The Sociological Quarterly 12 (Spring 1971):191-203

A Cybernetic Model of Economic Development

JONATHAN H. TURNER, *University of California, Riverside*

ECONOMIC development has long been a dominant topic in sociology. Since Marx' and Weber's initial insights, sociologists have been unraveling the complex relationships in this ubiquitous process. Recent conceptual work (Smelser, 1959, 1963; Parsons, 1966; More, 1964; Eisenstadt, 1964, 1965; Rostow, 1963) has attempted to isolate critical variables and relationships among them in the process of economic development. One of the consistent attempts of this literature is predicting when, where, and how fast economic development will occur in modernizing Third World nations. Drawing upon this growing body of literature, this paper will outline an analytical model of economic development. This model is especially relevant to developing Third World nations, although it is sufficiently abstract to encompass economic development in other types of historical and contemporary societies.

The term model has an ambiguous meaning. In this paper, a model is a map or grid of relationships among analytically important units. The model presented here is cybernetic, denoting key feedback processes, both negative (Weiner, 1954; Nadel, 1953) and positive (Maruyama, 1963). Ideally, a model should assign differential weights to various relationships, but in the model to be presented, only general weights will be assigned to some relationships. As will be emphasized, feedback relationships among units will be considered to carry more weight than other relationships in determining rates of economic development. Beyond this, existing data do not warrant further weighting. But an attempt will be made to delineate those variables within and outside the economy affecting the weights of any particular relationship in the model. In doing so, elements in the model can begin to approximate a set of propositions in a more general theory of economic development.

For the purposes of analysis, the economy can be divided into two general sectors (Moore, 1967): (1) the productive; and (2) the distributive. *Production* concerns those structures and processes involved in gathering resources from the environment and converting them into goods and commodities, while *distribution* refers to those structures and processes dealing with the dissemination of commodities throughout a social system. The model presented in this paper will focus on relationships between and within these two general economic sectors.

Production

Classical and neo-classical economics isolated four factors of production (Schumpeter, 1934): *land, labor, capital,* and *entrepreneurship.* And later, Marx and Engels (1848) added an additional factor: *technology.* In the present analysis, *land* will refer to the existent level of natural resources in a system as well as the degree of access a system has to its resources. *Capital* pertains to the tools and implements (as well as the money to buy them) an economy has

available for production. *Labor* concerns the attributes, both physical and psychological, possessed by incumbents in the economic role structure. *Technology* refers to the level of knowledge in a system about how to control and manipulate the environment.[1] *Entrepreneurship* is the process whereby the factors of production are organized, coordinated, and integrated.

Traditional economies are low in all these factors (Lenski, 1966). Only limited knowledge—or technology—about how to manipulate the environment exists. This forces reliance on low levels of capital formation including, at best, animal-drawn plows and water power. Labor in conjunction with animals and other crude sources of power thus must supply the major sources of energy for the economy. Entrepreneurship is supplied by the extended kinship structure and/or community stratification system (Nash, 1966). As a consequence of these factors, access to natural resources is low and the production of goods and commodities is near the subsistence level. It is from this economic base that economic development begins.[2]

Technology and Capital

Economic development is initiated when the level of technology is expanded. Such expansion can occur in a variety of ways including innovation, conquest, borrowing, colonialism, and other processes of diffusion (Smelser, 1963, 1965). Under certain conditions (outlined below) expanded technology can result in a greater capacity to raise the level of capital formation resulting in the use of more sophisticated tools and eventually machines in gathering resources and converting them into commodities. In current developing economies, technology is usually borrowed from already developed systems resulting in dramatic expansion of the developing economy's technological base. With this base, subsequent development depends upon various internal economic processes: (1) the degree to which the economy can continue to borrow technology; (2) the capacity of the economy to convert technology into higher levels of capital formation; (3) the extent to which the economy can produce capital goods instead of consumer goods; and (4) the ability of the economy to generate its own technology. These processes are diagramatically represented in Figure 1.

Arrow *a* in Figure 1 represents the quantity of initial expansion in the technological base of an economy. Arrow *b* designates the capacity of the economy to apply and utilize this technology in generating a machine capital base. Arrow c_1 denotes the capacity of the economy to generate capital goods and feed them

[1] Technology obviously affects the level of other basic economic elements. The degree of access to land, the nature and extent of capital formation, the amount of skill in the labor force, and the degree of efficiency in entrepreneurship are all a reflection of the level of technology. One of the purposes of this model is to delineate the way in which basic economic elements, including technology, are interrelated with each other and with the broader institutional environment of the economy.

