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Akin L. Mabogunje

Systems Approach to a Theory of Rural-Urban Migration

In the growing literature on the study of migration, two theoretical issues have attracted the greatest attention, namely, why people migrate and how far they move. A simple model for explaining the reasons why people move has been formulated in terms of the "pull-push" hypothesis [*12*, *19*]. This has been elaborated variously to take account of internal migration movements of the rural-rural, rural-urban, or urban-urban types and international migrations. The issue of how far people move has, in turn, given rise to the formulation of a surprisingly large number of models of varying degrees of statistical or mathematical sophistication. In most of these models the distance covered is treated as either the sole independent variable or as one of many independent variables explaining the number of migrants moving to particular destinations. Morrill [*21*] has provided a valuable summary of these models and suggests that they can be classified broadly into deterministic and probabilistic models.

Most of these theoretical formulations have been applied to conditions in the developed countries of the world and especially to urban-to-urban migrations. Their relevance for handling migratory movements from rural to urban areas and particularly in the circumstances of underdeveloped countries has hardly been considered. Yet, it is these areas of the world where rural-urban migrations are presently taking place that afford the best opportunity for testing theoretical notions about this class of movements.

It is suggested that Africa, in particular, is a unique area from which to draw important empirical evidence about this type of movements. Similarly valuable data, however, can also be derived from examining the history of some of the advanced countries of the world. It is, of course, true that in Africa attention to date has been focussed to a disproportionate extent on seasonal and other non-permanent transfers of population from rural to urban areas, that is, on what has been referred to as a "constant circulatory movement" between the two

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areas [*20*]. But, it will be shown that this type of movement represents a very special case of rural-urban migration. To make the point clear, it is necessary to offer a definition of the latter. Essentially, rural-urban migration represents a basic transformation of the nodal structure of a society in which people move from generally smaller, mainly agricultural communities to larger, mainly non-agricultural communities. Apart from this spatial (or horizontal) dimension of the movement, there is also a socioeconomic (or vertical) dimension involving a permanent transformation of skills, attitudes, motivations, and behavioral patterns such that a migrant is enabled to break completely with his rural background and become entirely committed to urban existence. A permanence of transfer is thus the essence of the movement.

Rural-urban migration also represents an essentially spatial concomitant of the economic development of a region. Indeed, it has been suggested that one of the basic goals of economic development is to reverse the situation wherein 85 per cent of the population is in agriculture and lives in rural areas while only about 15 per cent is in non-agricultural activities and lives in the cities [*14*]. Rural-urban migration represents the spatial flow component of such a reversal. It is a complex phenomenon which involves not only the migrants but also a number of institutional agencies, and it gives rise to significant and highly varied adjustments everywhere in a region.

It can be argued with a great deal of justification that few of the theoretical models provided so far have considered migrations, especially rural-urban migration, as a spatial process whose dynamics and spatial impact must form part of any comprehensive understanding of the phenomenon. It is the main contention of this paper that such an understanding can best be achieved within the framework of General Systems Theory [*30*]. This approach demands that a particular complex of variables be recognized as a system possessing certain properties which are common to many other systems. It has the fundamental advantage of providing a conceptual framework within which a whole range of questions relevant to an understanding of the structure and operation of other systems can be asked of the particular phenomenon under study. In this way, new insights are provided into old problems and new relationships whose existence may not have been appreciated previously are uncovered. In this paper no attempt is made to define major components and relationships in a formal, mathematical manner. The emphasis here is on a verbal analysis of the ways in which the system operates. This, it is hoped, will enable us to identify areas where present knowledge is fragmentary and where future research may be concentrated with some profit.

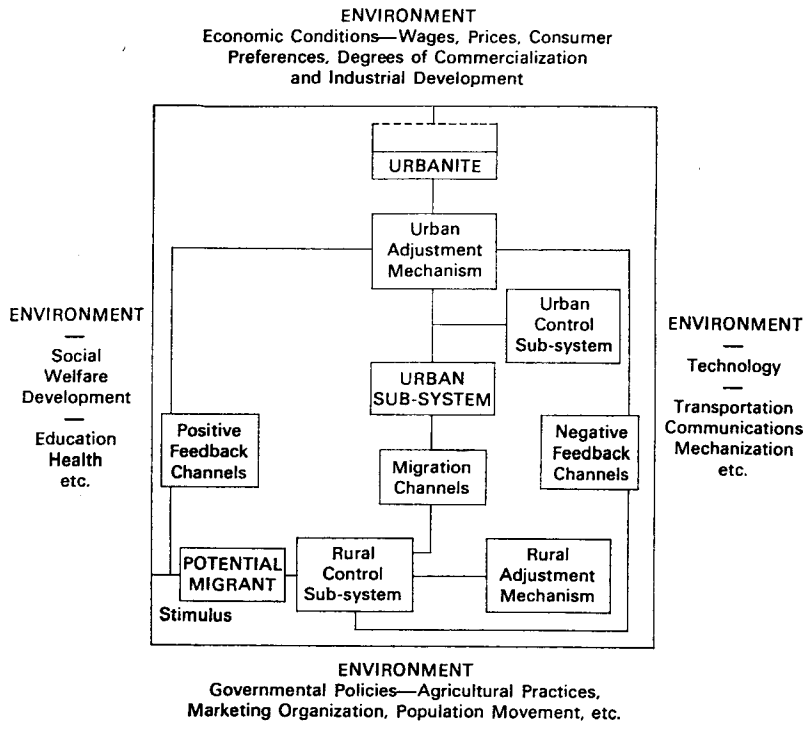

FIG. 1. A System Schema for a Theory of Rural-Urban Migration.

