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Social Science Knowledge and Induced Institutional Innovation: An Institutional Design Perspective

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Abstract:
In this paper I advance a model in which institutional innovation is induced by changes in resource endowments, cultural endowments and technical change. I also introduce the role of advances in social science knowledge as a source of institutional innovation. The sources of institutional innovation are illustrated by changes in land tenure and labor relations in Philippine agriculture, by the development of institutional design principles based on studies of small scale resource management, and by the transition from command and control to market based systems of resource management at the national level in the United States. In a final section I elaborate a pattern model that maps the general equilibrium relationship among change in resource endowments, cultural endowments, technology and institutions.

This paper represents a substantial revision of Staff Paper P02-07. Earlier drafts of this paper have been presented at the Workshop in Political Theory and Policy Analysis, University of Indiana, October 17, 2005; at the Conference on Sociological Knowledge for Induced Development, Bibliotheca Alexandrina, May 30-June 1, 2005; and at the Annual Meeting of the Society for the Advancement of Socio-Economics. University of Minnesota, June 28, 2002. The author is Regents Professor Emeritus in the Department of Applied Economics and the Department of Economics and Adjunct Professor in the Hubert H. Humphrey Institute of Public Affairs, University of Minnesota.

Social Science Knowledge and Induced Institutional Innovation: An Institutional Design Perspective

The central premise of this paper is that the demand for social science knowledge is derived from the demand for institutional change.[1] If this view is correct then any claim by the social science disciplines and related professions for public support depends on a credible promise that advances in social science knowledge represent an efficient source of institutional innovation.

In work published in the early 1970s Yujiro Hayami, Hans Binswanger and I extended the theory of induced technical change and tested it against the history of agricultural development in the United States and Japan (Hayami and Ruttan 1971; Binswanger and Ruttan 1978). The demonstration that technical change can be treated as largely endogenous to the development process does not imply that the progress of either agricultural or industrial technology can be left to an 'invisible hand' that drives technology along an 'efficient' path determined by relative resource endowments. The capacity to advance knowledge in science and technology is itself a result of a product of institutional innovation - 'the great invention of the nineteenth century was the invention of the method of invention' (Whitehead 1925, 96).

In this paper I elaborate a theory of induced institutional innovation in which institutional innovation is induced by changes in resource endowments, cultural endowments and by technical change. I also consider the impact of advances in social science knowledge on the supply of institutional change. After examining the forces that act to shift the demand and supply of institutional innovation the elements of a more general model of institutional change is presented.[2]

What is Institutional Innovation?

Institutions are the rules of a society or of organizations that facilitate coordination among people by helping them form expectations, which each person can reasonably hold in dealing with others. They reflect the conventions and ideologies that have evolved in different societies regarding the behavior of individuals and groups relative to their own behavior and the behavior of others.[3] In the area of economic relations they have a crucial role in establishing expectations about the rights to use resources in economic activities and about the partitioning of the income streams resulting from economic activity: "institutions provide *assurance* respecting the actions of others, and give order and stability to expectations in the complex and uncertain world of economic relations."[4]

In order to perform the essential role of forming reasonable expectations in dealings among people, institutions must be stable for an extended time period. But institutions, like technology, must also change if development is to occur. Anticipation of the latent gains to be realized by overcoming the disequilibria resulting from changes in factor endowments, cultural endowments, and technology represents powerful inducements to institutional innovation (North and Thomas 1970; Schultz 1975; Binswanger and Deininger 1997).[5] The growing disequilibria in resource allocation due to institutional constraints generated by economic growth create incentives for political entrepreneurs or leaders to organize collective action to bring about institutional change.[6]

This perspective on the sources of demand for institutional change is similar, in some respects, to the traditional Marxian view.[7] Marx considered technological change as the primary source of institutional change. The induced innovation perspective is somewhat more complex in that it considers that changes in cultural and factor endowments are also important sources of

institutional change. Nor is the definition of institutional change employed in this paper limited to the dramatic or revolutionary changes of the type anticipated by Marx. Institutions such as property rights and markets are more typically altered through the accumulation of 'secondary' or incremental institutional changes such as spontaneous modifications in contractual relations or shifts in the boundaries between market and non-market activities (Davis and North 1971, 9).

There is a supply dimension as well as a demand dimension for institutional change. Advances in knowledge in the social sciences (and in related professions such as law, administration, planning, and social service) can reduce the cost of institutional change in a somewhat similar manner as advances in the natural sciences reduce the cost of technical change. Advances in game theory have, during the last several decades, enabled economists and political scientists to bring an increasingly powerful set of tools to bear on the understanding of the processes of institutional change (Schotter 1981; Ostrom 1990; Aoki 1996). In spite of the power of these new tools I continue find the application of standard neoclassical micro-economic theory to interpret the sources of the demand and supply of institutional change exceedingly useful.

Insistence that important advances in the understanding of the processes of institutional innovation and diffusion can be achieved by treating institutional change as endogenous to the economic system represents a clear departure from the tradition of modern analytical economics.[8] This does not mean that modern analytical economics must be abandoned. On the contrary, the scope of modern analytical economics is expanded by treating institutional change as endogenous.[9]

There is general agreement that institutional change has and continues to evolve in response to long-term changes such as the pressure of population against land resources or the rise in the price of labor relative to capital. But there has been substantial disagreement within

the social sciences about the role of purposeful or rational design in institutional innovation.[10] Those holding an "organic" or "spontaneous order" perspective argue that the fact that the institutions of civilization have been created by human action "does not mean that man must also be able to alter them at will" (Hayek 1978, 3).[11] The organic view of the sources of institutional change is reinforced by a theory of "unintended consequences" that runs through the work of Adam Smith, Max Weber, and Frederich Hayek (Lal 1998).[12] In contrast the constructivist or design perspective holds that advances in social science knowledge can play an important role in the rational design of institutional reform and institutional innovation.

Much of my work with Yujiro Hayami on induced institutional innovation reflects an organic perspective. In other work, on the development of agricultural research institutions for example, I have employed both organic and constructivist perspectives (Ruttan 1982). I reject any demand to choose between the organic and constructivist perspectives. They should be viewed as complements rather than as alternatives. I also reject the ideological implication, advanced by some proponents of the organic approach that the unintended consequences of institutional change preclude the possibility of a rational or analytical approach to institutional reform and design. In the next section of this paper on demand for institutional innovation I employ an organic approach to interpret a series of institutional changes in land and labor relationships. In a following section on the supply of institutional innovation I employ a constructivist or design perspective.

Demand for Institutional Innovation

In some cases the demand for institutional innovation can be satisfied by the development of new forms of property rights, more efficient market institutions, or even by evolutionary changes

arising out of direct contracting by individuals at the level of the community or the firm. In other cases, where externalities are involved, substantial political resources may have to be brought to bear to organize non-market institutions in order to provide for the supply of public goods. This section draws from agricultural history to illustrate how changes in factor endowments, technical change, and growth in product demand have induced change in property rights and contractual arrangements.

The agricultural revolution that occurred in England between the fifteenth and the nineteenth centuries involved a substantial increase in the productivity of land and labor. It was accompanied by the enclosure of open fields and the replacement of small peasant cultivators, who held their land from manorial lords, by a system in which large farmers used hired labor to farm the land they leased from the landlords. The First Enclosure Movement, in the fifteenth and sixteenth centuries, resulted in the conversion of open arable fields and commons to private pasture in areas suitable for grazing. It was induced by expansion in the export demand for wool. The Second Enclosure Movement in the eighteenth century involved conversion of communally managed arable land into privately operated units. It is now generally agreed that demand for changes in land tenure arrangements was largely induced by the growing disequilibrium between the fixed institutional rent that landlords received under copyhold tenures (with lifetime contracts) and the higher economic rents expected from adoption of new technology which became more profitable as a consequence of higher grain prices and lower wages. When the land was enclosed there was a redistribution of income from farmers to landowners and the disequilibrium was reduced or eliminated.[13]

In nineteenth-century Thailand, the opening of the nation to international trade and the reduction in shipping rates to Europe following the completion of the Suez Canal resulted in a

sharp increase in the demand for rice. The land available for rice production, which had been abundant, became more scarce. Investment in land development for rice production for export became profitable. The rise in the profitability of rice production for export induced a demand for the reform of property rights in both land and man. Traditional rights in human property (corvee and slavery) were replaced by more precise private property rights in land (fee-simple titles) (Feeny 1982; 2002).