[2] Naturally, this portrayal is over-simplified and represents only an analytical starting point. In an era of intense foreign aid and economic assistance by developed systems, certain sectors in any traditional or underdeveloped economy will reveal high levels of labor skill, capital accumulation, technology, access to resources, and efficiency in entrepreneurship. Yet, in examining the whole economy of traditional societies, it is clear that considerable subsistence production occurs in Third World nations.

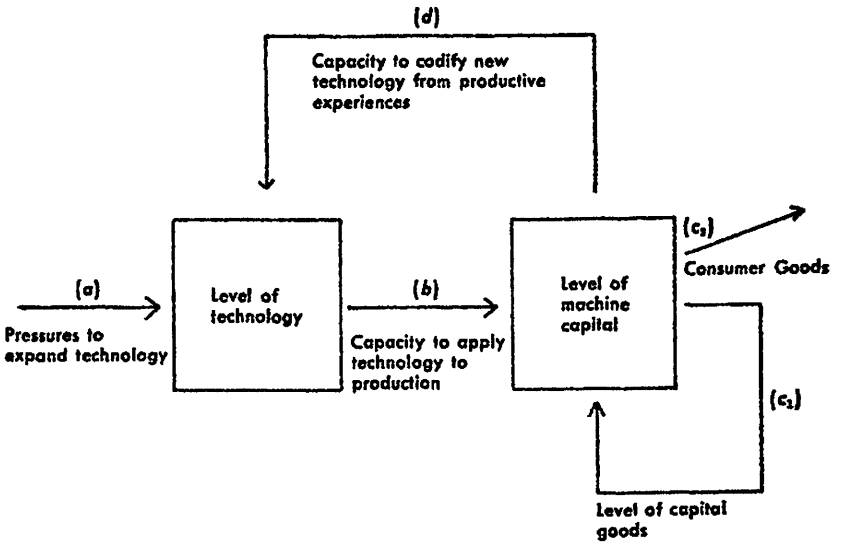

FIGURE 1. Technology and Capital As Elements of Production

back into the productive process. Arrow *d* marks the capacity of the economy on its own to codify new technology on the basis of productive experiences. And arrow c_2 represents the quantity of consumer goods generated in the economy. The rate of initial economic development (for a specific economy) depends upon the weights or quantities of each relationship designated by arrows *a* through *c*. In turn, the quantities of each relationship are a function of processes in the broader, non-economic institutional structure. Below, some of these broader influences are outlined for each focal point in Figure 1.

Expanding Technology. The capacity of an economy to continue to expand its technology is a dual function of its capacity to borrow from economically developed systems and institutionalize technological expansion. In turn, these two capacities are a reflection of broader structural conditions in a society (Moore, 1964).

Borrowing in current developing economies is usually a function of political processes (Spengler, 1961). Economic development cannot be initiated in Third World systems until the political elite is committed to development. Once committed, the polity initiates the importation of technology (arrow *a*) from more modern systems through a variety of mechanisms: allowing foreign investment, exporting students to foreign universities, and encouraging economic and technical assistance from modern systems. The extent to which the polity can do this, however, is circumscribed by a number of conditions: (1) Those developing systems not located in strategic resource, geographical, or political areas usually cannot borrow as much as systems located in these strategic areas. (2) Developing systems with strong nationalistic ideologies eventually have problems reconciling the desire for national autonomy with extensive borrowing from more developed systems. When nationalism becomes high pitched, it places

limits on the ways borrowing can occur. (3) Polities in systems with abundant and valuable resources rarely have trouble encouraging foreign investment, but often they have difficulty extracting the technology used by foreign industry. Developing systems usually come out on the short end when exchanging their resources for foreign technology which could be used for more comprehensive economic development.