Defining the System of Rural-Urban Migration

A system may be defined as a complex of interacting elements, together with their attributes and relationships [*11*]. One of the major tasks in conceptualizing a phenomenon as a system, therefore, is to identify the basic interacting elements, their attributes, and their relationships. Once this is done, it soon becomes obvious that the system operates not in a void but in a special environment. For any given system, this environment comprises "the set of all objects a change in whose attributes affects the system, and also those objects whose attributes are changed by the behaviour of the system" [*11*, p. 20]. Thus, a system with its environment constitutes the universe of phenomena which is of interest in a given context.

Figure 1 indicates the basic elements in the rural-urban migration system as well as the environment within which the system operates. It shows that a systems approach to rural-urban migration is con-

cerned not only with why people migrate but with all the implications and ramifications of the process. Basically, the approach is designed to answer questions such as: why and how does an essentially rural individual become a permanent city dweller? What changes does he undergo in the process? What effects have these changes both on the rural area from which he comes and on the city to which he moves? Are there situations or institutions which encourage or discourage the rate of movement between the rural area and the city? What is the general pattern of these movements, and how is this determined? These, and other such questions, define the problems for which we require a theory of rural-urban migration.

It can be shown theoretically that areas with isolated and self-sufficient villages such as were found in many parts of Africa until recently, are not likely to experience rural-urban migration, since, in any case there would be hardly any cities in such areas. The fact that today such movements characterize many parts of the continent and are lately assuming spectacular proportions means that rural areas are in general no longer isolated or self-sufficient. It is therefore relevant to ask: what forces have contributed and continue to contribute to the decline in these conditions of isolation and self-sufficiency in the rural areas? They are, in the main, forces set in motion by increasing economic development. In most African countries, this was brought about initially by the colonial administrations and further reinforced in recent years by the activities of the new African governments. Decreasing isolation means not only improvement in transportation and communication links but also greater integration of the rural economy into a national economy. Such integration makes the rural economy more responsive to changes in wages and prices, consumer preferences, and the overall demand pattern within the country. It also subjects it to a wide range of governmental legislations or official policies over which, in many cases, the rural community has little or no control. Decreasing isolation also means greater social and cultural integration of rural and urban areas such that levels of expectations in both areas begin to converge towards a recognizable national norm of what is the "good life." The breakdown of isolation brings the rural areas within the orbit of one or more urban centers and sharpens the awareness and desire of villagers for the ever increasing range of goods and services which the urban centers have to offer. To acquire these, the villagers have to produce more agricultural goods and enter into an exchange relation with the city. Alternatively, they may move into the city to sell their labor direct in exchange for wages with which to buy goods and services.

This then is the environment within which the system of migration from rural to urban areas operates. This is the environment which stimulates the villager to desire change in the basic locale and rationale

of his economic activities and which, in consequence, determines the volume, characteristics, and importance of rural-urban migration. Moreover, it is an environment which is constantly changing, and these changes affect the operation of the system. Hence, for any theory of rural-urban migration to be of value it must take into account this dynamic aspect of the problem.

The basic elements in the system of migration are shown in Figure 1. It identifies first the potential migrant who is being encouraged to migrate by stimuli from the environment. Few studies have concerned themselves with the universe of potential migrants. More often, the the tendency has been to study only those who successfully made the move. Even for these, attention is given mainly to classificatory characteristics such as age, sex, religion, education, and ethnic or racial origin rather than to an analysis or understanding of the background to their move [*7*]. There is, of course, no doubt that what this variety of information is meant to indicate is the pattern of distribution of the "propensity to migrate" within the rural population. But this is neither explicitly stated nor formulated. Moreover, an equally valuable concept which this variety of information might have been used to explore is that of "migration elasticity" [*31*]. This relates not so much to the propensity to migrate but to how long impulses or stimuli from the environment must be transmitted to a potential migrant before he makes the desired move.

Within the systems framework, attention is focussed not only on the migrant but also on the various institutions (sub-systems) and the social, economic, and other relationships (adjustment mechanisms) which are an integral part of the process of the migrant's transformation. The two most important sub-systems are the rural and the urban control sub-systems. A control sub-system is one which oversees the operation of the general system and determines when and how to increase or decrease the amount of flow in the system. A simple example is provided by the thermostat which controls the amount of heat that flows within a given area. If we accept the existence of control sub-systems in this type of migration movement, the problem then is to identify which institutions operate in this manner both in the rural and the urban areas.