In Japan, at the beginning of the feudal Tokugawa period (1603-1867), peasants' rights to cropland had been limited to the right to till the soil with the obligation to pay a feudal land tax in kind. As the population grew, commercialization progressed and irrigation and technology were developed to make intensive farming more profitable. Some peasants divided their holdings into smaller units and leased them out to servants or to extended family members. Some accumulated land through mortgaging arrangements that made other peasants de facto tenants. As a result of the accumulation of illegal leasing and mortgaging practices, peasants' property rights in land approximated those of a fee-simple title by the end of the Tokugawa period. These rights were readily converted to the modern private property system in the succeeding Meiji period (Hayami and Kikuchi 1981, 28).[14]

Research conducted by Yujiro Hayami and Masao Kikuchi in the Philippines during the late 1970s has enabled us to examine a contemporary example of the interrelated effects of changes in resource endowments and technical change on the demand for institutional change in land tenure and labor relations (Kikuchi and Hayami 1980; Hayami and Kikuchi 1981; Hayami and Kikuchi 2000). The case is particularly interesting because the institutional innovations occurred as a result of private contracting among individuals—what Hayek termed “spontaneous order” and in more recent literature has been referred to as “Coasian bargains” (Hayek 1978;

Olson 2000). The study is unique in that it is based on a rigorous analysis of microeconomic data from a single village over a period of about 20 years.[15]

Land Tenure and Labor Relations in a Philippine Village

Between 1956 and 1976, rice production per hectare in the study village rose dramatically, from 2.5 to 6.7 metric tons per hectare per year. This was due to two technical innovations. In 1958, the national irrigation system was extended to the village. This permitted double-cropping to replace single-cropping, thereby more than doubling the annual production per hectare of rice land. The second major technical change was the introduction in the late 1960s of modern high-yielding rice varieties. The diffusion of modern varieties was accompanied by increased use of fertilizer and pesticides and by the adoption of improved cultural practices such as straight-row planting and intensive weeding.

Population growth in the village was rapid. Between 1966 and 1976 the number of households rose from 66 to 109 and the population rose from 383 to 464, while cultivated area remained virtually constant. The number of landless laborer households increased from 20 to 54. In 1976, half of the households in the village had no land to cultivate not even land for rent. The average farm size declined from 2.3 hectares to 2.0 hectares.

The land is farmed primarily by tenants. In 1976, only 1.7 hectares of the 108 hectares of cropland in the village were owned by village residents. Traditionally, share tenancy was the most common form of tenure. In both 1956 and 1966, 70 per cent of the land was farmed under share tenure arrangements. In 1963, a new national agricultural land reform code was passed which was designed to break the political power of the traditional landed elite and to provide greater incentives to peasant producers of basic food crops.[16] A major feature of the new

legislation was an arrangement that permitted tenants to initiate a shift from share tenure to leasehold, with rent under the leasehold set at 25 per cent of the average yield for the previous three years. Implementation of the code between the mid-1960s and the mid-1970s resulted in a decline in the percentage of land farmed under share tenure to 30 per cent.

The shift from share tenure to lease tenure was not, however, the only change in tenure relationships that occurred between 1966 and 1976. There was a sharp increase in the number of plots farmed under subtenancy arrangements. The number increased from one in 1956 to five in 1966 and 16 in 1976. Subtenancy is illegal under the land reform code. The subtenancy arrangements were usually made without the consent of the landowner. All cases of subtenancy were on land farmed under a leasehold arrangement. The most common subtenancy arrangement was 50-50 sharing of costs and output (Table 1).

It was hypothesized that an incentive for the emergence of the subtenancy institution was that the rent paid to landlords under the leasehold arrangement was below the equilibrium rent - the level which would reflect both the higher yields of rice obtained with the new technology and the lower wage rates implied by the increase in population pressure against the land.

To test this hypothesis, market prices were used to compute the value of the unpaid factor inputs (family labor and capital) for different tenure arrangements during the 1976 wet season. The results indicate that the share-to-land was lowest and the operators' surplus was highest for the land under leasehold tenancy. In contrast, the share-to-land was highest and no surplus was left for the operator who cultivated the land under the subtenancy arrangement (Table 1). Indeed, the share-to-land when the land was farmed under subtenancy was very close to the sum of the share-to-land plus the operators' surplus under the other tenure arrangement.

Table 1. Factor Shares of Rice Output per Hectare, 1976 Wet Season. (From Yujiro Hayami and Masao Kikuchi, *Asian Village Economy at the Crossroads: An Economic Approach to Institutional Change*. [Tokyo: University of Tokyo Press, 1981, and Minneapolis: University of Minnesota Press, 1982], 111- 13.)

	Number of Plots	Area (ha)	Rice Output	Current Inputs	Land-owner	Factor shares[a] Sub-Tenancy	Total	Labor	Capital[b]	Operators' Surplus
			----------kg/ha----------							
Leasehold land	44	67.7	2,889 (100.0)	657 (22.7)	567 (19.6)	0 (0)	567 (19.6)	918 (31.8)	337 (11.7)	410 (14.2)
Share tenancy land	30	29.7	2,749 (100.0)	697 (25.3)	698 (25.4)	0 (0)	698 (25.4)	850 (30.9)	288 (10.5)	216 (7.9)
Subtenancy land	16	9.1	3,447 (100.0)	801 (23.2)	504 (14.6)	801[c] (23.2)	1,305 (37.8)	1,008 (29.3)	346 (10.1)	-13 (-0.4)

[a] Percentage shares are shown in parentheses.

[b] Sum of irrigation fee and paid and/or imputed rentals of carabao, tractor and other machines.

[c] Rents to subleasors; in the case of pledged plots are imputed by applying the interest rate of 40 per cent crop season (a mode in the interest rate distribution in the village).

The results are consistent with the hypothesis. A substantial portion of the economic rent was captured by the leasehold tenants in the form of operators' surplus. On the land farmed under a subtenancy arrangement, the rent was shared between the leaseholder and the landlord.

A second institutional change, induced by higher yields and the increase in population pressure, has been the emergence of a new pattern of employer-labor relationship between farm operators and landless workers. According to the traditional system called ***hunusan,*** laborers who

participated in the harvesting and threshing activity received a one-sixth share of the paddy (rough rice) harvest. By 1976, most of the farmers (83 per cent) adopted a system called *gamma*, in which participation in the harvesting operation was limited to workers who had performed the weeding operation without receiving wages.

The emergence of the *gamma* system can be interpreted as an institutional innovation designed to reduce the wage rate for harvesting to a level equal to the marginal productivity of labor. In the 1950s, when the rice yield per hectare was low and labor was less abundant, the one-sixth share may have approximated an equilibrium wage level. With the higher yields and the more abundant supply of labor, the one-sixth share became larger than the marginal product of labor in the harvesting operation[17] (Table 2).

To test the hypothesis that the gamma system was adopted rapidly primarily because it represented an institutional innovation that permitted farm operators to equate the harvesters' share of output to the marginal productivity of labor, imputed wage costs were compared with the actual harvesters' shares (Table 2). The results indicate that a substantial gap existed between the imputed wage for the harvesters' labor alone and the actual harvesters' shares. This gap was eliminated if the imputed wages for harvesting and weeding labor were added. Those results are consistent with the hypothesis that the changes in institutional arrangements governing the use of production factors were induced when disequilibria between the marginal returns and the marginal costs of factor inputs occurred as a result of changes in factor endowments and technical change. Institutional change, therefore, was directed toward the establishment of a new equilibrium in factor markets.[18]

Table 2. Comparison between the Imputed Value of Harvesters' Share and Imputed Cost of *Gamma* Labor. (From Yujiro Hayami and Masao Kikuchi, *Asian Village Economy at the Crossroads: An Economic Approach to Institutional Change*. [Tokyo: University of Tokyo Press, 1981, and Minneapolis: University of Minnesota Press, 1982], 121.)