Institutionalizing technological expansion presents equally difficult problems for developing systems. To effect such institutionalization, a developing system must establish and continually expand research and development organizations within and outside the economy, as well as relations between higher education and the economy (Halsey, 1960). Only in this way can innovation (arrow a) and codification of productive experiences (arrow d) occur. However, there are several limitations on a system's capacity to do this: (1) The polity faced with the short term demands of the populace for a "better life" (usually welfare and primary education) typically must divert resources away from expensive research and development organizations and higher education. This is compounded when the polity has only tenuous legitimacy and must divert further resources to social control structures (Easton, 1965). (2) Even if some of these structures could be financed, developing systems rarely have the technical personnel to staff them (Moore, 1951; Brown and Harbison, 1957; Kaplan, 1964). This reduces the effectiveness of these organizations in either innovation or codification and hence the willingness of the burdened polity to finance them. (3) These facts force the importation of foreign organizations and experts, but this solution becomes less viable with increases in nationalism. (Furthermore, innovation and codification by foreign organizations of technology is frequently exported rather than re-inserted into the host economy.) (4) Institutionalizing technological expansion often encounters severe resistance from the religious institutions in a system (Monsma, 1962). To innovate secular knowledge or codify secular experiences can be viewed as a threat by religious practitioners whose political and social influence in developing systems tends to be great.

Expanding Capital. To develop economically, a system must be capable of constantly expanding its capital base—especially its machine capital (Moore, 1964:889-890). This involves the capacity to apply and translate new technologies into machine capital (arrow b) and to continually produce and feedback into the economy a high proportion of capital (arrow c_1) over consumer goods (arrow c_2). These capacities are in turn a reflection of other institutional processes, especially in the polity. Ultimately, the polity controls capital formation(Parsons and Smelser, 1956) in an economy whether directly through nationalization, or indirectly through taxes, subsidies, or some form of federal reserve systems.

Even with rapid technological expansion, the polity's ability to expand its machine capital base is limited in several ways: (1) Machine capital is expensive and developing economies are typically low in wealth. The available resources are further lessened by the immediate demands of the population for welfare and primary education. And this situation is compounded by an unstable polity's need to invest heavily in social control structures (Easton, 1965). (2) Populations in developing systems also place heavy demands for consumer goods. Polities facing problems of legitimacy usually must defer to these demands and thus increase the proportion of consumer over capital goods produced. (3) These problems in

generating capital can force the polity to borrow or encourage foreign investment in order to secure the capital base necessary for development; and for systems not in strategic locations, borrowing or encouraging investment can be problematic. (4) Even when successful, borrowing or foreign investment are only short run solutions, since "strings" are usually attached to foreign aid and investment.[3] (5) Increasing nationalism and the accompanying desire for economic and political autonomy eventually can lead to the curtailment of conspicuous borrowing as a means of capital formation by the polity.

Labor and Entrepreneurship. The money and machine capital of developing economies usually becomes centralized. This occurs for at least two reasons: (1) capital needs to be located near sources of natural resources, fuel, transportation, and commerce; and (2) the centralization of machine capital is less expensive and more efficient than decentralized capital. As the capital base of a developing economy becomes centralized, so does the labor force. The resulting concentration of capital (and technology) and labor in urban areas creates entrepreneurial problems: labor and machines must become organized. But work can no longer be effectively organized by the extended family unit, community, or ascriptive stratification systems. These entrepretneurial problems are increasingly resolved through the emergence of the *factory system* as the principal productive unit. Factories are organizations with large concentrations of labor and machine capital into which resources are fed and out of which goods and commodities flow. In them, labor is highly specialized with each incumbent performing a set of tasks in conjunction with machines. Labor must thus learn to schedule, pace, standardize, and coordinate work with machines. Work becomes regulated by the nature of the machine capital, formal and informal rules, and direct supervision. Thus, the factory system allows for the organization of vast numbers of laborers around an extensive network of machines. Once initiated, it expands the capacity of the economy to centralize and organize even larger masses of machines and labor. This results in the expansion of the productive sector which in turn generates entrepreneurial problems resulting in the further expansion of the factory system.

With this growth in the factory system, severe administrative problems of coordinating, integrating, keeping track of, controlling, managing, and communicating emerge. The typical system adjustment to such entrepreneurial problems is the proliferation of specialized administrative roles. Such roles tend to be organized bureaucratically in a rational form with specialized positions, clear cut rules, hierarchies of authority within and between offices, and recruitment and promotion on the basis of expertise and performance (Weber, 1946:196-240).[4] Despite many problems, bureaucratization enables the factory system to expand

[3] Although the existence of a World Bank and other international credit agencies can reduce many of the "political strings" associated with borrowing by developing systems, the financial resources of these international agencies are limited and not sufficient to meet the demands of a modernizing economy. This fact has made direct nation to nation foreign aid an economic inevitability in the contemporary world.

