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Diffusion of Innovation in Latin America: A Geographer's Perspective

That innovation diffusion is a basic element of economic and social change requires no argument. That geographers specializing in Latin America have made contributions to the study of innovation diffusion which are of either practical or scientific utility, however, is doubtful, This is especially surprising in view of the significant contributions to this topic by geographers hot specializing in Latin America, such as Hagerstrand (1967). This hiatus provides the motivation for this paper, which briefly reviews the work on innovation diffusion in Latin America carried out by social scientists, and indicates some avenues of research that geographers might pursue.

Streams of diffusion research in Latin America

A useful paradigm of social change and, by implication, economic change in a given social system (read place or location) is given by Rogers (1969). Such change is seen to have two basic aspects: (1) recognition of the need for change, which may be either internal or external to the social system or place; (2) a new idea (in terms of the existing social or economic system), which originates either within or outside the social system or place. The result is identification of four types of social or economic change:

Paradigm of Types of Social and Economic Change
(After Rogers, 1969:6)

Recognition of Need for Change	Origin of the New Idea	
	Internal to Social System or Place	External to Social System or Place
Internal: recognition is by members of the social system or place	I. Imminent change	II. Selective contact change
External: recognition may be by change agents outside the social system or place	III. Motivated imminent change	IV. Directed contact change

It is clear that the bulk of recent efforts by governmental agencies and researchers that focus upon economic development and social change are concerned with *directed contact change* (type IV) and (to a lesser degree) *selective contact change* (type II). Both relate to ideas that originate external to a given social system or place. In the former, however, recognition of the need for change comes from outside the system, thus necessitating that its members be *persuaded* to change. In selective contact change such recognition occurs within the population comprising the social system or place.

Reported research on change covers all four of Rogers' types. However, a basic division on the basis of whether recognition of the need for change is internal or external does seem apparent. Thus, one major concern is with internal conditions that are conducive to change, examples of which are the work of McClelland (1961) and Hagen (1962). These efforts tend to emphasize individual conditions, particularly psychological ones, that spawn a milieu of change and ready acceptance (or searching out) of new ideas and innovations, conditions that are not readily manipulable in the short run.

A second major thrust, represented by the work of Foster (1962) and Rogers (1962), gives primary emphasis to change initiated externally. These efforts tend to emphasize the acceptance of single innovations, manifest or objectively measurable characteristics related thereto (rather than states of mind or subjective characteristics), and strategies for changing a given community. This work has exceedingly practical implications, and it is probably not an overstatement to say that every change agent in Latin America would do well to read and digest Foster and Rogers.

In all the work referred to above, spatial processes generally have been neglected. This is not surprising. For the McClelland-Hagen tradition, spatial processes are probably of little relevance except in some very indirect fashion related to education processes. Spatial processes are important within the Rogers-Foster tradition. However, this has been carried on largely by sociologists studying adoption within a single, usually small community or a highly localized rural area (Hanneman, et al. 1969; Deutschmann, 1962; Deutschmann and Fals Borda, 1962; Fals Borda, 1955; Deutschmann, Mendez, and Herzog, 1967), where spatial processes play a relatively minor role. At a larger scale, however, this is not the case, and it is in that context that geographers can make an important contribution. To illustrate, two examples are now considered; one concerned with diffusion at a macro-scale, the other concerned with diffusion within a single

urban field.

Diffusion at a macro-scale

The traditional model of innovation diffusion a la Hagerstrand is concerned with the processes by which non-adopters are *persuaded* to adopt via the transfer of information about the innovation. Such information is the result of either interpersonal communication or exposure to the mass media, both of which have marked spatial biases, primarily in terms of distance decay effects. For interpersonal communication, these occur on a local scale (Morrill and Pitts, 1967). By contrast, spatial biases in mass media communication appear in the macro-scale (Hagerstrand, 1966), there being ample evidence that the probability of tuning in to a given media declines with distance from the town of origin of that media (Brown and Cox, 1970). Brown (1968; 1969) and Brown and Cox (1970), however, point out that in addition to considering the acquisition of information about an innovation (the persuasion aspect), an adequate model must also consider acquisition of the innovation itself. For the acquisition aspect of adoption, they suggest that the distribution policy of the propagator of the innovation and shopping trip behavior of potential adopters are particularly important.