In the rural areas, a true control sub-system would, of course, be the family, both nuclear and extended. In the first place, it is the family that holds back potential migrants until they are old enough to undertake the move. Even when they are of an age to move, the family still acts as a control sub-system in many ways. In some places, it enables members of both sexes to move out; in others, members of one sex tend to get away more easily than those of the other. Where the potential migrant is married, the issue of whether he can move alone or with his wife and children may depend on the customary role of the sexes in agricultural activities, the age at which marriage is encour-

aged, and the circumstances and age at which a young man may expect to be economically independent of his parents. More important as a control mechanism is the relation of family members to the family land, especially as this relation is expressed through the lineage system and the inheritance law. An inheritance law that encourages most of the land to go into the hands of the first child (the primogeniture rule) will tend to stimulate more migration of the other children [*2*] compared to one based on the equality of access (partible inheritance rule) by all the children. In either case, the size of the farmland, the nature of the major agricultural products, and the prevailing prices for these would also be of decisive significance.

Apart from the family, the village community itself may act as a control sub-system. Its controlling role is not often direct but is obvious in either a positive or negative way in the various activities which it sponsors or encourages. Thus, a village community which attempts to improve its economic conditions, for instance, through co-operative farming or marketing, may discourage, at least in the short-run, permanent migration. On the other hand, a village community which puts emphasis on social betterment, for example, through education, may inadvertently stimulate migration to the city through training the younger generation to be more enlightened and more highly motivated. A pertinent aspect of the study of rural-urban migration is thus to assess how different rural communities react to migration away from the village. Such assessment should involve more than the opinion survey of the older generations. It should include an investigation of village activities and administration, and of the degree of cohesiveness in the community.

The urban control sub-system operates at the opposite end of the migrant's trajectory to encourage or discourage his being absorbed into the urban environment. Absorption at this level is of two kinds: residential and occupational. Basically, the control sub-system here can be identified with the city administration and other employment agencies operating under national laws and statutes. The city administration can ensure availability of relatively cheap and adequate housing in quantities which could make the transition of the rural migrant either difficult or easy. Apart from housing, the activities of the city administration in providing reception centers as well as various amenities and services may be a vital factor in gradually inducing a migrant to commit himself to the urban way of life.

A major factor in this commitment is, of course, the securing of an employment. In the city, there are numerous employment agencies offering, at any one time, very limited opportunities for the migrant. A pressing problem in the control sub-system is how to bring together and make known these disparate, but sometimes impressive, lists of vacancies. In some urban communities, this function of collation is left entirely to the press and their advertising columns. In others, a

labor exchange is provided. The effectiveness with which these organizations function can be crucial for the inflow of migrants. However, once the migrant has secured an employment, a number of other factors determine his final commitment. Among these are: the type of job he secures, whether seasonal or permanent, the opportunity the job offers for improvement in his skill and for advancement in his status, the provisions available for security against the normal hazards of industrial life, and his eventual retirement due to old age.

At both the village and the city level, the decision of the migrant to move from or to move into the community sets in motion a series of adjustments. With regard to the village community, the mechanism for these adjustments should operate in such a way as to lead to an increase in the *per capita* income of the community. At least theoretically, the loss of one of the productive units in the village should lead to an increase of the productive capacity available to the remaining units; otherwise such losses from the rural area would eventually lead to a significant drop in agricultural production, to food shortage, and to famine. That these do not occur in many places means that some adjustments do take place to maintain aggregate productivity from these areas. The Ardeners [*1*] in their study of the Hsu of the Cameroons, for instance, point out that, in spite of the fact that as much as 40 per cent of the adult male population in the village was absent, food production did not show any significant drop. Studies of other communities in Africa have indicated similar observations [*25*]. However, what is involved in the adjustment to rural-urban migration is more than the minor arrangements by which the farmlands belonging to seasonal or short-term migrants are tended in their absence by their wives, their friends or other members of their families. What is involved here are the ways and methods by which rural communities permit migrants to renounce partially or wholly their rights to productive resources in the rural areas.

One of the major research frontiers in rural-urban migration studies is the understanding of how this renunciation is accomplished. In Africa, for instance, such renunciation must be seen against the background of a complex land tenure situation and the fact that sale of land is regarded as basically a foreign concept. There is some evidence that one of the implications of rural-urban migration is to encourage a growing individualization of land-holding (with or without enclosuring) and a disposition to treat land as a marketable commodity. In the Eastern Region of Nigeria, for instance, rural-urban migration has been leading to a new pattern of land distribution and ownership. This is especially so in those areas not too far from the major urban centers [*23*, *24*]. It would appear, however, that initially it is the usufruct (or right to beneficial usage) on the land and not ownership that is regarded as negotiable. As a result, leasehold or annual rental of agricultural land has become widespread in many parts of West

Africa and serves as a means of re-allocating land which would otherwise remain unutilized because its owners have migrated to the cities. In some other cases, it is the right to exploit tree crops such as the oil-palm, cocoa, or rubber that is exchanged for monetary considerations either by outright payment or by share-cropping arrangement. In all cases, the effect of the renunciation of the migrant's claims on land or other resources is to enable some members of the village community to increase their net income by the expenditure of their often under-utilized labor. The more complete the renunciation by the migrant, the greater the acceptance of the idea of outright sale or alienation of land. Renunciation, by providing increased capacity in land or other resources, also encourages attempts at production for a market, diversification of crop production on individual farms, and a reduction in the subsistence sector of the village economy.

