it appears they must surely have a reputation for good judgment. People who discuss impending adoption decisions with them want advice with the information. They want to know about its application to their own local situation. Perhaps those who seek their advice also expect them to be well informed.

Merton has suggested that influentials obtain information (keep informed on a subject) partly for status considerations while others obtain information for their own use (130). It was also in relation to this differential use of information sources and communicative behavior that the two-step and multi-step flow of communication theory was formulated (93; 130). The theory holds that influentials who are most exposed to outside information sources transmit what they know to persons who are less exposed. Yet, despite inferences drawn about role expectations from related research, comprehensive studies directed toward defining role expectations for functionary referents are lacking.

Communication

Posing of a separate communication function is certainly more tenuous than the posing of either the innovation or legitimation function. However, the relative lack of overlap of persons named as *first or additional sources* of farm information with those named as *most influential* in final adoption decisions suggests that there are other people who are instrumental in communicating information; thus, the reason for posing a separate communicative function.

This does not deny the existence of communication with innovators and of communication as a means of transmitting influence from influentials or legitimators. Undoubtedly, communication must occur in these situations also. Certainly, more research needs to be done on the conceptualization of this function and on the role that communicators play in the individual adoption process. It

may be that some serve as communicators merely because they are accessible (117; 202). Also, communicators may have developed a reputation of being well informed without necessarily developing a reputation for good judgment in farm management decisions. Those who consult them may expect to get information, but not advice. The latter, if given, may be discounted or even disregarded. Perhaps no evaluation of the information obtained is expected from communicators in the proposed restricted sense.

Certainly, one requirement for arriving at adoption decisions is acquisition of additional or more detailed information. Sources most used for this purpose tend to be different from the one used for evaluation of ideas and their application to the local situation (43; 103, p. 32; 159, pp. 98-105). Thus, people who are most qualified to perform each function may be selected differentially as are information sources in general (111).

CHARACTERISTICS OF FUNCTIONARIES

Once functionaries are defined, matters of functional overlap and characteristics of the functionaries become important considerations. Several functional overlap questions may be raised. One centers around whether or not overlap occurs between innovation and legitimation and whether or not innovators and legitimators are one and the same (1; 7; 159, p. 243). In regard to innovators, a common question is whether they are frequently sought as sources of farm information. Whether they are or not and under what conditions appears to be closely related to local norms regarding the relative acceptability of innovations in farming (7; 69; 129; 149; 189). In any case, where variations occur, it is important to learn the conditions under which this happens.

A more recently posed overlap question is whether there is an information communication function quite aside from innovative behavior and the exercise of personal influence (111). Recent Missouri studies indicate that this is the case. These and undoubtedly other yet undiscovered overlap conditions have very important educational implications. For example, if innovators and influentials are the same persons, one educational approach may suffice. If they are not, separate educational and promotional programs may be needed. Also, each will need to be involved differently in educational efforts by change agents.

Determination of characteristics of functionaries pertinent to the performance of the various specialized functions and to change agents offers a second avenue of fruitful research. Whatever the function performed, innovator, communicator, or legitimator, there are characteristics and role expectations pertinent to the performance of these functions. Some relate to the ability of each to perform his respective functions, and some are of consequence because of their potential for involvement in educational programs. For the legitimation of ideas and practices even such a simple characteristic as age may assume considerable significance. For example, if the exercise of influence is heavily concentrated in the hands of elderly people whose

influence is in turn fortified by the extended family system or other group structures, age may be of great importance.

Innovators by definition are persons out ahead of others in their adoption behavior (72). But where do they get information about the innovations they adopt? Is it from reliable sources and does it consist largely of validated truths from public and private research agencies or from erratic developments outside of these research laboratories? Do innovators have their own reference groups and own special sources of farm information? How does their prestige or standing in the community compare with that of others? Are they actually marginal men as some have suggested? Is their behavior rewarded or punished in the community? Do they have the resources to risk in innovative endeavors?