	Based on employers' data	Based on employers' data
No. of working days of *gamma* labor (days/ha)[a]		
Weeding	20.9	18.3
Harvesting/ threshing	33.6	33.6
Imputed cost of *gamma* labor (P/ha)[b]		
Weeding	167.2	146.4
Harvesting/threshing	369.6	369.6
Total	536.8	516.0
Actual share of harvesters:		
(1) In kind (kg/ha)[c]	504.0	549.0
(2) Imputed value (P/ha)[d]	504.0	549.0
(2) - (1)	-32.8	33.0

[a] Includes labor of family members who worked as *gamma* laborers.

[b] Imputation using market wage rates (daily wage = P8.0 for weeding, PI 1.0 for harvesting).

[c] One-sixth of output per hectare.

[d] Imputation using market prices (I kg = PI).

It is important to recognize that subtenancy and *gamma* contracts were the institutional innovations arrived at by voluntary agreements among farm operators, tenants and laborers. The land reform laws gave leasehold tenants strong protection of their tenancy rights. It gave them

the right to continue tilling the soil at an institutional rent that was lower then the economic rent. But the laws prohibited tenants from renting their land to someone else who might utilize it more efficiently, when they became elderly or found more profitable off-farm employment, for example. Subtenancy reduced such inefficiency due to the institutional rigidity in the land rental market resulting from the land reform programs. Likewise, the *gamma* system counteracted the institutional rigidity in the labor market associated with the institutional wage rate based on the traditional harvest share.

It might appear that these institutional innovations increased efficiency at the expense of equity. But, if the subtenancy system had not been developed, the route would have been closed for some of the landless laborers to become farm operators and use their skills more profitably. If the wage rate for harvesting work had been raised in the absence of the implicit *gamma* contract, it would have encouraged mechanization in threshing thereby reducing both employment and labor earnings.

In the case reviewed here the induced innovation process leading toward the establishment of equilibrium in factor markets occurred very rapidly in spite of the fact that many of the transactions - between landlords, tenants, and laborers - were less than fully monetized. Informal contractual arrangements or agreements were utilized. The subleasing and the *gamma* labor contract evolved without the mobilization of substantial political activity or bureaucratic effort. Indeed, the subleasing arrangement evolved in spite of legal prohibition. Where substantial political and bureaucratic resources must be mobilized to bring about technical or institutional change, the changes occur much more slowly, as in the cases of the English enclosure movements and the Thai and Japanese property rights cases referred to at the beginning of this section.

The examples of institutional change advanced in this section, such as the enclosure in England and the evolution of private property rights in land in Japan and Thailand, have contributed to the development of a more efficient market system. Institutional changes of this type are profitable for society only if the costs involved in the assignment and protection of rights are smaller than the gains from better resource allocation. If those costs are very high, it may be necessary to design non-market institutions in order to achieve more efficient resource allocation.[19]

The Supply of Institutional Innovation

The disequilibria in economic relationships associated with economic growth, such as technical change leading to the generation of new income streams and changes in relative factor endowments have been identified as important sources of demand for institutional change. But the sources of supply of institutional innovation are less well understood (Olson 1968; Ostrom 1990). The factors that reduce the cost of institutional innovation have received only limited attention by economists or by other social scientists.

In the Philippines village case discussed earlier, innovations in tenure and labor market institutions were supplied, in response to the changes in demand generated by changing factor endowments and new income streams, through the individual and joint decisions of owner-cultivators, tenants and laborers. But even at this level it was necessary for gains to the innovators to be large enough to offset the risk of ignoring the land reform prohibitions against subleasing and the transaction costs involved in changing traditional harvest sharing arrangements. While mobilization of substantial political resources was not required to introduce

and extend the new land and labor market institutions, the distribution of political resources within the village did influence the initiation and diffusion of the institutional innovations.

The supply of major institutional innovations necessarily involves the mobilization of substantial political resources by political entrepreneurs and innovators. It is useful to think in terms of a supply schedule of institutional innovation that is determined by the marginal cost schedule facing political entrepreneurs as they attempt to design new institutions and resolve the conflicts among interest groups (or suppression of opposition when necessary). It was hypothesized that institutional innovations will be supplied if the expected return from the innovation that accrues to the political entrepreneurs exceeds the marginal cost of mobilizing the resources necessary to design and introduce the innovation. To the extent that the private return to the political entrepreneurs is different from the social return, the institutional innovation will not be supplied at a socially optimum level.[20] If the institutional innovation is expected to result in a loss to a dominant political bloc, the innovation may not be forthcoming even if it is expected to produce a large net gain to society as a whole. And socially undesirable institutional innovations may occur if the returns to the entrepreneur or the interest group exceed the gains to society (Tullock 1967; Krueger 1974; Tollison 1982).

The failure of many developing countries to institutionalize the agricultural research capacity needed to take advantage of the large gains from relatively modest investments in technical change may be due, in part, to the divergence between social returns and the private returns to political entrepreneurs. In the mid-1920s, for example, agricultural development in Argentina appeared to be proceeding along a path roughly comparable to that of the United States. Mechanization of crop production lagged slightly behind that in the United States. Grain yields per hectare averaged slightly higher than in the United States. In contrast to the United

States, however, output and yields in Argentina remained relatively stagnant between the mid-1920s and the mid1970s. It was not until the late 1970s that Argentina began to realize significant gains in agricultural productivity. Part of this lag in Argentine agricultural development was due to the disruption of export markets in the 1930s and 1940s. Students of Argentine development have also pointed to the political dominance of the landed aristocracy, to the rising tensions between urban and rural interests, and to inappropriate domestic policies toward agriculture (de Janvry 1973; Smith 1969 and 1974; Cavallo and Mundlak 1982). The Argentine case would seem to represent a case where the bias in the distribution of political and economic resources imposed exceptionally costly delays in the institutional innovations needed to take advantage of the relatively inexpensive sources of growth that technical change in agriculture could have made available.

Cultural endowments, including religion and ideology, may exert a strong influence on the supply of institutional innovation. They make some forms of institutional change less costly to establish and impose severe costs on others (Jones 1999). For example, the traditional moral obligation in the Japanese village community to cooperate in joint communal infrastructure maintenance has made it less costly to implement rural development programs than in societies where such traditions do not prevail. These activities had their origin in the feudal organization of rural communities in the pre-Meiji period. But practices such as maintenance of village and agricultural roads and of irrigation and drainage ditches through joint activities in which all families contribute labor were still practiced in well over half of the hamlets in Japan as recently as 1970 (Ishikawa 1981). The traditional patterns of cooperation have represented an important form of social capital on which to erect modern forms of cooperative marketing and joint farming activities. Similar cultural resources are not available in South Asian villages where, for

example, the caste structure inhibits cooperation and encourages specialization (Lal 1998; Ruttan 2003: 232-235).

Likewise, the adoption of new ideology may reduce the cost to political entrepreneurs of mobilizing collective action for institutional change. For example, in the United States the Jeffersonian concept of agrarian democracy provided ideological support for the series of land ordinances culminating in the Homestead Act of 1862, which established the legal framework designed to encourage an owner-operator system of agriculture in the American West (Cochrane 1979, 41-47, 179-88). Strong nationalist sentiment in Meiji Japan, reflected in slogans such as 'A Wealthy Nation and Strong Army' (Fukoku Kyohei), helped mobilize the resources needed for the establishment of vocational schools and agricultural and industrial experiment stations (Hayami and Kikuchi 1981). In China, communist ideology, reinforced by the lessons learned during the guerrilla period in Yenan, inspired the mobilization of communal resources to build irrigation systems and other forms of social overhead capital (Schran 1975). Thus, ideology can be a critical resource for political entrepreneurs and an important factor affecting the supply of institutional innovations.[21]

Advances in social sciences that improve knowledge relevant to the design of institutional innovations that are capable of generating new income streams or that reduce the cost of conflict resolution act to shift the supply of institutional change to the right. Throughout history, improvements in institutional performance have occurred primarily through the slow accumulation of successful precedent or as by-products of expertise and experience. Institutional change was generated through the process of trial and error much in the same manner that technical change was generated prior to the invention of the research university, the agricultural experiment station, or the industrial research laboratory. With the institutionalization of research

in the social sciences and related professions the process of institutional innovation has begun to proceed much more deliberately; it has become increasingly possible to substitute social science knowledge and analytical skill for the more expensive process of learning by trial and error.