[4] Obviously, not all bureaucracies are rational, including many which deliberately strive to maximize rationality and efficiency. What is being emphasized here is that some degree of bureaucratic "rationalization" must exist in order for rapid economic development to occur. The conditions affecting whether or not this is the case in a society are discussed below.

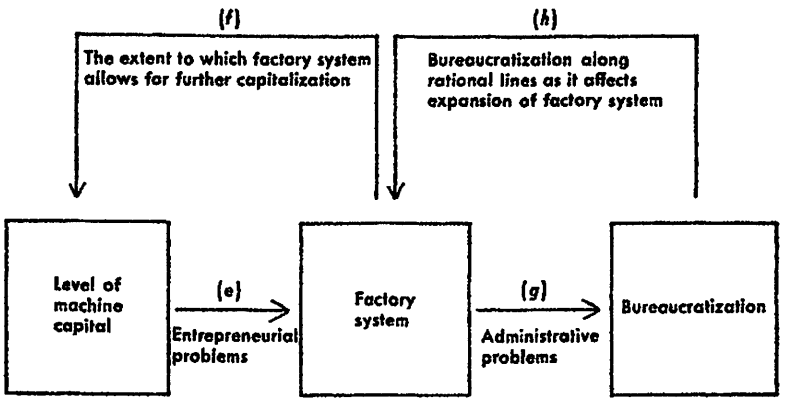

FIGURE 2. The Factory System and Bureaucracy as Elements of Production

further by resolving the administrative problems inherent in coordinating men with men, men with machines, machines with machines, factories with factories, and factories with markets and natural resources. These processes are diagramatically represented in Figure 2.

In Figure 2, arrow *e* represents the entrepreneurial problems of organizing technology and labor around an increasingly centralized machine capital base. Arrow *f* denotes the extent to which the emergence of the factory system resolves these entrepreneurial problems and thus allows for further centralization. Arrow *g* designates the degree of severity in administrative problems encountered with expansion of the factory system. And arrow *h* marks the degree to which bureaucratization along "rational" lines will enable expansion of the factory system. If at junctures *e* through *h* we could record positive weights, then we could predict rapid economic development. If, on the other hand, as is usually the case, negative weights or only low positive weights were assigned to these junctures, economic development would be impeded. As in Figure 1, the weights at each arrow (and hence the rate of development) are a reflection of broader societal conditions. Below, some of these are discussed.

The Factory System. The extensiveness of the entrepreneurial problems (arrow *e*) is a function of how much machine capital is generated in an economy (*a, b, c, d* in Figure 1). Given that entrepreneurial problems exist at relationship *e* in Figure 2, the emergence of a factory system facilitating (*f*) further centralization of capital (given that processes designated in *a-d* will allow) is a positive function of the degree of development of two institutions: (1) education and (2) law.

The factory system in a developing economy requires a new set of attributes on the part of labor (Moore, 1964). The attempts to classify these attributes have been various. Aside from trade skills, "modern man" or "industrial man" (Inkeles, 1960, 1966; Smith and Inkeles, 1966) has been viewed as having high n-achievement (McClelland, 1961), mastery, achievement, and futuristic orientations (Rosen, 1964), empathic interpersonal styles (Lerner, 1958), as well as

the capacity to schedule, pace, and perform in an impersonal work situation (Moore, 1951, 1964). Furthermore, "industrial man" must be amenable to supervision by non-kinsmen in accordance with "universalistic" standards of performance. Modern school structures are best suited for the socialization of most of these necessary attributes because they are formal structures where: (1) activities are scheduled, paced, and coordinated, (2) incumbents' activities and performance are supervised and evaluated universalistically, (3) cognitive knowledge is imparted, and (4) emphasis is on adjustment to the occupational world. Systems with extensive and developed educational systems are thus more capable of imparting to labor those attributes necessary for participation in the factory system.[5] Furthermore, systems with mass education at the primary and secondary levels can to some extent break down the ascriptive class structure and thus increase the number of qualified incumbents in the factory system.

Developed legal systems display universalistic rules, extensive court structures, and mediation agencies. Without these, entrepreneurial problems are intensified since there are few institutionalized ways to settle the grievances of labor and establish a contractual basis for its integration into the economy. If a large proportion of these grievances cannot be resolved peacefully, the efficient functioning of the factory system is impaired (Moore, 1964:893). The lack of developed and stable legal structures in developing systems is one of the greatest impediments to their economic development (f).