These questions all bear on ability to perform the innovative function, which in this case refers to the introduction of new ideas into the immediate locality. Aside from innovators that exist in the present farm environment, there is a possibility that others may be trained for this function.

Quite aside from strictly personal characteristics, communication of information and the exercise of influence are very directly related to the manner in which special functionaries are integrated into the prestige structure of the community. If their prestige is high, their utility may be enhanced by virtue of this position (105). But differences may also serve as impediments to the communication of information and the exercise of influence. Attendant social distances may be too great for communication to occur. Also, influentials have sometimes been described as being like other farmers in the community, except more so, from the standpoint of their adoption behavior and feelings about the acceptance of changes in agriculture (158; 159). Whether this is true or whether freedom to deviate in the adoption of new farm practices without loss of status is possible should be determined; also whether influence is exercised in a polymorphic or monomorphic manner.

A further consideration is the manner in which special functionaries are integrated into the communicative, influence, and associational patterns of the local community and beyond. Participation in both types of social groups enhances accessibility for communicative purposes and thus for the exchange of farm information. Such groups also mete out rewards for compliance and reprisals for non-compliance with group expectations. The manner and extent of their integration into the various networks is related directly to their communicative potential at the local level.

Other significant considerations relate to the nature and quality of contacts that functionaries have with information sources outside of the immediate locality and their relative receptivity to new ideas about matters related to farming. If their information receptivity is higher than that of people who seek advice and information from them, they can provide low resistance avenues for reaching those who consult with them (113).

STRUCTURAL CONSIDERATIONS

Of people from whom information may be obtained, only a few are selected regularly by each individual (98; 113; 160). Where unrestricted choice is possible, choice is likely based on individual standards imposed for the desired purpose. Where obstructions are present, persons most desired as sources of information may not be the ones actually used. Obstructions may be imposed by personal attributes, situational conditions, or group structures (202). Conversely, all three may also have a facilitating influence on communication and the exercise of influence. The simplest structural unit (the information seeker-sought dyad) provides an appropriate unit for investigating the structuring influence of personal attributes and social groups (179).

Seeker-sought Dyads. When a person names another as a most valued source of farm information, what does he consider? Kinship relationships, technological competence, age, education, or what? Conversely, are certain kinds of people avoided as information sources, e.g., do low competence farmers talk to low competence ones and high competence ones with those of their own kind, or do they all tend to select at the high competence level of the continuum?

In like manner, do big farmers talk to big farmers and little ones to little ones, or do they all tend to look to large operators as personal sources of information? The first has been referred to as a segregating effect (i.e., the tendency to select one's own kind) and the latter as a differentiating effect, which is a situation where all tend to look to some point on a continuum for persons with whom to consult (17; 112).⁴¹

Techniques are available for determining the degree to which either of these effects occurs and the magnitude of each (17; 39; 112). Thus, the effects of various attributes and the comparative effects on evaluative or interactional choices may be determined. A larger differentiating effect on persons chosen as most valued sources of farm information than on those actually chosen as sources can be taken as evidence of resistance to obtaining information from most valued personal sources (202).

Perhaps a more difficult problem is to determine why such a differential occurs. Possible explanations may be found in the social distances that intervene between the chooser and the chosen. Or causes may lie in social structure that either impede or facilitate contacts in the dyad relationships. Obviously, an interactional choice requires a degree of reciprocation not required in an evaluative choice, i.e., the naming of a person as most valued for a particular purpose. Perhaps some clue to the question of why resistance forces on an attribute basis may be detected by the use of Campbell's social distance interaction scales (31).

⁴¹A generalized tendency to select unlikes is another type of segregating effect but not considered in this paper. An example of such a segregating effect is represented by boys choosing girls as dates and vice versa.