The research that led to advances in our understanding of the production and consumption of rural households in less developed countries represents an important example of the contribution of advances in social science knowledge to the design of more efficient institutions (Schultz 1964; Nerlove 1974; Binswanger, Evenson, Florencio and White 1981). In a number of countries this research has led to the abandonment of policies that viewed peasant households as unresponsive to economic incentives. And it has led to the design of policies and institutions to make more productive technologies available to peasant producers and to the design of more efficient price policies for factors and products.

Institutional Design Principles

Where does one turn for the knowledge and experience needed to guide institutional design? Modest beginnings have been made by students who have been employing the tools of what became variously known as the "new political economy" or the "new institutional economics" (Downs 1957; Olson 1965).The rapid penetration of the political economy perspective into the traditional territory of political science was initially welcomed (or at least not actively opposed) by many political scientists who found the new analytical tools, primarily drawn from economics, useful (Almond 1993).

A major implication drawn by early practitioners of the new institutional economics was profoundly conservative: "Unless the number of individuals in a group is quite small, or unless there is coercion or some other device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests" (Olson

1965:2). The initial positive reception of the "zero contribution" inference was followed by a large critical literature. "Many people do vote, do not cheat on their taxes, and contribute to voluntary organizations. … Individuals in all walks of life and in all parts of the world voluntarily organize themselves to gain the benefits of trade, to provide mutual protection against risk, and to create and enforce rules that protect natural resources" (Ostrom 2000, 137-138).

Over the last several decades Elinor Ostrom and her colleagues at he University of Indiana Workshop on Political Theory and Policy Analysis have brought together the results of a massive body of field observations, extensive laboratory evidence, and careful theoretical analysis to distill a set of principles that provide fundamental insight into the process of institutional design (Table 3). The principles articulated in Table 3 are consistent with the process of "spontaneous order" arising out of individual and small group action. But they also advance a set of principles, derived from social science research, for the design of sustainable institutions to enhance economic development at the local and regional level (Ostrom 1992:39; Boettke and Coyne 2005) (Table 3).

Table 3. Institutional Design Principles

Elinor Ostrom and colleagues at the Workshop in Political Theory and Policy Analysis at Indiana University have articulated eight design principles drawn from their research on self-organized resource management regimes.

The *first* design principle is that the presence of clear boundaries and rules …enables participants to know who is in and who is outside of a defined set of relationships and thus with whom to cooperate.

The *second* design principle is that the local rules-in-use define the amount, timing, timing and technology of harvesting the resource: allocate the benefits proportional to required inputs; and are drafted to take local conditions into account.

The *third design* principle is that most of the individuals affected by the resource regime can participate in making and modifying the rules. Resource regimes that that use this principle are both able to tailor better rules to local circumstances and to devise rules that are considered fair by participants.

The *fourth* design principle is that … resource regimes select their own monitors, who are accountable to the users or are users themselves and who keep an eye on resource conditions as well as on their use.

The *fifth* design principle is that the resource regimes use *graduated sanctions* that depend on the seriousness and context of the offense. By creating official positions for local monitors a resource regime does not have to depend only on willing punishers to impose personal costs on those who break a rule.

The *sixth* design principle is the importance of access to rapid, low cost, local arenas to resolve conflict among users or between users and officials. By devising simple, local mechanisms to get conflicts aired immediately the number of conflicts that reduce trust can be reduced.

The *seventh* design principle is that the capability of local users to deliver an ever-more effective regime over time is affected by whether they have minimal recognition of the right to organize by a local, regional or national government unit.

The *eighth* design principle that characterizes systems when common pool resources are somewhat larger is the presence of government activities organized in multiple layers of nested

enterprises. Among long enduring self-organized regimes, smaller scale organizations tend to be nested in ever-larger organizations.

This table is adapted from the institutional deign principles articulated in Elinor Ostrum, "Collective Action and the Evolution of Social Norms," *Journal of Economic Perspectives* 14 (2000): 237-58. The institutional design rules developed by Elinor Ostrom drew heavily on her research on the design and management of irrigation systems. See Elinor Ostrom, 1992, *Crafting Institutions for Self-Governing Irrigation Systems*, San Francisco: ICS Press. The design principles were most fully articulated in Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action.* New York, Cambridge University Press, 1990.

Constructed Markets for Emissions Trading

In this section I present a case study of the contribution of advances in social science knowledge to the design of a contemporary institutional innovation at the national level. The case involves the design and implementation of an emission trading system to reduce the transaction costs of controlling sulfur dioxide (SO_2) emissions—an important industrial pollutant. Advances in economic knowledge led to an understanding of the very large cost reductions that could be achieved by designing a "constructed market" to replace the "command and control" approach to the management of SO_2 emissions.

The concept behind the design of a constructed market for the control of SO_2 pollutants is fairly simple. It is based on the realization that the behavioral sources of the pollution problem can often be traced to poorly defined property rights in open access natural resources such as air and water.[22] A system of property rights and tradable permits for the management of pollution was first proposed in the late 1960s by Crocker (1966) and Dales (1968a, 1968b). The suggested

institutional innovation did not emerge from its inventors in a fully operational form. Their proposals were followed by a large theoretical and empirical literature by resource and environmental economists (Bohm 1985). Design and implementation involved an extended process of "learning by doing" and "learning by using."

Proposals to replace the command and control approach by Presidents Johnson and Nixon by effluent fees or taxes on pollutants were dismissed as impractical and characterized by environmental activists as a "license to pollute." Beginning in the mid 1980s, however, a series of events conspired to make a more market oriented approach to reducing SO_2 emissions politically feasible (Taylor 1989, 28-34; Hahn and Stavins 1991; Stavins 1998). One was the predilection of President George H. W. Bush in favor of a market oriented approach to environmental policy. Another was the enthusiasm of Environmental Protection Agency administrator William Reilly and a number of key staff members in the Executive Office of the President for validating Bush's desire to be known as "the environmental president." There was also bipartisan support in key Congressional committees for a variety of market based approaches to environmental policy.

Within the environmental community the Environmental Defense Fund (EDF) began to differentiate itself from the rest of the environmental community by advocating market based approaches as early as the mid 1980s. In 1989 EDF staff began to work closely with the White House staff in drafting an early version of proposed legislation. The credibility of the effort was enhanced by the fact that EPA Administrator Reilly, formerly president of the Conservation Foundation, was a "card carrying" environmentalist. Executives of several major corporations, influenced by subtle lobbying by the EDF commented favorably on the emissions trading proposals.

The design of the SO_2 emissions trading system advanced in the Clean Air Act of 1990 drew on earlier EPA experience. The EPA began experimenting with emission trading permits in 1974. The early programs included the elimination of lead in gasoline, the phase-out of chlorofluorocarbons and halons in refrigeration, and the reduction of water pollution from nonpoint sources. The early programs had a mixed record. They were typically grafted onto existing command-and-control programs. The difficulty of converting from command-and-control programs encountered substantial transaction costs. These experiences did, however, provide important lessons for the design of more market oriented trading programs in the 1990s.

The Clean Air Act created a national market for SO_2 allowances for coal burning electrical utilities. The commodity exchanged in the SO_2 emissions trading program is a property right to emit SO_2 that was created by the EPA and allocated to individual firms. A firm can make allowances that had been issued to it available to be traded to other firms by reducing its own emissions of the pollutant below its own base line level. In 1995, the programs first year, 110 of the nation's dirtiest coal burning plants were included in the program. The affected plants were allowed to emit 2.5 pounds of SO_2 for each million British Thermal Units (Btu) of energy that they generated. During Phase II initially projected, to begin in 2000, almost all coal-burning plants were scheduled to be included and allowances for each plant to be reduced to 1.2 pounds per million Btu. Utilities that "overcomply" by reducing their emissions more than required may sell their excess allowances. Utilities that find it more difficult, or expensive, to meet the requirements may purchase allowances from other utilities.