Sometimes, however, this process of adjustment is induced by government and has the effect of widely stimulating migration from the rural areas. This was in fact, what happened in Britain in the 18th and 19th centuries with the various Enclosure Acts. In Africa, especially in East and Central Africa, the same process can be witnessed today. Thus, in Rhodesia, the Native Land Husbandry Act of 1951 individualized agricultural holdings and occasioned the loss by many farmers of their right to cultivate former family land. This disenfranchisement, as was only to be expected, gave rise to a flood of migrants most of whom had no alternative but to become permanently committed to wage employment and psychologically attuned to surviving in an urban environment.

In the urban areas, the mechanism of adjustment is basically one of incorporating the migrant into a new frame of reference more relevant to his needs in the city. In this respect, a city can be described as an assemblage of interacting interest groups. Part of the process of becoming a member of such a community would thus be to identify closely with one or more of these groups. The mechanism of incorporation in the urban areas, in contrast to the adjustment process in the rural areas, has been the subject of a number of studies. In particular, attention has been called to the role of ethnic unions and various voluntary organizations such as the church, trade unions, occupational associations, and recreation societies in helping the rural migrant to adjust to his new environment [*4*, *15*].

Finally, of the various elements of the system, there is the city *qua* city, seen as part of an urban sub-system. What aspects of urban life and activities are relevant for the understanding of rural-urban migration? To answer this question, it is important to visualize the city as comprising a hierarchy of specializations. In other words, a city is a place where everyone is trying to sell specialized skill. The more specialized the skill, the greater the demand for it, and hence the higher the price it commands on the market. Within this conceptual framework, the illiterate, unsophisticated rural migrant is seen as belonging to the lowest level of the hierarchy. A corollary is that the higher a person moves up within the hierarchy, the greater his commitment to the urban way of life and the less the probability of his reversion to rural existence. This is one reason why the type of job which a rural migrant secures in the city can be so crucial to how soon he becomes committed to urban life. This is also one reason why those countries, such as Rhodesia, which are anxious to ensure that the African does not become an urban resident, pursue a discriminatory policy with regard to his acquistion of skill in urban employment. Yet, as Masser pointed out, even in Rhodesia the propensity to return to the village after migrating to the city decreases with the minimal rise in the skill of the migrant [*18*].

Another interesting aspect of this concept of the city is that upward mobility within the hierarchy of specializations is often accompanied by changes in residential location within the city. This is no doubt a function of rising income, but it is also closely related to the length of stay in the city and the increasing commitment of a migrant to spend the remaining part of his working life there. There have been many studies of the residential pattern and varying length of stay of migrants in urban areas. Unfortunately, a good number of these studies have been concerned more with indicating the ethnic basis of this pattern than with investigating the dynamic factor of skill differentiation and status advancement which is operating to blur out the importance of ethnicity. As a result, this rather crucial dimension of rural-urban migration has tended to be neglected. Its investigation should yield some rather interesting results.

One final aspect of the examination of cities as a hierarchy of specializations relates to the significance of size. What effect has the size of a city on the type of migrants attracted to it? Clearly, small urban centers have fewer tiers of specializations and more restricted employment opportunities than the larger ones. Yet, competition for positions in them may be less intense. Are certain types of migrants attracted to such centers first and then able to "leap-frog" gradually to bigger and bigger centers? What type of migrants would make direct for the larger cities? Does rural-urban migration into the larger cities take place in the manner of "a series of concentric migratory contractions" suggested by Ashton [*3*] for Britain in the 18th century? According to Ashton, the larger industrial centers attracted a number of workers and their families who were living in the larger market towns on their perimeters. These towns in turn made good their losses from the surrounding villages, the villages from the hamlets, and the hamlets from the farms. In this way, there was no sharp discontinuity in the pattern of life with which the migrant was familiar. Are there conditions, for instance, the nature of the transportation network and development, which would make such a pattern of

migration appropriate for Britain of the 18th century but not for Africa in the 20th century? Or, does this pattern reflect stable human reaction to a permanent spatial dislocation of existing networks of social contacts?