The resulting innovation diffusion model consists of a two stage process which considers both information factors and market factors. It is seen to be generally applicable whatever the level of spatial aggregation or the type of innovation, although it is most relevant for diffusion in the context of a central place system or diffusion viewed at a macro-scale.

To illustrate its generality with regard to the level of spatial aggregation on which the diffusion is viewed, consider the situation of diffusion through a group of farmers residing in the same general area, where the individual constitutes the unit of observation. Further, assume that the temporal unit of data aggregation is relatively large, say, one year or six months. Under these circumstances information factors might be sufficient to explain the spatial pattern of diffusion; consideration of market factors would not be necessary because virtually all individuals would have opportunity for sufficient contact with a market distributing the innovation. Thus, although interpersonal communication may legitimately be the focus of the study, and the market may be de-emphasized, the market factor is still present in the conceptualization of the process. Furthermore, as data is aggregated temporally in smaller and smaller units, individual differences

in shopping-trip behavior probably must be considered (even while the propagator's distribution policy is still ignored, since its effect remains the same for everyone). As the level of spatial aggregation is increased towards viewing diffusion on a landscape of central places, consideration of the whole market factor -- shopping-trip behavior of potential adopters and distribution policies of the propagator of the innovation -- is necessary.

To illustrate the generality of the conceptualization with regard to the type of innovation, the use (or not) of the market factor mechanism may again be considered. This mechanism is relevant for any innovation distributed through some central point such as a commercial market place, agricultural extension station, study group, club, convention, etc. Otherwise, the information factor alone should be sufficient to account for the pattern of diffusion, since acquisition may be seen as occurring contemporaneously with the receipt of effective information. Again, however, the market factor is still present in the conceptual framework of the process. To elaborate in somewhat more specific terms, consider a scaling of innovations according to the likely relevance of the market factor, in addition to the information factor. In terms of broad types of innovation, such a scale might pass from culture traits through ideology and culminate at manufactured goods, e.g.,

likely relevance of the market factor

culture
traits ——————————————— ideology ———————————————→ manufactured goods
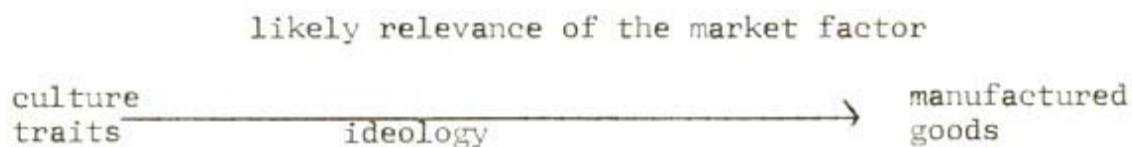
The place of a particular innovation along such a scale, however, is likely to be determined by the degree to which it is characterized by the presence of a distributor who is vitally concerned with propagation (not by whether the innovation is a culture trait, ideology, or manufactured good). Such a person, impatient with the restrictions and relative inefficiencies of spread solely through interpersonal communication, may be expected to operate through the appropriate distribution centers.

Let us now consider the relevance of the model previously described in terms of the implementation of a program of change. The suggestion of that model is that development planners and other agents of change should give attention to diffusion to the locality in which the adopter resides (an aspect which is neglected by the majority of social science diffusionists). Further, particular attention should

be given to manipulating the distribution policy of the propagator of the innovation, since this is the only element of the system which has great control over the extent of diffusion and is subject to manipulation. Shopping trip behavior and personal communication behavior exert great control over the extent of diffusion, but they can not he manipulated by an outsider, at least not in the short run. Given this type of focus and sufficient empirical data, a model such as the one developed by Brown might be employed to test the effect of different policies of distribution by the propagator of the innovation. This could provide a basis for a strategy of change, where simultaneous consideration given to factors such as the predicted extent of diffusion, cost of manipulating the system, the overall gain from wide spread adoption, etc. However, even if data are not available so as to permit direct application of the model, other research related to the effect of manipulating the distribution policies of the propagator of the innovation would be a valuable contribution.