The evidence available at the time this paper was completed suggests that emission trading has been even more cost effective than originally anticipated. Prior to initiation of the program the utility industry had complained that reducing SO_2 in amounts sufficient to meet the

projected target (down from about 19 million tons in 1980 to 8.95 million tons in 2000) might cost as much as $1,500 per ton. By the late 1990s allowances were being sold in the $100-150 range. The decline in the cost of abatement has been due in part to technical changes in coal mining and deregulation of rail transport that have lowered the cost of low sulphur coal to mid-western power producers. It has also been due to technical changes in fuel blending and SO_2 scrubbing that was induced by the introduction of performance based allowance trading. As a result benefits substantially exceeded early estimates (Joskow, Smalensee and Bailey 1998)

The successful experience with SO_2 emissions trading illustrates a very important principle in inventing new property rights institutions to manage formerly open access resources. In a now classic paper Coase (1960) argued that when only a few decision makers are involved in the generation of externalities, the two parties, if left to themselves, will voluntarily negotiate a new institutional mechanisms—rules and payments—that result in a reduction of the externalities to an acceptable level. However important the Coase theorem might be for understanding the small institutional innovations in the Philippine village case presented earlier in this chapter it has little relevance to most contemporary large scale externality problems. The important externality problems that concern society today—such as SO_2 pollution, ozone pollution or the greenhouse gases responsible for global climate change—typically involve large numbers of polluters and even larger numbers of persons affected by the externalities. In contrast to the evolution of a "natural market" government must establish the conditions necessary for a "constructed" market to function. In the SO_2 case it was necessary for an outside principle, the U.S. Congress, to define the size (or the boundaries) of the resource, in this case the maximum tons of SO_2 emissions, and to establish the trading rules. The social science effort involved in the

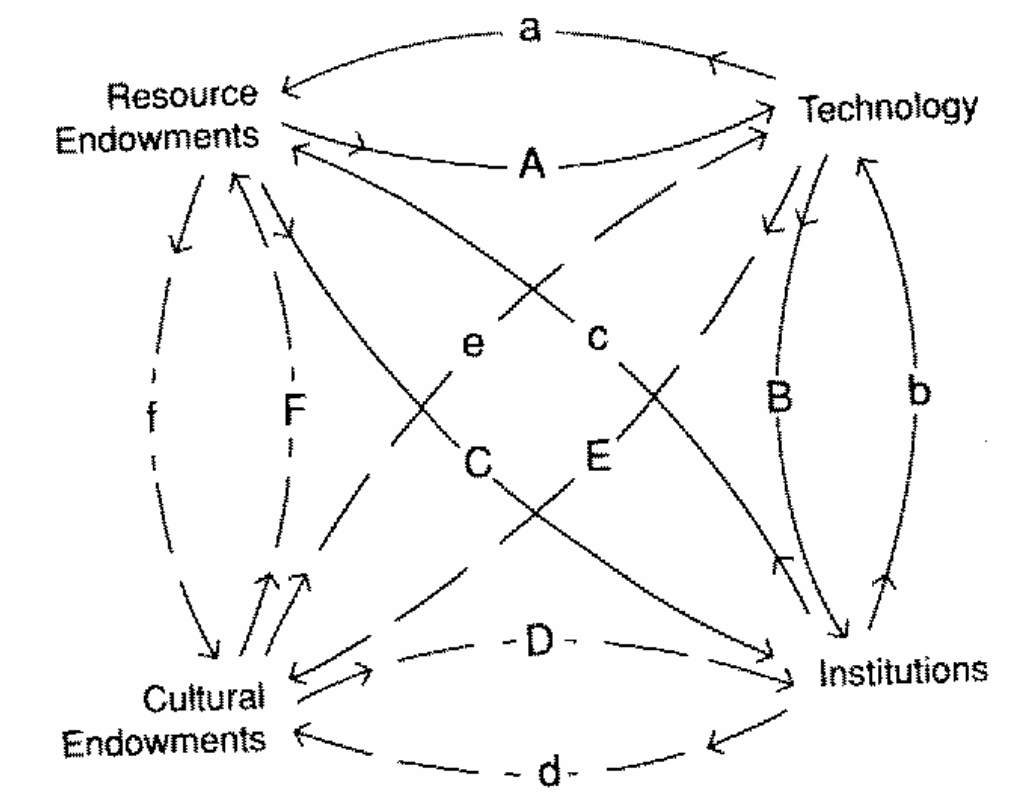
design and implementation of the institutional arrangements to confront such problems requires the mobilization of large economic and political resources.

Toward a More Complete Model of Induced Innovation

The elements of a pattern (or structural) model that maps the general equilibrium relationships among changes in resource endowments, cultural endowments, technology and institutions are presented in Figure 1.[23] The model goes beyond the conventional general equilibrium model in which resource endowments, technologies, institutions, and culture (conventionally designated as "tastes" in the economics literature) are given.[24] In the study of long-term social and economic change the relationships among the variables must be treated as recursive and dynamic (Harsanyi 1960). The formal microeconomic models that are employed to analyze the supply and demand for technical and institutional change can be thought of as 'nested' within the general equilibrium framework of Figure 1.

An important advantage of the pattern model outlined in Figure 1 is that it avoids the necessity of choosing between a materialist conception of human action, in which agents mechanically respond to changes in resource endowments, and an idealist conception of human action, in which agents respond only to subjective changes in cultural endowments (such as religion or ideology). Another advantage of the 'pattern model' outlined in Figure 1 is that it helps to identify areas of ignorance. Our capacity to model and test the relationships between resource endowments and technical change is relatively strong. Our capacity to model and test the relationships between cultural endowments and either technical or institutional change is relatively weak. The model is also useful in identifying the model components that enter into other attempts to account for secular economic and social change. Failure to analyze historical

Figure 1. Interrelationships between changes in resource endowments, cultural endowments, technology, and institutions. (From Yujiro Hayami and Vernon Ruttan, *Agricultural Development: An International Perspective*, rev. ed. [Baltimore: Johns Hopkins University Press, 1985], 111.)



change in a general equilibrium context tends to result in a unidimensional perspective on the relationships bearing on technical and institutional change.[25]

For example, historians working within the Marxist tradition often tend to view technical change as dominating both institutional and cultural change. In his book, *Oriental Despotism*, Wittfogel (mistakenly) views the irrigation technology used in wet rice cultivation in East Asia as determining political organization (Wittfogel 1957). In terms of Figure 1 his

primary emphasis was on the impact of changes in resources and technology on institutions (C) and (B).

A serious misunderstanding can also be observed in the neo-Marxian critiques of the 'green revolution' in rice production in Asia (Cleaver 1972; Hayami and Ruttan 1985, 336-45). These criticisms focused attention almost entirely on the impact of technical change on labor and land tenure relations. Both the radical and populist critics emphasized relation (B). But they tended to ignore relationships (A) and (C).[26] This has led to repeated failure to identify effectively the separate effects of population growth and technical change on the growth and distribution of income.

Economists such as Coase (1960) and Alchian and Demsetz (1973) identify a primary function of property rights as guiding incentives to achieve greater internalization of externalities. They consider that the clear specification of property rights reduces transaction costs in the face of growing competition for the use of scarce resources as a result of population growth and/or growth in product demand. North and Thomas, building on the Alchian-Demsetz paradigm, attempted to explain the economic growth of Western Europe between 900 and 1700 primarily in terms of changes in property institutions.[27] During the eleventh and thirteenth centuries the pressure of population against increasingly scarce land resources induced innovations in property rights that in turn created profitable opportunities for the generation and adoption of labor-intensive technical changes in agriculture. The population decline in the fourteenth and fifteenth centuries was viewed as a primary factor leading to the demise of feudalism and the rise of the national state (line C). These institutional changes in turn opened up new possibilities for economies of scale in non- agricultural production and in trade (line b).