The Energy Concept in Systems Analysis

A system comprises not only matter (the migrant, the institutions, and the various organizations mentioned) but also energy. In the physical sense, energy is simply the capacity of a given body to do work. It can be expressed in a number of ways, but two forms of it are relevant here. There is "potential energy" which is the body's power of doing work by virtue of stresses resulting from its relation either with its environment or with other bodies. The second form is "kinetic energy" which is the capacity of a body to do work by virtue of its own motion or activity.

In a theory of rural-urban migration, potential energy can be likened to the stimuli acting on the rural individual to move. What is the nature of these stimuli? As pointed out earlier, a number of studies have tried to identify why people migrate and have come up with a variety of answers generally subsumed under the push-and-pull hypothesis. This suggests that people migrate from rural areas to the cities because of one of two general causes: overpopulation and environmental deterioration in the rural areas (the push factor) or the allurement or attraction of the city (the pull factor or the so-called "bright-light theory"). The push factor, it is claimed, explains migrations directed to earning extra income to pay the annual tax or to take a new bride or to buy a few manufactured articles or to escape oppressive local mores. The pull factor, on the other hand, explains migrations undertaken as a modern form of initiation ceremony to adult status or as the basis for later receiving preferential admiration of the village girls or as the product simply of an intense curiosity about the city.

These explanations, to the extent that they have any theoretical validity at all, are relevant only at the aggregate level. These are notwithstanding the results from completed questionnaire surveys requiring individuals to indicate the reason or reasons for their migrating into the city. But, as Richards [*27*] and Gulliver [*9*] stress, the battery of questions usually asked of migrants hardly ever reveals anything about why they moved. In Africa, the great number of temporary migrants to the cities on whom most studies have been concentrated, are involved in making no major decisions other than on the length of time they can or have to be away from home. The reasons for their migration are very often manifold and usually not easy to

articulate in a few, simple sentences. What the questionnaire does, in fact, is to suggest to the migrant a set of equally plausible reasons, besides the obvious one of coming to earn extra income.

Within the systems framework, the explanation of why people migrate must be in terms of differential individual responses to the stimuli both from the environment and from within the system. It differs from the pull-and-push hypothesis in putting the emphasis at the individual level, not on why people migrate from particular areas but why any person from any village would want to migrate to the city. The stimulus to migrate is related to the extent of the integration of rural activities into the national economy, to the degree of awareness of opportunities outside of the rural areas, and to the nature of the social and economic expectations held by the rural population not only for themselves but also for their children. Indeed, the notion of "expectations" or "aspirations" is central to an understanding of the ways in which the stimulus from the environment is transmitted to individuals, and for that reason it is a crucial variable in the theory of rural-urban migration. What determines the variation in the level of individual expectations in rural areas and conditions individual responses to the stimulus to migrate? Clearly, for a given cohort in any rural area, one can, at least theoretically, conceive of individuals who respond promptly to the stimulus and others who take a much longer time to respond. One may in fact ask whether there is a threshold below which the stimulus cannot be expected to act and an upper limit beyond which its impact is no longer felt? How are these limits defined—by age, wealth, natural alertness, or family position? In short, two problems in the theory of rural-urban migration which still require resolution concern the nature and significance of rural expectations and their relation to the differential effectiveness of the stimulus to migrate.

Once an individual has been successfully dislodged from the rural area, we can assume that he is translating his "potential energy" into its "kinetic form." The major issues concern not only the act of moving but also the cost, the distance, and the direction of movement. These three variables clearly determine the crisscross channels of migration as well as their destinations. Again, as already indicated, this aspect of migration studies has received considerable theoretical attention. Starting with Ravenstein's laws of migration [*26*] which try to establish the relation between distance and the propensity to move, there have been various attempts to seek understanding through using the gravity model [*8*, *28*], and the intervening opportunities model [*29*]. There have also been other studies which have tried to understand the pattern of migration channels through probabilistic models [*13*].

As soon as a migrant has moved from the rural to the urban area,

his role in the system is greatly amplified. Basic to an understanding of this amplified role is the concept of "information," a central notion in the theory of communications. Information can be defined simply as bits of messages in a system which lead to a particular set of actions. Thus, one can easily assume that the first migrant from a village to a city would soon start to transmit back to the village information about his reception and progress in the city. Ignoring for the moment the question of "information content," it can be shown that the level of information can be measured in terms of decisions [*30*]. A particular set of decisions can be compared with the random choice from a universe of equally probable decisions. Its deviation from the latter becomes a measure of the level of information. It also represents a statement of the level of order or organization existing within the system. Information is thus a crucial feature of the operation of a system since it determines at any point of time the state of organization of the system.

Of equal importance is the notion of "feedback" which has been the focus of the field of Cybernetics. This can be explained quite simply in terms of stimulus-response behavior. A stimulus affects a receptor which communicates this message to some controlling apparatus and from this to an effector which gives the response. In feedback, the effector's activity is monitored back to the receptor with the result that the system's behavior is in some way modified by the information. The feedback process can have one of two effects. It can further amplify the deviation (in this case by stimulating further migration), or it may counteract the deviation by encouraging a return to the initial situation. Deviation-amplifying feedbacks are regarded as positive; deviation-counteracting feedbacks as negative.