Bureaucratization. The extensiveness of administrative problems generated by the factory system is a function of the rate and level of the latter's increases in size (g). To continue expanding, increasing "rational" bureaucratization must accompany expansion of the factory system (h). In turn, the extensiveness of such bureaucratization is a reflection of several forces: (1) the extensiveness of education, especially higher education; (2) the rigidity of the stratification system; and (3) the prevalence of "ascriptive" bureaucracies. (These latter are bureaucracies where recruitment to, and to a lesser extent promotion within, the bureaucracy are based upon particularistic and ascriptive criteria).

Bureaucratic structures with their demands for expertise place a heavy burden on the educational system in a developing society. To function effectively and efficiently incumbents must have specialized expertise and a host of interpersonal capacities which can only be acquired with formal education, especially in higher education structures. These educational requirements will escalate as the demand for expertise in bureaucratic structures increases (Clark, 1962; Halsey, 1960). Furthermore, as the demands for specialized expertise increase, extension or "massification" of education is necessary to insure a sufficient number of qualified incumbents for the economy (Coombs, 1968). Yet, to extend education to groups beyond the elite is problematic in systems with a rigid ascriptive stratification system (Parsons, 1965). Coupled with the typically limited financial resources of the polity, extension and "massification" of even secondary education is difficult. Thus, to the extent that incumbents in the emerging bureaucracies of a developing system have not participated in higher educational structures, bureaucratization will be inefficient and thus impede further economic growth

[5] Even schools which are not "modern" in the Western sense, or which are religious in emphasis, can still have consequences for at least (1) and (2) above and thus facilitate the adjustment of labor to the factory system.

(*h*). In systems with existing ascriptive bureaucracies within the political and religious sphere, this tendency will be compounded because implementation of "achievement" and "universalistic" criteria for recruitment and promotion will encounter resistance from traditional forms of organizing administrative roles.

In Figures 1 and 2 the principal relationships between variables in the productive sector of the economy have been delineated. It is argued that by knowing the weights of each relationship (*a* through *h*) for the productive sector of a specific economy, predictions about the rate of economic development could be made. Of particular importance in making such predictions are relationships *d*, *f*, and *h* which denote feedback processes. It is predicted that if these are not heavily positive, the rate of economic development will be slow. Systems incapable of organizing efficient factory systems and rational bureaucracies cannot develop rapidly, even with high levels of technology and capital. A corollary to this conclusion is that already developed systems will encounter severe difficulties in further development if these feedback processes cease to be strongly positive.

Probably the most difficult problem in utilizing any model is actually establishing the weights for each relationship delineated in the model. In models dealing with large social units this problem is acute, since the total institutional fabric of a society is involved. In the above discussion, we have pointed to certain structures and forces most influential in affecting the weights for each arrow. Below, we turn to delineating a model for the other major sector in the economy, the distributive. While presented separately, this partial model of distributive processes is intended to be viewed as connected to the model just presented. Both are sub-parts of a more comprehensive model of economic development.

Distribution

Except in extremely traditional economies, distribution occurs in the *market*. Markets in most traditional economies display these features (Smelser, 1959): (1) *Barter* is still prominent with commodities often being exchanged for other commodities. (2) Extensive *bargaining* exists with buyers and sellers initially stating prices different from what they eventually intend to pay or receive. They then "haggle" or bargain on a compromise price. (3) Due to the lack of a stable money in traditional economies and the typical instability of the market, *credit* is not easily formed, for large accumulations of money are scarce and interest rates high and prohibitive. (4) The lack of a stable money and credit creates a market in which product demand is uneven and sporadic.

With the emergence of concentrations of machine capital and the factory system, the productive sector of the economy becomes capable of producing rapidly large quantities and varieties of standardized goods. The traditional market structure with its reliance on barter and bargaining, lack of credit institutions, sporadic demand curve, and over-all instability is usually inadequate to distribute this increasing volume and variety of standardized commodities. This fact generates from the productive sector pressures on the market to reorganize and modernize. With modernization of the market, it becomes possible for the productive sector to increase production. Increases in production then force even further market reorganization. As this spiraling process continues, pressures are generated by the market for an increasing number of specialized