Mancur Olson (1968, 1982) has emphasized the proliferation of institutions as a source of economic decline. He also regards broad-based encompassing organizations as having incentives to generate growth and redistribute incomes to their members with little excess burden. For example, a broadly based coalition that encompasses the majority of agricultural producers is more likely to exert political pressure for growth-oriented policies that will enable its members to obtain a larger share of a larger national product than a smaller organization that represents the interests of the producers of a single commodity. Small organizations representing narrow interest groups are more likely to pursue the interests of their members at the expense of the welfare of other producers and the general public. In contrast, an even more broadly based farmer-labor coalition would be more concerned with promoting economic growth than an organization representing a single industry or commodity. But large groups, in Olson's view, are inherently unstable because rational individual members are reluctant to incur the costs of contributing to the realization of the large group program--they have strong incentives to act as free riders. As a result, organizational 'space' in a stable society will be increasingly occupied by special interest 'distributional coalitions.' These distributional coalitions make political life more divisive. They slow down the adoption of new technologies (line b) and limit the capacity to reallocate resources (line c). The effect is to slow down economic growth or in some cases initiate a period of economic decline.[28]

The relationships in the lower left hand corner of Figure 1 (dashed lines) have received relatively little attention from economists. The classic analysis by Weber (1958; 1904) of the impact of the Protestant Reformation, particularly Calvinism, on the emergence of capitalism in *The Protestant Ethic and the Spirit of Capitalism* is an important exception (line D). The analysis by Greif (1994) of how the differential impact of the collectivist cultural endowments of

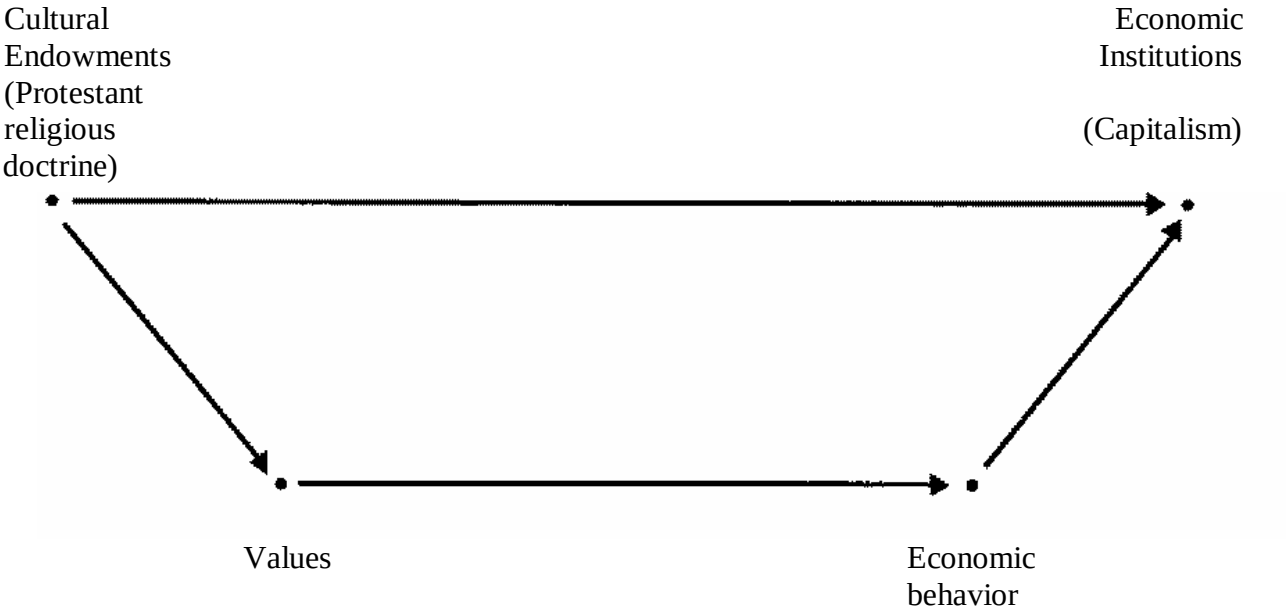
Maghrebi traders and the individualistic cultural endowments of Genoese traders influenced the development of commercial institutions in the Mediterranean region in the eleventh and twelfth centuries is a more recent example. Political scientist Ronald Inglehart employs a model in which cultural endowments (value changes) respond to changes in resource endowments (line f). Materialist values are stronger in poor societies that are resource constrained while wealthy societies are characterized by post-materialist (or post-modern) values (Inglehart 1997).

The effect of resource endowments on the international diffusion of institutions has recently been explored in a series of important papers (Engerman and Sokoloff 2002; Acemoglu, Johnson and Robinson 2001; Levine 2005). A common conclusion was where the disease environment was not favorable to settlement, that European colonizers established extractive states (such as the Spanish in Peru, Britain in the Gold Coast and Belgium in the Congo). Where the disease environment was favorable the European colonizers established settler colonies. Where extractive states were established legal institutions were adopted that favored the extraction and transfer of resources to the metropolitan country and, after independence, to the new ruling elites. In settler colonies in contrast, legal institutions that favored the rule of law and encouraged investment were established. Those differences in legal culture and institutions explain substantial differences in contemporary per capita income (lines F, D and C).

A potential criticism of the pattern model depicted in Figure 1 is that it does not stipulate the mechanisms through which changes in resource endowments, for example, induce changes in technology. However it is not too difficult to visualize the mechanisms that mediate the relationships among changes in resource endowments, technical change and institutional change. The market represents a “master mechanism” for translating the uncoordinated behavior of individuals into system level coordination (Headstrom and Swedberg 1998, 3). It is somewhat

more difficult, however, to describe the mechanisms that link institutional change and changes in cultural endowments in terms of the neoclassical model (other than as metaphor). Another potential criticism of the pattern model of Fig. 1 is that it is "overdetermined." Identification problems become intractable since every variable in the system is subject to influences arising from changes in every other variable (Resnick and Wolff 1987) But because changes in the different relationships in the model occur a different rates the identification problem, while difficult, is tractable (Figure 2).

Figure 2. Macro- and micro-level propositions: effects of religious doctrine on economic organization. (Adapted from James S. Coleman, *Foundations of Social Theory*. [Cambridge, MA: Harvard University Press, 1990], 8. Reprinted by permission of the publisher from *Foundations of Social Theory* by James S. Coleman, Cambridge, Mass: Harvard University Press, Copyright © 1990 by the President and Fellows of Harvard College.)



Coleman, a leading social theorist of the last generation, advanced what he termed a macro-micro-micro-macro model (Coleman 1986; 1990, 1-23). In Figure 2 the Coleman model is used to interpret the Weber thesis on the relationship between the protestant ethic and the spirit of capitalism. Protestant theology inculcated a change in social values among its adherents (line 1); individuals internalized new value orientations (rationalism, antitraditionalism, asceticism) toward economic behavior (line 2); the new value orientations resulted in the actions by individuals and groups that induced the development of the economic institutions of capitalism (line 3). Coleman argues that Weber's own interpretation was incomplete because he did not address the critical theoretical problem—how individual actions combined to produce the unanticipated behavior of groups of individuals that brought about the economic institutions of capitalism.[29] "What is necessary to account for the growth or occurrence of any social organization, whether capitalist organization or something else, is how the structure of organizations come into being, how persons who come to occupy each of the positions in the organization are motivated to do so, and how this interdependent system of incentives is sustainable" (Coleman 1990, 9). Coleman's challenge to the social sciences research community has seldom been met.[30]

Perspective

What are the implications of the theory of induced institutional innovation for research on the contribution of social science knowledge to economic development? In my research, with Hayami and Binswanger, on the direction and rate of technical change we were able to advance significantly our knowledge by treating technical change as largely endogenous—as induced primarily by changes in relative resource endowments and the growth of demand. We were also

able to interpret the advances in knowledge about the role of changes in the economic environment on the rate and direction of technical change for the design of research systems and the allocation of research resources (Ruttan 1982; 2001).