The notion of a "most probable or random state" is one that needs further clarification. Imagine a situation in which migrants from a village are lost to their communities as soon as they move out and send back no information on their reactions to the cities to which they moved. Later migrants then, not knowing where the first set of migrants went to might choose any city in the system, almost in a random manner. Over time, the distribution of migrants from individual villages may come to approximate a situation in which the number of migrants from any village to a city is proportional to the size of that city. This is the most probable state in which no order or organization is evident in the system. Conceptually, it can be seen as a state of maximum disorder, or a state of maximum "entropy."

Yet, the general experience is that migrants are never lost in this sense to their village or origin but continue to send back information. If the information from a particular city dwells at length on the negative side of urban life, on the difficulties of getting jobs, of finding a place to live, and on the general hostility of people, the effect of this negative feedback will slow down further migration from the village

to this city. By contrast, favorable or positive feedback will encourage migration and will produce situations of almost organized migratory flows from particular villages to particular cities. In other words, the existence of information in the system encourages greater deviation from the "most probable or random state." It implies a decrease in the level of entropy (or disorder) or an increase in negative entropy (negentropy). The result is greater differentiation in the pattern of migration which reflects some form of organization. Thus, experience of rural-urban migration in many parts of the world emphasizes this organized nature of the moves. In many North African cities, for instance, it is not uncommon for an entire district or craft occupation in a city to be dominated by permanent migrants from one or two villages [*6*, *17*]. Furthermore, this element of "organization" resulting from the operation of feedback in the system underlies the varying rate of population growth among cities.

A major area of research into rural-urban migration thus concerns the flow of information between the urban and the rural areas. Considerable work on this question has been undertaken in Europe and the United States and some of the results are of great interest. Hägerstrand, for instance, insists that we must distinguish between "active" and "passive" migrants [*10*]. The former are those who seek out suitable destinations which, in their eyes, guarantee future prosperity; the latter are those who follow impulses (feedbacks) emanating from persons of their acquaintance, primarily those who had made "fortunate" moves. One implication of this distinction is that in a theory of rural-urban migration, the crucial moves which we need to understand and explain are those of the active migrants. In the aggregate, these moves are likely to be complex and not easily explained in terms of a few choice variables.

A number of other studies have concentrated on the measurement of the information field of a potential migrant as a means of understanding the general pattern of his behavior in space [*16*, *22*]. Individual information fields may be aggregated to produce community mean information fields, and these have been used in studies which attempt to predict the volume and pattern of migratory movements [*21*].

Relation Between a System and its Environment

Systems can be classified into three categories depending on the relationship they maintain with their environment; first, the isolated systems which exchange neither "matter" nor "energy" with their environment; second, the closed systems which exchange "energy" but not "matter"; third, the open systems which exchange both "en-

ergy" and "matter." The distinction between the categories, however, is largely one of scale and depends on which elements are regarded as belonging to the system and which to the environment. Thus, if the scale was to be reduced significantly, an open system could become an isolated system.

Given the system in Figure 1, it can be seen that rural-urban migration is an open system involving not only an exchange of energy but also of matter (in this case, persons) with the environment. The persons concerned would be defined as all those, who having migrated into cities, have become involved in making local decisions or formulating national policies and legislations on economic and other matters which do affect the volume, character, and pattern of migration. The energy exchange has to do with the increasing economic activities resulting from rural-urban migration and affecting the overall economic and social conditions of the country.

One major implication of viewing rural-urban migration as an open system is the fact that it enables us to explore the principle of equifinality in so far as it applies to this phenomenon. This principle emphasizes that the state of a system at any given time is not determined so much by initial conditions as by the nature of the process, or the system parameters. In consequence, the same results may spring from different origins or, conversely, different results may be produced by the same "causes." In either case, it is the nature of the process which is determinate, since open systems are basically independent of their initial conditions. This principle is of considerable importance in studying rural-urban migration in different parts of the world since there has been a tendency to regard this movement in countries such as in Africa and Asia as a special kind different from elsewhere in the world. There is, of course, no doubt that initial conditions in Africa today are vastly different from what they were in countries such as Britain and the United States at the times of the massive migrations there of people from the rural areas into the cities. But, according to the principle of equifinality, as long as we keep in mind the particular system's parameters, an understanding of the migration process as it affected and continues to affect those developed countries may throw considerable light on what is currently happening in many parts of the underdeveloped world.

Growth Processes in the System

From what has been said so far, it must be assumed that one of the concomitants of the continued interaction between the system and its environment will be the phenomenon of growth in the system. This will be indicated by, among other things, a rise in the volume of migration from the rural to the urban areas. Within a system framework, this phenomenon involves more than a simple growth or increase in

the number of people moving from one area to another. It is much more complex, involving not only the individual components of the system but also the interaction between them and the system as a whole.