The important point to be drawn from the above discussion is that there exists a model provided by a geographer that is relevant to policies of economic development and social change and related social science research. This model identifies a number of relevant factors that should be the focus of future inquiry. In addition to information factors, the relevance of which many of us are already aware, geographers interested in diffusion problems should investigate shopping and other travel behavior of individuals and distribution policies of the propagators of innovations. For such problems of market related behavior, geographers have a strong background in theory, empirical findings, and methodology. This area, then, presents a line of inquiry that has been neglected by other social scientists, for which spatial processes are relevant, and through which geographers may make an important contribution relevant to both policy and research on economic development and social change.

Diffusion within a single urban field

To take a somewhat less general view, and more specifically illustrate diffusion research that a geographer might conduct, consider the relative roles of site factors related to adoption as compared with situation factors. Previous work by sociologists and other social scientists studying diffusion in Latin America has, in general, given much attention to site factors, and little if any attention to situation factors. From work on transportation development, growth poles, and related topics, as well as from geographic research on diffusion in a non-development context, we have reason to believe that situation factors are equally relevant. To

date, however, there is no study of innovation adoption in developing areas that focuses upon these two elements as joint entities in the adoption process. In fact, I know of no study which even focuses upon situation factors alone.

The problem of the relative role of site and situation factors in adoption was recently considered in an analysis of data collected in the Mexican department of Aguascalientes in 1968 (Brown and Lentnek, 1970). Adopters are farmers who contract their milk products to Nestle Corporation. Nestle is located in the town of Aguascalientes, and goes into the rural hinterlands of Aguascalientes to collect contracted milk products. The date at which a farmer contracts with Nestle is taken as the time of adoption, and that variable (or a derivative of it) is treated as dependent for purposes of analysis. Independent variables consist of five site factors and two situation factors. These were derived by separately subjecting sixteen site variables and five situation variables to principal components analysis (Table I), The five site components relate to the *age* of the respondent: *economic indices* of the farm enterprise; the *size* of the farm enterprise; *contact* with United States agriculture; and *education* of the respondent. The two situation components relate to the *density of adopters* around the respondent at his time of adoption, and the *distance* or *accessibility* to market of the respondent.

Three separate analyses were carried out, each employing the five site and two situation components as independent variables in a stepwise regression procedure.

The first test consisted of a two-group discriminant analysis distinguishing adopters from non-adopters on the basis of the seven components, Density and accessibility components are entered first and second, respectively, and the age component entered the third. These accounted for 84.8 percent of the total variance (r=.921), with only five of five-hundred and sixty-six farmers (observations) misclassified. No other components were significant. One further item of interest in this analysis is that if only situation components (density and accessibility) are considered, 60.7 percent of total variance (r=.779) is accounted for, with only twenty four of five-hundred and sixty-six farmers misclassified. Thus, an argument may be made that situation components alone provide a satisfactory basis for discriminating between adopters and non-adopters at any point in time.

The second analysis treated adopters only, with time of adoption as the dependent variable. The most important component was accessibility, followed by that representing economic indices of the farm enterprise. These accounted for 49.9

percent of total variance (r=.704), with no other components significant. However, the situation component again proves to be nearly as adequate by itself as the model considering both site and situation components, explaining 45.2 percent of variance (r=.672).