In this paper I have presented a theory of induced institutional change. I argue that the theory has advanced our understanding of the process of institutional change. It suggests that substantial new insights have been obtained by treating institutional change as a response to changes in resource endowments and to technical change. But, as in the case of technical change, my concern goes beyond advancing our understanding of the process of institutional innovation. It is essential for the social sciences to advance our understanding of the historical processes of social and economic development. But that is not sufficient! If social science knowledge is to be valued by society it must also advance the knowledge to successfully intervene in the process of development—to reduce the cost of the "trial and error"—that has been the constant companion of the historic “organic” processes of institutional innovation.

I have also insisted on the significance of cultural endowments, including the factors that economists typically conceal under the rubric of tastes and that political scientists include under ideology, for economic development. In an article published in the mid 1980s Yujiro Hayami and I insisted that until our colleagues in the other social sciences provide us with more helpful analytical tools, we would be forced to adhere to a strategy that focused primarily on the interactions between resource endowments, technical change, and institutional change (Ruttan and Hayami 1984). This strategy had the clear advantage of allowing us to explore how far a strategy based on the rather straightforward extension of standard neoclassical microeconomic theory could take us in advancing out understanding of institutional change.[31]

In spite of the fact that this strategy has yielded very substantial insight into the process of institutional change I do not regard it as a very satisfactory conclusion. Beginning in the mid-1980s I initiated a program of research and writing designed to explore in greater depth what development economists should learn from scholars in the other nomothetic social sciences—anthropology, sociology and political science—working in the field of development. My recent book, *Social Science Knowledge and Economic Development* (Ruttan 2003), grew out of that effort.

A consistent theme in that book and in this paper is that advances in social science knowledge represents a powerful source of economic growth and more broadly of economic development. Advances in social science knowledge contribute both to economic and social policy reform and to institutional design. Advances in social science knowledge represents a high payoff input into economic development. This position falls squarely into the tradition of Enlightenment political philosophy. The U.S. Constitution was an early, and magnificent, example of this design perspective.

The design perspective stands in sharp contrast to the organic or evolutionary perspective. Hayek, for example, has argued that improvements in institutional performance are the result of a process of collective learning that has passed the slow test of time and are embodied in a people's language, culture and institutions. This accumulated knowledge is built into ways of learning and has a powerful impact on both the present and the future. Since collective learning occurs at the level of the community rather than the individual there are severe constraints on the rational design of policies and institutions. But there can be no presumption that the institutions that emerge out of the process of social evolution, unguided by

advances in social science knowledge, will result in efficient trajectories of cultural, social, or economic development (Hayek 1987; North 1994). Spontaneous order is not enough!

The induced institutional innovation model employed in my work embraces and challenges both the idealist and the evolutionary concept of institutional innovation. Successful and productive institutional innovations are not the result of simply taking thought independently of historical and contemporary context. Nor are they determined entirely determined by changes in resource endowments, cultural endowments or technical change.

The pattern model outlined in this paper is built on recursive relationships among changes in resource endowments, technology, institutions and culture. Successful institutional innovation will almost always be culture specific. It involves more than simply institutional (or technology) transfer. Advances in social science knowledge can open up new and productive opportunities for institutional innovations that enhance development. In the induced institutional innovation model there is no role for simple resource, technological, institutional or cultural determinism. The dialectical relationships changes in resource and cultural endowments and technical and institutional change influence the rate and direction of o social, political and economic development. And the feedback from these changes become the sources of change in resource and cultural endowments.

Finally I would like to emphasize that intellectual history conducted apart from technical and institutional history is arid, as is theoretical inquiry carried on apart from a continuing dialogue with data.

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Endnotes

[1] In this paper I draw heavily on Ruttan and Hayami (1984) and Ruttan (2001, 2003).

[2] In the economics literature on induced innovation technical and institutional change is induced by changes or differences in resource endowments and technology and in relative factor and product prices (Grubler, Nakiicenovic, and Nordhaus 2003; Ruttan 2001:100-146). This concept of induced innovation, which has informed much of my work, differs from the concept in much of the sociological literature, in which induced development is defined as "the activities of government and of national and international agencies to purposively cause development to happen" (Cernnea, 2005).

[3] There is considerable disagreement regarding the use of the term institution. A distinction is often made between the concepts of institution and organization (Hurwicz 1966). I find the broad view which includes both concepts most useful. This is consistent with the view expressed by both Commons (1950, 24) and Knight (1952, 51). This definition also encompasses the classification employed by Davis and North (1971, 8-9; and by Elster 1989, 147-58). The more inclusive definition is employed in order to be able to consider changes in the rules or conventions that govern behavior (a) within economic units such as firms and bureaucracies, (b) among economic units as in the cases of the rules that govern market relationships, and (c) between economic units and their environment, as in the case of the relationship between a firm and a regulatory agency. It includes policy, mechanism and system innovations. North's use of the term institution in his more recent work (North 1991; 1994) is similar to the use of the term culture by anthropologists (Fogel 1992) and to my use of the term "cultural endowment" (Figure 1). The distinction that I make between institutions and cultural endowments is that institutions are the formal rules and arrangements that govern behavior among and within organizations

while cultural endowments are the informal codes of behavior that influence individual and group behavior.

[4] See Runge (1981b, xv). Formal analysis of the role of institutions in providing assurance of stability in economic relationships emerged from dissatisfaction with the implications of the assumption of strict dominance of individual strategy in modern welfare economics (Sen 1967; Runge 1981a). In a less formal treatment, North argues, in a chapter on 'Ideology and the Free Rider Problem', that shared ideological and ethical perspectives provide assurance that is lacking in models built on the dominance of individual strategies (North 1981, 45-58).

[5] Edward Constant has used the term “presumptive anomaly” rather than “latent gains” to describe a perception by scientists and engineers that under some anticipated conditions advances in scientific and technical knowledge will open up the possibility if radical alternatives to conventional technology (Constant 1980: 15). It seems appropriate to extend the concept to include advances in knowledge and practice that reveal a demand for and the possibility of radical improvements in the performance of economic, social or political institutions.

[6] The role of special interest 'distributional coalitions' in slowing society's capacity to adopt new technology and reallocate resources in response to changing conditions is a central theme in Olson (1982, 74).

[7] “At a certain stage of their development, the material forces of production in society come in conflict with existing relations of production, or - what is but a legal expression for the same thing - with the property relations within which they had been at work before. From forms of development of the forces of production these relations turn into their fetters. Then comes the period of social revolution. With the change of the economic foundation the entire immense

superstructure is more or less rapidly transformed" (Marx 1913, 11-12). For a discussion of the role of technology in Marxian thought see Rosenberg (1982, 34-54).

[8] The orthodox view was expressed by Samuelson (1948, 221-22): "The auxiliary [institutional] constraints imposed upon the variables are not themselves the proper subject of welfare economics but must be taken as given." Contrast this with the statement by Schotter (1981, 61): "We view welfare economics as a study ... that ranks the system of rules which dictate social behavior." There are now five fairly well-defined 'political economy' traditions that have attempted to break out of the constraints imposed by traditional welfare economics and treat institutional change as endogenous. These include (a) the theory of property rights, (b) the theory of economic regulation, (c) the theory of interest group rent seeking, (d) the liberal-pluralist theories of government, and (e) the neo-Marxian theories of the state. In the property rights theories the government plays a relatively passive role; the economic theory of regulation focuses on the electoral process; the rent-seeking and liberal-pluralist theories concentrate on both electoral and bureaucratic choice processes; and the theory of the state attempts to incorporate electoral, legislative choice, and, bureaucratic choice processes. For a review and criticism see Rausser, Lichtenberg, and Lattimore (1982).

[9] My use of the neoclassical microeconomic approach to interpret the process of institutional change is closer in spirit to that of Hicks (1969) and to North and Thomas (1973) than to North's more recent work (North 1994). It is similar to that employed by Gary Becker in analyzing the institutions of the family (Becker 1981; 1993). An important difference is that in my work I focus on the effects of long-term changes in the external environment that must be treated as exogenous by the agents who act to bring about institutional change.