Boulding [5] has identified three types of growth processes that may occur in a system. The first is "simple growth" and involves the addition of one more unit of a given variable such as a migrant, a farm, a vehicle, or a retail establishment. The second type is "population growth," a process which involves both positive and negative additions. In general, this type of growth depends on the surplus of births (positive additions) over deaths (negative additions) and applies to variables which have an age distribution and regular rates of births and deaths. The third type is "structural growth," the growth process of an aggregate with a complex structure of interrelated parts. This process often involves a change in the relation of the components since the growth of each component influences and is influenced by the growth of all other components in the system. Structural growth shades imperceptibly into structural change since, in most cases, it is not only the overall size of the structure that grows but also its complexity.

In viewing rural-urban migration as a system, growth, in the form of structural growth, is an important dimension for more detailed investigation and study. What effects have an increase in the volume of migration on the character of the cities? What effects have the growth in the size and complexity of the cities on the types of migrants, on villages and their spatial distribution, on farms and their areal extent, on the crops grown and their qualitative importance, on the types of equipment used and on the average income of families in the rural areas? What effects have changes or growth in these variables on the volume and characteristics of migrants and on further growth and complexity in the urban areas?

It may be argued, of course, that to conceive of a theory of rural-urban migration in this broad, systematic framework is to suggest a catchall embracing a wide range of changes taking place in a country at any given time. In a sense, this is deliberate since part of the object of this paper is to call attention to the paramount importance of "flow phenomena" in the spatial processes modifying the character of any country. Thus, just as the flow of water acts as a major sculpturing agent in the physical geography of any area of the world, the flow of persons (migration), of goods and services (trade and transportation), and of ideas (communication) is a crucial agency in shaping the human geography of a country.

More than this, there is the fact that growth in such "flow phenomena" creates form. Growth in the flow of rural-urban migrants affects the pattern of population distribution, the areal size and internal configuration of cities, the types of buildings in rural areas, the size and

arrangements of farms, and the number, size, and network density of rural roads. These, in a sense, are simply the results of the way the system tries to adjust to growth processes. However, as Boulding has pointed out, there is a limit to the extent to which the system can go on making these adjustments. "Growth," states Boulding, "creates form; but form limits growth. This mutuality of relationship between growth and form is perhaps the essential key to the understanding of structural growth" [5, p. 72].

Conclusion

This paper has tried to show how a theory of rural-urban migration can gain in incisiveness and breadth by being construed within a General Systems Theory framework. The conceptualization of the problem in this way emphasizes the structural congruencies or isomorphy with other problems. Further, one of the major attractions of this approach is that it enables a consideration of rural-urban migration no longer as a linear, uni-directional, push-and-pull, cause-effect movement but as a circular, interdependent, progressively complex, and self-modifying system in which the effect of changes in one part can be traced through the whole of the system. Such a circularity gives special prominence to the dynamic nature of rural-urban migration and allows the process to remain as one of considerable interest over an indefinite period of time. In other words, it emphasizes rural-urban migration as a continuous process, occurring in most countries all the time though at different levels of complexity. In this respect, the systems approach also serves as a normative model against which one can seek to explain obvious deviations. If the movement of people from the rural to the urban areas is not generating the set of interconnected effects which the theory leads us to expect, we may ask why. We may then investigate the various elements in the system to ascertain which of them is not functioning in the proper way. Alternatively, we may examine critically the politico-economic environment (such as, for example, the situation in those areas of the world where discriminatory policies exist based on race or caste) in order to appreciate those features that do impair the efficient operation of the system. In either case, the basic systems approach would provide the most important insight to the many dimensions of the problem. More than that, it would emphasize the crucial role of rural-urban migration as one of the most important spatial processes shaping the pattern of human occupance of the earth's surface.