Interpersonal Networks. Interpersonal seeker-sought dyads aggregate into various patterns that have distinctive characteristics (116). A common type of aggregation is on a village or community basis. The component dyads may be thought of as more or less habitual "farmer talk to farmer" patterns about matters related to farming. This assumed, the total network may be thought of as a means of disseminating information from various outside information sources to the local farmers. Information transfer then is dependent upon the exposure of component members to outside information sources and the way the dyads are connected with the persons exposed to the outside sources. Four exposure situations are possible with respect to any given outside information source (116):

Situation A. Where both the information seeker and the one sought obtain information from an outside information source. In this case, information received directly by the seeker can be reinforced by that obtained from his referent.

Situation B. Where the information seeker obtains information directly from an outside source, but the one sought does not. Obviously, if one-way transmission is assumed, no potential for indirect information transfer is provided.

Situation C. Where the information seeker does not obtain information directly from an outside source, but the "sought" does. This provides an opportunity to get information from an outside information source through the exposed referent.

Situation D. Where neither the information seeker nor the one sought obtains information from the outside source. This, like situation B, permits no opportunity for message transfer.

These dyads suggest certain features of the aggregate network regarding its potential for message transfer from various "outside" information sources. (Outside means outside the network.)

First, it is obvious that the communicative potential of the network for a source increases as the number of exposed "soughts" in the total network increases. The opposite is true when exposed soughts are situated in a network that restricts communication with them or when relatively few are exposed to a given outside information source.

A second network feature of interpersonal message transfer is the degree to which exposed and unexposed persons interact exclusively among themselves. No opportunity is provided for the communication of information indirectly from an information source outside of the network if unexposed persons consistently seek information from others who are unexposed.

A third feature of the interpersonal network is the opportunity that it offers for reinforcing messages. This occurs when the seeker-sought situations permit information coming directly from an outside source to coincide with information coming indirectly from a personal referent

who also obtains information from the same outside source. The significance of this relationship is based on the assumption that double exposure from information sources is more likely to influence personal behavior than single exposure (93).

Methods for calculating mechanistic indirect transfer, total interpersonal transfer, and total mechanistic potential of interpersonal networks for message reinforcement, have been suggested (116). Whether these measures have applied utility or not, it is appropriate to recognize that networks have differing potentials for indirect message transfer from outside information sources and that the kind of potential varies.

This, of course, is closely related to the two or multi-step flow of information theory which may be investigated either in terms of the conditions that permit transfer (94; 105) or in terms of the actual information flow (98).

Social Groups

Social groups structure both interpersonal communication and the adoption of farm practices. Both represent aspects of diffusion research that should be pursued. Commonly found social groups of likely consequence in all societies include family, kinship, locality, and special interest groups. The significance of social groups in adoption behavior and the communication of information stem from features characteristic of all groups, the selective nature of their membership, and the specialized functions they perform. From the standpoint of relevant general features, they provide:

1. *Ready made interpersonal channels of communication.*
2. *Norms that relate either directly or indirectly to the acceptance of various types of proposed changes, and definitions of what should and should not be done in relation to them.*
3. *Mechanisms for meting out group rewards and punishments and for enhancing the influence of power figures and the communicative potential of key communicators.*
4. *Mechanisms for commitment of aggregates of people for or against proposed changes with attendant mechanisms to encourage conformity.*

From a research standpoint there is a need for knowledge first about existing group structures [i.e., who belongs, and what each stands for (norms) in terms of the proposed changes], second, how patterns of communication and exercise of influence operate within and across group lines, and third, what linkages of groups occur and with reference to whom. A few findings of studies will illustrate. It has been found that—

People in high adoption neighborhoods look higher on the competence scale of personal sources of information than do the people in low adoption ones (124).

—Social cliques facilitate communication of information within neighborhoods and tend to restrict flow across clique lines (115).

—Neighborhoods (locality groups) have a localizing influence on interpersonal information seeking patterns (119).

—Groups norms influence the functional overlap of communication with legitimation and innovation (124).

—General cultural background and norms may impede or enhance the adoption of many farm practices (149).

—Family values influence adoption behavior in various ways (199).

—Adoptions sometimes occur by groups at least for some kinds of practices (129).