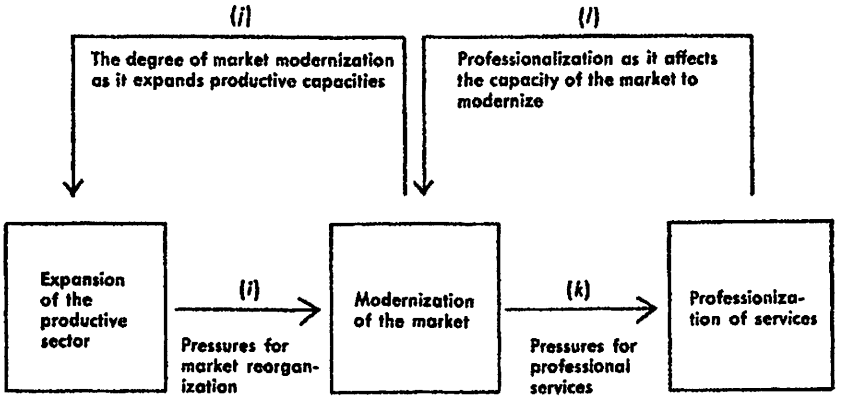

FIGURE 3. Markets and Professions as Elements of Distribution

professional services, including banking, advertising, insuring, financing, holding, and contracting (Moore, 1964:893). As these specialized service roles increase, they increase the capacity of the market to distribute a large volume of commodities. These relationships among the productive, market, and service sectors are diagramatically presented in Figure 3 below.

In Figure 3, arrow *i* denotes the pressures from the expanded productive sector for market reorganization and modernization. Arrow *j* represents the degree of market modernization as it affects expansion of the productive sector. Arrow *k* marks the pressures from the modernizing market for the expansion of professional services. And arrow *l* marks the extent to which professionalization of services affects the capacity of the market to modernize. If the weights are all positive for relationships *i* through *l*, especially for the feedback loops (arrows *j* and *i*), then development will be rapid. The reverse would be true if the weights are low at any juncture, particularly *j* and *l*. As is the case with arrows *a* through *h*, the weights of the processes denoted in Figure 3 are a reflection of broader societal conditions. Some of these are examined below.

Market Modernization. Pressures for market modernization (*i*) are a function of the size and efficiency of the productive sector. The more intense the pressures, the more likely market modernization. Modernization of the market involves reduction in barter and bargaining as mechanisms of exchange, as well as the emergence of a stable money, standardized prices, the availability of credit, and a more stable demand curve. These features greatly expand the capacity of the market to distribute the increased volume of standardized goods generated by the productive sector (Moore, 1967), thus encouraging even greater production (*l*). The extent to which these features come to dominate the market is a dual function of (*l*) the degree to which bargaining is institutionalized (Belshaw, 1965); and (2) the amount of political stability.

In many systems, bargaining is a long standing tradition and often considered an "inalienable right." Even with a stable money as a medium of standardized exchange, this tradition often persists. This is especially true in markets domi-

nated by small, independent businessmen. To the extent that bargaining is thus institutionalized, it will congest the market and inhibit the rapid distribution of goods and commodities. As marketing pressures mount and larger market organizations emerge (chain stores, super-markets, etc.), bargaining inevitably disappears. But the rate at which it disappears can vary depending on the extent of institutionalized bargaining.

Political stability affects market modernization by influencing monetary stability, the availability of credit, and the demand curve. Polities of developing nations having difficulties in obtaining legitimation inflate their currency by issuing *fiat* money to finance welfare and social control programs. This results in an unstable currency which either reinforces traditional barter and bargaining operations or black markets in foreign currency or valuable goods. With political and monetary instability, credit becomes unavailable and product demand sporadic, since lending money except at exhorbitant interest rates becomes dangerous in the face of either rapid inflation or potentially radical changes in political regimes. Thus, markets unable to utilize stable currency, standardize prices, and form credit cannot distribute rapidly the potential volume and variety of goods of a machine-based productive sector. Such "bottle-necking" in the market becomes negative feedback (arrow j) for expansion of the productive sector.

Professionalization of Services. The amount of pressure for expansion and professionalization of the service sector (k) is a function of the initial capacity of the market under pressure from the productive sector to modernize. In turn, subsequent modernization of the market is a partial function of how much expansion and professionalization occurs in the service sector (l). An important key to market reorganization is thus the capacity of services such as contract and corporate law, banking, crediting, mortgaging, and advertising to become institutionalized. This process also involves professionalization (Moore, 1967) whereby services become careers for groups of specially trained experts. These experts tend to belong to various professional associations which regulate the level of performance of members. The extent to which this occurs in the service sector of an economy is a reflection of educational and political processes.