[10] Schotter (1981, 3-4) notes that in economics there have been, historically, two distinct interpretations of the sources of institutional change--"organic" and "collectivist." He identifies the organic view with the work of Hayek and the collectivist view with the work of Commons. Hayek (1978, 3-22) uses the term "constructivism" rather than collectivist. The collectivist perspective, as employed by Schotter, is similar in concept to the "designer" perspective as employed by Hurwicz (1998).

[11] Hayek was apparently referring to a statement by Karl Marx: "Men make their own history, but they do not make it as they please; they do not make it under circumstances chosen by themselves, but under circumstances directly formed, given and transmitted from the past" (Marx 1936, 15).

[12] In an earlier work Hayek argued that it was misleading to divide all phenomena into those which are "natural" and those which are "artificial." He suggests a threefold classification: (a) phenomena which are natural in the sense that they are wholly independent of human action. (b) Those unintended patterns and regularities in human society which are due to human action but not to human design. (c) Those patterns and regularities that are the deliberate product of human design. He regarded the explanation of the unintended patterns and regularities, which he termed "spontaneous order," as the proper task of social theory. He was, and remained, skeptical of constructivism because of the inability of social theory to anticipate unintended consequences (Hayek 1967: 96-105).

[13] There has been a continuing debate among students of English agricultural history about whether the higher rents that landowners received after enclosure was (a) because enclosed farming was more efficient than open field farming, or (b) because enclosures redistributed

income from farmers to landowners. See Chambers and Mingay (1966), Dahlman (1980), and Allen (1982).

[14] Timur Kuran (1997.1998, 2000a, 2000b) has raised a series of question about why in the Islamic world traditional commercial institutions have been so slow to evolve into institutions capable of mobilizing large-scale resources for commercial and industrial development. He also explores the failure of traditional "pious foundations" (*waq)* to evolve into institutions of local governance or along the lines of the social institutions of the modern welfare state.

[15] For additional case studies using the framework employed in this paper see Feeney (1988).

[16] Although the passage and implementation of the Land Reform Code of 1963 was exogenous to the economy of the village, the land reform of the 1960s has been interpreted as the result of efforts by an emerging industrial elite to simultaneously break the political power of the more conservative land-owning elite and to provide incentives to peasant producers to respond to the rapid growth in demand for marketable surpluses of wage goods, primarily rice and maize, needed to sustain rapid urban industrial development. Thus, the Land Reform Code can be viewed as an institutional innovation designed to facilitate realization of the opportunities for economic growth that could be realized through rapid urban industrial development. See Ruttan (1969).

[17] Real wages for agricultural labor declined significantly between the mid-1950s and the mid-1960s in the Philippines. See Khan (1977). Thus, while we cannot be certain that the labor market was in equilibrium in the 1950s, it is clear that the degree of disequilibrium widened, as a result of both higher yields and lower wage rates, prior to the introduction and diffusion of the gamma system.

[18] A second round of technical and institutional changes occurred in the 1990's. Non-farm employment opportunities expanded as a result of better transport to the metropolitan Manila area and the location of a small metal craft firm in the village. Higher wage rates have induced the substitution of small portable threshing machines for manual rice threshing. The labor share for harvesting has declined and a new form of labor contract, referred to as *new hunusan* has emerged. As a result of the new non-farm employment opportunities the incomes of landless labor households have risen (Hayami and Kikuchi 2000).

[19] Demsetz (1964) has pointed out that the relative costs of using market and political institutions is rarely given explicit consideration in the literature on market failure. An appropriate way of interpreting the 'public goods' vs. 'private goods' issue is to ask whether the costs of providing a market are too high relative to the cost of non-market alternatives. A similar point is made by Hurwicz (1972).

[20] See, for example, Frohlich, Oppenheimer, and Young (1971). For a review and extension of concepts of political entrepreneurship see Guttman (1982).

[21] I do not, in this paper or in my book, *Social Science Knowledge and Economic Development* (Ruttan 2003), attempt to advance or draw on formal models of trial and error or unintended consequences as a source of institutional change. Nelson and Winter have advanced a theory of technical change based on random evolutionary processes (Nelson and Winter 1982).

[22] This section draws heavily on Ruttan (2001: 511-516). For a retrospective perspective on the use of tradable permits see Tietenberg (2002).

[23] Fusfeld used the terms 'pattern' or 'Gestalt' model to describe a form of analysis that links the elements of a general pattern together by logical connections. The recursive multi-causal relationships of the pattern model imply that the model is always 'open'--'it can never include all

of the relevant variables and relationships necessary for a full understanding of the phenomenon under investigation' (Fusfeld 1980, 33). Ostrom uses the term *framework* rather than *pattern model*. "The framework for analyzing problems of institutional choice illustrates the complex configuration of variables when individuals ... attempt to fashion rules to improve their individual and joint outcomes. The reason for presenting this complex array of variables as a framework rather than a model is precisely because one cannot encompass the degree of complexity within a single model" (Ostrom 1990, 214).

[24] In economics the concept of cultural endowments has traditionally subsumed under the concept of 'tastes' which are regarded as 'given'--that is, not subject to economic analysis (Stigler and Becker 1977; Jones 1995; Ruttan 2003: 33-67). I use the term *cultural endowments* to capture those dimensions of culture that have been transmitted from the past. Contemporary changes in institutions, for example, can be expected to "harden" into the next generation's cultural endowments.

[25] Induced innovation theory should be viewed as a diagnostic tool. Accurate prediction is not an appropriate test of the theory. If, for example, an increase in population pressure against land resources fails to induce the expected innovation in property rights institutions the appropriate response is to augment the model. Thus in my own work I employ induce innovation theory not to predict the effects of changes in resource endowments, technology, institutions and culture but rather as a guide to a "dialogue with data."

[26] A major limitation of the Marxian model is the emphatic rejection of a causal link between demographic change and technical and institutional change (North 1981, 60-61). This blindness to the role of demographic factors, and to the impact of relative resource endowments, originated in the debates between Marx and Malthus. An attempt to correct this deficiency represents the

major innovation of the 'cultural materialism' school of anthropology. See Harris (1979; Chapter 2).

[27] See North and Thomas (1970, 1-17a; 1973). For a critical perspective on the North-Thomas model see Field (1981). Field is critical of North and Thomas for treating institutional change as endogenous.

[28] For a dramatic example see Eggertsson (1996). Eggertsson poses the question of why Iceland, until well into the 19th century, neglected to exploit its rich offshore fishing resources. His answer was that the country was stuck in "a pernicious equilibrium trap that had an external and internal component. The internal component was related to the economic self-interest of landlords and farmers who feared that the development of high productivity fisheries would weaken the institutions that tied labor to the land…The external element was the policy of the Danish Crown of isolating the country from foreign trade and taxing Icelanders by selling monopoly rights to trade with Iceland" (Eggertsson 1996: 21). These institutional constraints were broken only after a subsistence crisis in the latter 18th and early 19th centuries.

[29] Weber's thesis has also been criticized for not attempting to explain the social forces that led to the Protestant Reformation. The assertion by Douglas (1986, 36) that "Religion does not explain. Religion has to be explained" is at least half correct. Thus at a deeper level it may be possible to explain the emergence of Protestantism in terms of the economic changes associated with late medieval urban development or even the early financial reforms of the Catholic church (Harsanyi 1960, 143; Lal 1998).

[30] The issue of whether adherence to the extreme methodological individualism implied by Coleman's stipulation is necessary to understand social behavior is a source of continuing debate in the social sciences. One response is to argue that, while desirable, it imposes a demand on

social science research that cannot be met in practice. But even if it could be met would it be sufficient? The answer to this question appears to be negative. Variables that are not attached exclusively to individuals, such as culture and technology, are essential to efforts to understand the behavior of economic systems and, more broadly, of social systems (Arrow 1994; Satz and Ferejohn 1994).

[31] For a criticism and assessment of that strategy see the papers assembled in Koppel (1995). For a more positive assessment see Runge (1999). One of the reasons why explanations of institutional change in terms of changes in economic forces has been productive is that the economic system is one of the main channels through which exogenous changes or differences in natural environments act upon the social system (Harsanyi 1960, 141).