In developing countries where many social groups are locality based, adoption sequences can be traced very well and viewed against a background of group structure and a knowledge of how communication patterns operate within and across group lines. Since the development of a group consciousness from latent and perhaps uncommunicated interests seems possible, (64) some attempt to detect areas of latent interest for audience building may also provide research opportunities. Riley and Riley suggest a conceptual scheme of interlocking group structures that serve as conditioning factors in both message transmission and message receipt (154). Inclusion of both the message receiver and the message sender in the same social system is further indicated. Ennis has suggested the importance of interlocking primary groups as feedback mechanisms (64).

Conclusion

Much of the research suggested involves a somewhat uncommon structural unit in agricultural diffusion research, the seeker-sought dyad. Although research methods and concepts in terms of the social dyad may not revolutionize sociological research as some have suggested, they certainly open new avenues for the study of the structure of interpersonal relations in "diffusion research." They provide the basis for an operational definition of most functionalities considered up to now and have the advantage of being the most elemental unit of social structure (179).

To be sure, not all research areas enumerated can be recommended in developing countries or elsewhere. As with all types of research, priorities must be assigned in terms of the problems at hand, the urgency of the situation, and the resources available for doing the research. There can be little doubt that research, carefully selected, planned, and executed in the structure of interpersonal communications, can provide change agents with tools and insights that can make their efforts more effective and satisfying.

A Communication Research Approach to the Diffusion of Innovations

Everett M. Rogers⁴²

PRESENT STATE OF DIFFUSION RESEARCH

Past diffusion research has been voluminous, but perhaps somewhat stereotyped in its methods and central concerns. As of July 1, 1967, about 941 empirical publications⁴³ were available on the diffusion of new ideas, consisting of

- 377 in Rural Sociology
- 74 in Communication
- 66 in Anthropology
- 65 in Extension Education
- 65 in Medical Sociology
- 34 in Agricultural Economics
- 58 in Education
- 36 in Marketing
- 66 in General Sociology
- 100 "others" not included in these nine major diffusion research traditions

This represented a doubling in the number of publications on this topic in five years; in other words, as many research documents on diffusion appeared after 1962 as in the previous 34 years.

Certain general observations may be intuitively offered about trends in this research literature.

1. Rural sociological research on the diffusion of farm practices continues to predominate in numerical contribution to this body of literature.

2. Diffusion research, especially by rural sociologists, is being conducted increasingly in developing countries, often by North American scholars with the cooperation of host country colleagues.

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⁴³A current inventory of diffusion studies is maintained by the Department of Communication, College of Communication Arts at Michigan State University, East Lansing, Michigan, from which complete bibliographies are periodically published, one of which is listed as reference 168. The last in the series, labeled No. 6, was published July 1967.

3. Minor diffusion research traditions have been arising in recent years (largely since 1960) that use the frameworks originally developed by U.S. rural sociologists. Examples are demography (investigations on family planning), geography (diffusion simulation), and journalism and mass communication (diffusion of major news events).

4. Closer mutual recognition among the various diffusion research traditions is appearing, as evidenced by citation of other traditions' work and by use of methods developed in others' traditions.

5. There are still rather clear-cut "traditions" represented in the diffusion literature, with one tradition in particular (anthropology) evidently unaware of all others.

6. Increasing interest in diffusion research is apparent nowadays outside of the U.S., with new editions of U.S. diffusion writings appearing this year in Spanish, Japanese, Arabic, Italian, and Portuguese.

7. The use of diffusion research findings is still clearly lacking among most general sociologists, especially those writing on the topic of social change; they generally continue to ignore diffusion results, even where these results have obvious application.

Speculative reasons for these observations may be offered, and such speculation would be interesting but it is beyond the scope of this report.

Rather, my major purpose is to highlight what I consider some of the major (a) methodological and (b) substantive research needs for the diffusion research field. Certain of these needs, I suggest, may be obtained from the related field of communication research.