Expansion and professionalization of the service sector is dependent upon the extensiveness of higher education in a society. Systems with well developed universities, graduate, and professional schools are capable of generating sufficient incumbents for service roles. However, oftentimes the polity cannot afford to finance such higher education because of limited resources and/or the immediate welfare and primary education demands of the population.[6] To the extent this is true, generating incumbents for service roles will be impeded, and hence so will expansion of the market (arrow l).

The development of professional associations is a dual function of the number of trained service specialists and the attitude of the polity toward such organizations. Polities with only tenuous legitimacy are unlikely to encourage large associations unless they are scrupulously neutral (and this is rare in Third World nations) or dominated by the polity. When the latter is the case, the beneficial effects of these associations on the economy are often lessened, since they be-

[6] Also, investment in higher education diverts money from the productive sector of the economy—thereby impeding the latter's expansion and growth.

come political tools rather than organizations raising and maintaining the quality of workers in service roles. This in turn represents negative feedback for the market (arrow *l*).

As the market and service sectors modernize and expand in size, administrative problems of coordination, management, integration, and control emerge. As these problems intensify, bureaucratization of market and service processes increases. To the degree that such bureaucratization takes a "rational" rather than "ascriptive" form, it represents positive feedback to the market and service sector by enabling them to expand further. These processes are outlined diagramatically in Figure 4 below:

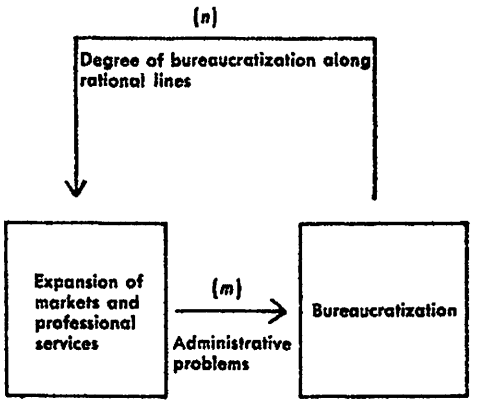

FIGURE 4. Bureaucratization as an Element of Distribution

In Figure 4, arrow *m* denotes the level of administrative problems created by expansion and modernization of the market as well as expansion and professionalization of services. Arrow *n* represents the degree to which bureaucratization occurs along rational lines representing positive feedback for markets and services. The weights of relationships *m* and *n* are affected by the same forces influencing those represented by arrows *g* and *h* in Figure 2: the extensiveness of higher education, rigidity of stratification, and the existent legacy of ascriptive bureaucracies. Bureaucratization is thus an essential process for development of both the productive and distributive sectors of the economy.

Conclusions

The model presented in this paper is only partial. Economic development is too complex, incorporating too many variables for a model to be otherwise. This paper has attempted to delineate some of the crucial units, relationships, and processes for constructing a model of economic development. This has entailed emphasis on certain crucial feedback processes among these crucial economic units.

Despite its crudity, the model has several potential uses. First, it has some degree of predictive value. By noting the weights of various feedback loops

(arrows *d, f, h, j, n,*), it can be determined at the very least whether or not economic development will be rapid or slow in the near future. And depending upon how many of these loops display low or negative weights, predictions about the actual rate of development might be possible. Secondly, the model can be used for comparative purposes. By noting different weights of each relationship in the model of a number of concrete economic systems, the really crucial differences among these economic systems are exposed. It might be possible with sufficient utilization of the model to develop classificatory schemes whereby various configurations of weights for various relationships could be labelled a *type* of developing economy. The model thus draws attention to important differences in developing economies. Thirdly, by viewing the weights of all relationships in the model as affected and circumscribed by non-economic structures and processes, general system-wide strategies for increasing the rate of economic development are readily apparent. Once the relationships with low or negative weights are established for a specific developing system, the kinds of changes in specific non-economic structures necessary for raising these low weights (and hence the level of development) become evident.

Obviously these potential uses for the model do not over shadow its deficiencies. A more complete model would add certain elements, including: (1) statements as to which of the six feedback loops and other relationships in the model should be weighted the most;[7] (2) statements about which of the several non-economic processes affecting each relationship is most important in determining that relationship's weight; (3) statements concerning the feedback processes between economic and non-economic structures; and (4) some clues on how to go about plugging data for any particular system into the model. These and other problems limit the utility of the model. But it is felt that the model begins the necessary groundwork in formalizing[8] an area where considerable data presently exist.