The third analysis treated both adopters and non-adopters, again using time of adoption as the dependent variable. Accessibility was the most important component, with the age and economic indices components second and third, respectively. These accounted for 65.0 percent of total variance (r=.806) with no other component significant, Considering only the accessibility component results in accounting for 48.0 percent of explained variance (r=.693)

Considering the three analyses together suggests that diffusion outward from an urban center to its hinterland, at least in some cases, operates in a step-by-step fashion with situation factors playing a critical role. In the initial step, the hinterland population may be seen to be divided into potential adopters and unlikely adopters on the basis of their accessibility to the urban center and, to a lesser degree, on their age and related characteristics. Members of this initial population of potential adopters will adopt at different times, although (theoretically) all will adopt earlier than potential adopters identified later who are initially in the population of unlikely adopters. The time of adoption for each member of the group of potential adopters is determined primarily by the accessibility of each to the urban center and, to a lesser degree, upon the economic characteristics of the farm enterprise of each.

TABLE I AQUASCALIENTES DIFFUSION ANALYSIS

Site Variables	Site Components: Age of Respondent	Economic Indices of Farm Enterprise	Size of Farm Enterprise	Contact with U.S. Agriculture	Education of Respondent
Age of farmer at date of adoption	x				
Number of years attended school					x
Estimated size of family at date of adoption	x				
Index of contact with mass media					x
Index of Spatial Mobility		x			
Contact with U.S. Agr.				x	
Average 1967-1968 net annual Income		x			
Average size of cultivated area 1966-68			x		
Number of hectares of irrigated land			x		
Number of hectares of pasture			x		
Average value of milk sales 1967-1968		x			
Average net income from cattle operation		x			
Profit Ratio for Cattle 1967-1968					
Number of factors considered by farmers in choosing Nestle as a buyer	x				
Earliest date when bracero income was used to purchase cattle				x	

Situation Variables	Situation Components: Density of Adopters	Accessibility to Market
Distance to nearest paved road at time of adoption		x
Total road distance to market destination		x
Airline distance to nearest adopter at time of adoption	+	+
Density of adopters in 9 cell area at time of adoption	x	
Density of adopters in 25 cell area at time of adoption	x	

Component loading significant on only one component indicated by x

Component loading significant on more than one component indicated by

The analysis suggests that this two phase process is repeated for a second, third, fourth, etc. time interval, each one pushing the zone of adopters further outward from the urban center into its hinterland. Presumably, this diffusion would stop

when either demand was completely satisfied or capacity for production was exhausted.

An interesting aspect of this analysis is the particularly important role of situation variables, particularly those related to accessibility. Indeed, our analysis indicates that situation variables alone could adequately account for the examined diffusion. Although the empirical situation is such that an important role for situation factors was anticipated, the Possible singular role of situation factors was a complete surprise. In any case, this analysis represents tangible evidence that situation factors are critical in at least some situations of diffusion of innovation in Latin America. The study also serves as an example to indicate that geographers can and should be playing an important role in development research and policy planning.

Concluding remarks

This paper is short enough so that a review of our findings and points made in the discussion is hardly necessary. Rather, I would like to take a moment to address the general question of research in Latin America.

The work reviewed here is done in a quantitative context. This is my approach; it is not necessarily yours. That this approach has great utility should be taken for granted at this stage in the development of our discipline. Nevertheless, such approaches have seldom been applied in Latin American research. Aside from the lack of training in this area by Latin Americanists, a presumed lack of suitable data might also be held responsible. However, the work here indicates that suitable data can be found for Latin America as well as other places. Further, every Latin American country has at least one census and related statistics, and many countries have censuses for several years. Despite the shortcomings in these data, many of which also exist in the United States census, quantitative analysis of existing materials could provide an important base for planning and research in Latin America, as Friedmann has demonstrated. As a geographer, I prefer that this be done by us rather than others.

However, far more important, whether quantitative or non-quantitative approaches are taken, is that research be problem oriented. It is my impression that the problem orientation of much work by Latin American geographers is *often* not clear-cut or not relevant to contemporary situations. Although the value of scholarship for its own sake can not be disputed, I feel that the practicalities of

the real world require that Latin American geographers address themselves to contemporary and relevant problems if they are to be successful in maintaining and improving their position with other social scientists working in Latin America and Latin American governments.

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