CONCERNS

1. Multi-Variable Correlational Analyses

Most past research studies have concentrated on investigating zero-order hypotheses; that is, the direct relationship between two variables, without considering the possible intervening effect of other variables on this relationship. Needed are analytical attempts to determine complex patterns of relationships among important diffusion concepts. This may be done by (a) multiple-corre-

lation analyses (a number of these investigations have been reported, but few used more than six or seven independent variables, a limitation no longer important with the availability of computers); (b) partial correlation analyses, where the effects of intervening variables may be tested (a recent example with Colombian peasant respondents indicates that mass media exposure intervenes in the relationship of functional literacy to agricultural innovativeness); and (c) more sophisticated correlational analyses, where models are used to guide the empirical investigation of zero-order relationships [examples are (46; 63; and 56)] so that *chains* of interrelationships are determined.

2. Field Experiments

Although more detailed methods of correlation analysis enable us to better understand the interrelationships of diffusion variables, this approach will never yield cause-effect relationships. Only field experiments on the diffusion of innovations can lead toward causal results, and they can only provide evidence of the time-order of variables and not the "forcing" quality of one variable upon another. Few such experiments have been reported; an Ecuadorian study on effects of radio, audio-visual, and other communication "treatments" on the adoption of latrines, etc., has been reported (180); and a Taiwan study of birth-control information diffusion methods is available (15).

Several other field experiments are underway: one in 14 Costa Rican villages on the effectiveness of radio farm forums and literacy-reading training in increasing knowledge, favorable attitudes, and adoption of farm, health, and other practices; and one in eight India villages where a similar before-after design seeks to determine the effectiveness of radio farm forums, literacy-reading classes, and "animation." Perhaps it is noteworthy that all these field experiments are in peasant villages in developing countries, social systems with rather distinct boundaries, where unintended contamination of the experimental units can be somewhat more easily prevented than in other settings.

Hoveland (84) pointed out that most laboratory experiments, which show relatively large attitude change as a result of communication stimuli, have not been reproducible (to this extent) in field conditions. Perhaps one reason is that we lack extensive experience in social scientific field experiments.

The diffusion field lends itself nicely to studies using a field experimental design, and it is my opinion that this method holds great promise for future research.

3. Prediction of Innovativeness

Past attempts to predict (a) the adoption or rejection of an innovation or (b) innovativeness as measured by a composite adoption scale depended upon two major data-analytic techniques: (1) *multiple correlation*, where the highest percentage of variation in the dependent variable reported is 70.3 percent (in the case of a Colombian peasant village where four independent variables were used: trips to cities, social status, empathy, and farm size) and (2) some

form of the *configurational* method, originally developed by Stuckert (182), and used to predict innovativeness with a generally similar approach. Only Bonilla (22) used an important second step in prediction, that of following up on deviant cases to determine why Colombian families whom she predicted would adopt vegetable gardens were in fact, nonadopters (and vice versa).

A promising new prediction method that combines certain elements of the configurational approach with some aspects of multiple correlation is Morgan and Sonquist's (132; 133) technique of "sequential interaction analysis." A computer program is available from Morgan to select the best independent variables to predict a given dependent variable (which could be innovativeness), select the order in which these independent variables maximize prediction, and halt further analysis when an acceptable level of prediction success has been accomplished. As yet, sequential interaction analysis has not been used to predict innovativeness, but at least one attempt is underway.

All previous methods of "prediction" suffer to the extent that they are really methods of "post-diction." Once a prediction scheme has been developed, it should then be used on a "future" sample of similar respondents to test its prediction possibilities.