REFERENCES

Belshaw, Cyril S.
1965 Traditional Exchange and Modern Markets. Englewood Cliffs, N.J.: Prentice-Hall.
Blalock, Hubert M.
1969 Theory Construction: From Verbal to Mathematical Formulations. Englewood Cliffs, N.J.: Prentice-Hall.
Brown, Joseph D. and Frederick Harbison
1957 High-Talent Manpower for Science and Industry. Princeton, N.J.: Princeton University Press.
Clark, Burton
1962 Educating The Expert Society. San Francisco: Chandler.
Coombs, Philip H.
1968 The World Educational Crisis: A Systems Analysis. New York: Oxford.
Easton, David
1965 A Systems Analysis of Political Life. New York: Wiley.

[7] A good example of how this is done in another area is Lenski's model of stratification (Lenski, 1966:89).

[8] For example, the model is structured such that certain mathematical formulations (Blalock, 1969) could be used to add more formal rigor and predictive power to the model. Also, by matching existing data to the relationships outlined in the model, detailed propositional inventories about the rate of growth would be possible.

Halsey, A. H.
1960 "The changing function of universities in advanced industrial societies." Harvard Educational Review 30 (Spring):124–125.
Inkeles, Alex
1966 "The modernization of man." Pp. 67-84 in Myron Weiner (ed.), Modernization: The Dynamics of Growth. New York: Basic Books.
1960 "Industrial man: the relation of status to experience, perception, and value." American Journal of Sociology 66 (July):1–31.
Kaplan, Norman
1964 "Sociology of science." Pp. 852-881 in Robert E. L. Faris (ed.), Handbook of Sociology. Chicago: Rand McNally.
Lenski, Gerhard
1966 Power and Privilege. New York: McGraw-Hill.
Maruyama, Magoroh
1963 "The second cybernetics: deviation amplifying mutual causal processes." American Scientists 51 (October):164–179.
Marx, Karl and Frederick Engels
1855 "The Communist manifesto." Pp. 1–42 in Lewis Feurer (ed.), Marx and Engels. Garden City, N.Y.: Doubleday, 1959.
Monsma, John C. (ed.)
1962 Science and Religion. New York: Putman.
Moore, Wilbert E.
1967 "Economic and professional institutions." Pp. 276–328 in Smelser (ed.), Sociology. New York: Wiley.
1964 "Social aspects of economic development." Pp. 882–911 in Robert E. L. Faris (ed.), Handbook of Modern Sociology. Chicago: Rand McNally.
1951 Industrialization and Labor. Ithaca, N.Y.: Cornell University Press.
Nadel, S. F.
1953 "Social control and self-regulation." Social Forces 31 (March):265–273.
Nash, Maning
1966 Primitive and Present Economic Systems. San Francisco: Chandler.
Parsons, Talcott and Neil J. Smelser
1956 Economy and Society. New York: Macmillan.
Parsons, Talcott
1965 Societies: Comparative and Evolutionary Perspectives. Englewood Cliffs, N.J.: Prentice-Hall.
Schumpeter, Joseph A.
1934 The Theory of Economic Development. Cambridge: Harvard University Press.
Smelser, Neil J.
1965 The Sociology of Economic Life. Englewood Cliffs, N.J.: Prentice-Hall.
1963 "Mechanisms of change and adjustment to change." Pp. 32–54 in Bert F. Hoselitz and Wilbert Moore (eds.), Industrialization and Society. New York: UNESCO.
1959 "A comparative view of exchange systems." Economic Development and Cultural Change 7 (October):173–182.
Smith, D. H. and Alex Inkeles
1966 "The OM scale: a comparative socio-psychological measure of individual modernity." Sociometry 29 (December):353–377.
Spengler, Joseph J.
1961 "Theory, ideology, non-economic values, and politico-economic development." Pp. 30–56 in Ralph J. Braibanti and Joseph Spengler (eds.), Tradition, Values and Socio-economic Development. Durham, N. C.: Duke University Press.
Weiner, Norbert
1954 The Human Use of Human Beings: Cybernetics and Society. New York: Doubleday.
Weber, Max
1946 "Bureaucracy." Pp. 196–240 in Hans Gerth and C. Wright Mills (eds.), From Max Weber. New York: Oxford Press.