LITERATURE CITED

1. Ardener, E., Shirley Ardener, and W. A. Warmington. *Plantation and Village in the Cameroons*. London, 1960. Pp. 211–229.
2. Arensberg, C. M. *The Irish Countryman, an Anthropological Study*. New York, 1937.
3. Ashton, T. S. *An Economic History of England: The Eighteenth Century*. London, 1966 ed. Pp. 15–17.
4. Banton, M. *West African City*. London, 1957; ———. "Social Alignment and Identity in a West African City," in *Urbanization and Migration in West Africa*, ed. Hilda Kuper. Los Angeles, 1956. Pp. 131–147.
5. Boulding, K. "Toward a General Theory of Growth," *General Systems Yearbook*, 1 (1956), 66–75.
6. Clarke, J. I. "Emigration from Southern Tunisia," *Geography*, 42 (1957), 99–101.
7. Diop, A. "Enquête sur la migration toucouleur à Dakar," *Bulletin de l'Institut Francais d'Afrique Noire, Ser. B*, 22 (1960), 393–418.
8. Dodd, S. C. "The Interactance Hypothesis: A Gravity Model Fitting Physical Masses and Human Groups," *American Sociological Review*, 15 (1950), 245–256.
9. Gulliver, P. "Nyakyusa Labour Migration," *Rhodes-Livingstone Journal*, 21 (1957), 59.
10. Hägerstrand, T. "Migration and Area: Survey of a Sample of Swedish Migration Fields and Hypothetical Considerations on their Genesis," in "Migration in Sweden, a Symposium," ed. D. Hannerberg et al, *Lund Studies in Geography, Ser. B*, 13 (1957), 132.
11. Hall, A. D. and R. E. Fagen. "Definition of System," *General Systems Yearbook*, 1 (1956), 18.
12. Herberle, R. "The Causes of Rural-Urban Migration: a Survey of German Theories," *American Journal of Sociology*, 43 (1938), 932–950.
13. Kulldorf, G. "Migration Probabilities," *Lund Studies in Geography, Ser. B*, 14 (1955).
14. Lewis, W. A. *Theory of Economic Growth*. London, 1955. P. 333.
15. Little, K. *West African Urbanization*. London, 1965.
16. Marble, D. F. and J. D. Nystuen. "An Approach to the Direct Measurement of Community Mean Information Fields," *Papers and Proceedings, Regional Science Association*, 11 (1962), 99–109.
17. Marty, G. "A Tunis: éléments allogènes et activités professionnelles," *Revue de l'Institut des Belles Lettres Arabes*, Tunis (1948), 159–188.
18. Masser, F. I. "Changing Pattern of African Employment in Southern Rhodesia," in *Geographers and the Tropics: Liverpool Essays*, ed. R. W. Steel and R. M. Prothero. London, 1964. P. 229.
19. Mitchell, J. C. "Migrant Labour in Africa South of the Sahara: the Causes of Labour Migration," *Bulletin of the Inter-African Labour Institute*, 6 (1959), 8–46.
20. ——— "Wage Labour and African Population Movements in Central Africa," in *Essays on African Population*, ed. K. M. Barbour & R. M. Prothero. New York, 1962. P. 232.
21. Morrill, R. L. "Migration and the Spread and Growth of Urban Settlement," *Lund Studies in Geography, Ser. B*, 26 (1965).
22. Morrill, R. L. and F. R. Pitts. "Marriage, Migration and the Mean Information Field: a Study in Uniqueness and Generality," *Annals of the Association of American Geographers*, 57 (1967). 401–422.
23. Ndukwe, N. I. *Migration, Agriculture and Trade in Abriba Town*. Unpublished Mss., Department of Geography, University of Ibadan, 1964.

24. ONWUEKE, A. I. *Awka Upland Region, the Land of Migrant Farmers.* Unpublished Mss., Department of Geography, University of Ibadan, 1966.
25. PROTHERO, R. M. "Migratory Labour from North-Western Nigeria," *Africa*, 27 (1957), 250.
26. RAVENSTEIN, E. G. "The Laws of Migration," *Journal of the Royal Statistical Society*, 48 (1885), 167–235; 52 (1889), 242–305.
27. RICHARDS, A. I., ed. *Economic Development and Tribal Change.* Cambridge, 1954. P. 66.
28. STEWART, J. W. "Demographic Gravitation: Evidence and Applications," *Sociometry*, 11 (1948), 31–57.
29. STOUFFER, S. A. "Intervening Opportunities: A Theory Relating Mobility and Distance," *American Sociological Review*, 5 (1940), 845–67; ———. "Intervening Opportunities and Competing Migrants," *Journal of Regional Science*, 2 (1960), 1–26.
30. VON BERTALANFFY, L. "An Outline of General System Theory," *British Journal of the Philosophy of Science*, 1 (1950), 134–165; ———. "General System Theory," *General Systems Yearbook*, 1 (1956), 1–10; ———. "General System Theory—a Critical Review," *General Systems Yearbook*, 7 (1962), 1–20.
31. WOLPERT, J. "Migration as an Adjustment to Environmental Stress," *Journal of Social Issues*, 22 (1966), 92–102.

A Water Balance Control-Theoretic Model for Regional Management*

Regional management of resources generally is practiced on a helter-skelter basis because of the complexity of the problem facing the decision-maker. In response to the need for improved management methodology for politically-bounded regions such as provinces and states, we have outlined a control-theoretic model for minimizing the cost of making desired hydrologic changes. We are more interested in the managerial problem faced by a governmental organization with jurisdiction within a regional boundary than either river basin system design on the one hand, or project evaluation on the other. We assume that these tools also will be used by decision-makers, but perhaps at other levels of government.

Framework Requirements

A province is as likely to be concerned with cost-effectiveness of various possible regulatory operations as with location and size of engineering projects. Because the institutional framework under which water is allocated is subject to continual review by legislative and governmental executive bodies, some procedure should be available for estimating the impact of various managerial possibilities for coping with local needs. Non-structural alternatives, such as marginal-cost pricing and restrictions on use or abuse, can be substituted for river diversions and large-scale public works projects in many cases; but great difficulty is experienced in taking into account the com-

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