4. Computer Simulation of Diffusion

The computer simulation of the diffusion of farm innovations (and other new ideas) initiated by the Swedish geographer Hågerstrand (74) has received increasing attention from U.S. and Scandinavian social geographers such as Karlsson (90), Pitts (147), and others (52; 53; 54). Great theoretical and practical profit can be realized from the computer simulation of diffusion, just as in the simulation of diffusion of political behavior and economic development. One important advantage of simulation in the diffusion field is that the time dimension can be compressed or expanded. The usual simulation approach has been to mimic diffusion processes and then compare the simulation with reality. Such an approach differs considerably from the usual research tactic of testing a number of hypotheses as if each were not highly interrelated and interdependent. Simulation allows us to gradually approach the more complete explanation of diffusion processes step-by-step.

CONCEPTUAL VARIABLES

Besides the previous procedural points, the following concepts deserve more research attention. Few of these are completely "new" in the sense that *no* previous research studies (about 1250) have touched on them. Many of the priority research needs that follow are essentially a call for closer integration of diffusion research with important concepts in the broader field of communication research. Examples are dogmatism, source credibility, achievement motivation, and empathy.

1. Dogmatism

The personality dimension of dogmatism or close-mindedness should affect the diffusion and adoption of new ideas, but this concept has received little research attention. One attempt was reported in Iowa (155), and its worth has been questioned (76). Jamias (87) found differences (on the basis of dogmatism) in information use in the innovation-decision process for Michigan dairy farmers. Difficulties in measuring dogmatism in field interviews have at least been partly solved, and the way is now clear to firmly establish the role of this personality variable in its relationship to innovativeness, length of the adoption period, the role of communication channels, etc.

2. Achievement Motivation

The relationship of achievement motivation, defined as a social value that emphasizes a desire for excellence to attain a sense of personal accomplishment, to innovativeness has been postulated by McClelland (128), but only rather weak evidence is available for this theory from the work of Morrison (134) with Wisconsin farmers, Neill and Rogers (135) with Ohio farmers, and Rogers and Neill (167) with Colombian peasants. Further study and improved measurement are needed; this type of investigation is presently underway in India, the Philippines, and Malaysia.

3. Cognitive Dissonance

The dissonance theories of Festinger (66) and related communicative theories (congruity, consonance, etc.) have received relatively little study in relationship to the innovation-decision (i.e., adoption) process. Exceptions are the work of Emery and Oeser (63) and Mason (125; 126), which suggest that further information-gathering and decision-making may occur for some individuals *after* the decision stage in the innovation-decision process. Dissonance toward an innovation may be especially likely in an organizational setting in which the individual is forced to adopt (or reject) by bureaucratic edict contrary to his existing attitude toward the innovation. The tension-reduction hypothesis would lead us to expect the individual to circumvent the edict, or else to eventually alter his attitudes.

DEVELOPING COUNTRIES AS A PRIORITY LOCALE FOR DIFFUSION STUDIES

About 90 percent of all diffusion research has been completed in such developed countries as the U.S., Western European nations, and Australia or New Zealand. Since 1962, however, about half of the diffusion studies have been conducted in such developing countries as India, Pakistan, the Philippines, Costa Rica, Puerto Rico, Mexico, Brazil, and Colombia. The locale of an investigation is important because variables important in developing countries (especially their rural portions) are different from those in developed areas. Examples are:

1. Empathy

The ability to take the role of others has been widely studied by social psychologists, more recently by Lerner (101) in Turkey, Eister (62) in Pakistan, Rao (151) in India, and Rogers and Whiting (169) in Colombia. The role of empathy in the modernization of traditional individuals has been conceptualized and partially established empirically, but the relationships of empathy measures to communication and adoption behavior have yet to receive much attention. In peasant villages, where new technological ideas enter from external sources, there is ample reason to expect that individuals who seek and use these innovations should be more empathic. Also, empathy should be an important variable in explaining the success-failure of change agents in working with client villagers.

2. Mass Media Exposure

In the U.S. where most commercial farmers receive farm magazines, listen to farm radio broadcasts, etc., exposure to the mass media may not differentiate between innovators and later adopters. However, in peasant villages, this type of communication channel orientation may be quite important, as studies in Colombia (55; 56; 166) seem to indicate.

3. Literacy

Various studies have established the importance of functional literacy in explaining the adoption of new farm ideas; examples are Goldsen and Ralis (72) in Thailand, Rahim (150) in Pakistan, Deutschmann (55) in Guatemala, and Deutschmann and Fals Borda (56) and Rogers and Herzog (166) in Colombia. We do not know if this is a direct relationship (suggesting that literates have a different type of mental ability than illiterates) or if literacy simply acts as a facilitator of information exposure (such as through printed mass media) and, hence, affects adoption of new ideas. Before-after studies of members of adult literacy training classes are one method of studying the "meaning" of literacy on the communication and adoption of new ideas.

4. Marginality

Traditional communities are also a fine site to determine the social marginality of innovators, a topic that has received much theoretical speculation but inadequate investigation [Barnett (8) and (7) Adams; (1) Putney and Putney; (149) Rogers (158) and Ben-David (13)]. Bearing on this problem are such closely-similar variables as cosmopolite orientations, reference group influences, alienation, social system norms, and social status consistency.

5. Why Change Campaigns Fail

A number of anthropological analyses of why programs of planned change failed in a community are available [Alers-Montalvo (2); Apodaca (6); Wellin (194); Dobyns (57)], especially in Latin American cultures. These studies suffer from the lack of generality in the application of their

findings because often the factors contributing to failure were idiosyncratic to the community studied. Derivation of generalizations from these studies has been attempted by Azensberg and Niehoff (156). Also needed is a similar type of analysis of the success or failure of change programs on a much larger scale (such as in 70 to 80 villages in a developing country) so that specification of general factors is possible.

ADDITIONAL TOPICS FOR RESEARCH

Some additional topics needing attention grow out of deficiencies in the existing diffusion literature and might well be conducted in the U.S. or abroad.

1. Symbolic Adoption

Almost all past diffusion research has concentrated on *material* ideas, in which adoption consists of idea use. Ideologies also should be subjected to analysis in a diffusion framework. Symbolic ideas without a direct material parallel are the National Farmers' Organization, the Alliance for Progress, and communism.

2. Prediction of Communication Channels

Much attention, as mentioned earlier, has been devoted to research on predicting innovativeness, but no attempt has yet been made to predict the communication stimuli (interpersonal-mass media, cosmopolite-localite, high-low credibility, etc.) used by individuals at stages in the innovation-decision process, for various types of innovations.

3. Early Knowing

Similarly, while great attention has been devoted to predicting who will adopt an innovation early and who will adopt one late in a given social system, few investigations

have sought to explain who will become aware of a new idea relatively early or late. One example is found in the Ryan and Gross (172) study, and another more recently in Colombia by Deutschmann and Fals Borda (56).

4. Interpersonal Communication

Although sociometric studies of opinion leadership in diffusion are numerous, there is much room for a more refined analysis of person-to-person communication of new ideas. Research approaches from laboratory studies of rumor transmission might be used in field investigations of diffusion. An example is a study of message sharpening in the spread of an agricultural chemical from demonstration farmers to other farmers in Iowa (98). Investigations of the conditions under which the "like-me" (or homophily) or the "prestige" hypothesis best explains seeker-sought dyads is needed. Indeed, the general approach to studying interpersonal diffusion with relational analysis (so-called by James Coleman of Johns Hopkins University because the dyadic relationship is the unit of analysis) appears profitable.

5. Consequences of a New Dependent Variable

Most past investigations have centered on innovativeness as the main dependent variable. At best, we should view this as only the immediate dependent variable; a more ultimate concern is to determine how innovativeness, once explained, explains variation in certain consequences. Thus, we should not halt our research efforts (as we have done in the past) in explaining agricultural innovativeness, but continue further to use innovativeness (and other variables) in explaining levels of farm production. The case is similar with health innovativeness and family illness.

Diffusion researchers have now reached the happy state of commanding considerable research resources. It is their responsibility to spend these riches wisely and ingeniously. Otherwise, their activities will amount to no more than simple replotting already well-tilled ground.

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