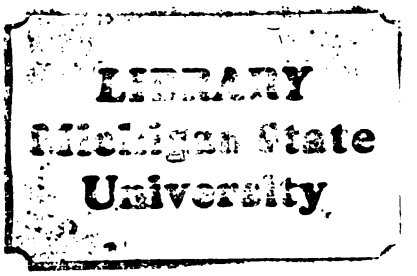

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THE ROLE OF NONMONETARY VALUES IN INDUCED INSTITUTIONAL INNOVATION: THE CASE OF THE STATE AGRICULTURAL EXPERIMENT STATIONS

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David Brian Schweikhardt

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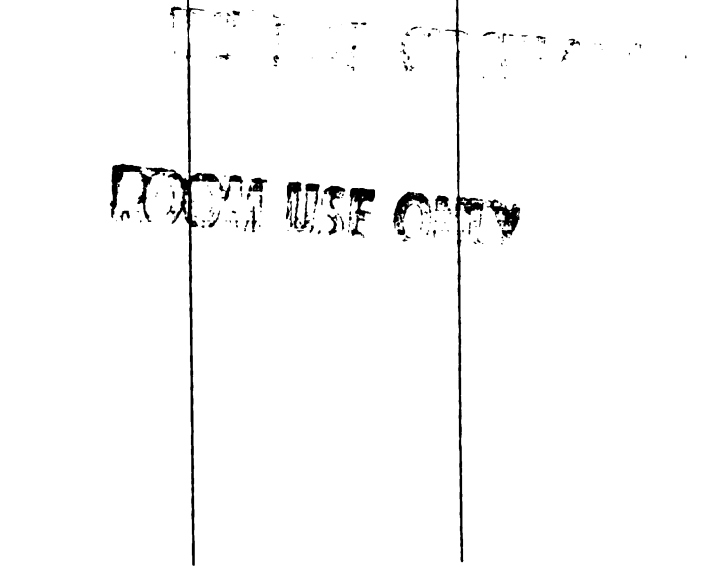

THE ROLE OF NONMONETARY VALUES IN INDUCED INSTITUTIONAL INNOVATION: THE CASE OF THE STATE AGRICULTURAL EXPERIMENT STATIONS

By

David Brian Schweikhardt

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ABSTRACT

THE ROLE OF NONMONETARY VALUES IN INDUCED INSTITUTIONAL INNOVATION: THE CASE OF THE STATE AGRICULTURAL EXPERIMENT STATIONS

By

David Brian Schweikhardt

Students of economic development must be concerned with technical and institutional innovations that create and distribute new income streams. Public sector institutional innovations are produced by prescriptive policy decisions. Such decisions are a function of positive and normative knowledge. This thesis examines the role of normative values in the decisions that created the state agricultural experiment stations in the United States.

A conceptual framework is developed to assess nonmonetary values in political decisions. The farm economy and the land-grant system from 1870 to 1914 are examined and the values embedded in the institutional form chosen by the Hatch Act of 1887 and Smith-Lever Act of 1914 are identified.

The results demonstrate that the decentralized U.S. system of agricultural research is the product of a compromise between the values of scientists (regarding scientific freedom), legislators (regarding decentralized government), and farmers (regarding practical research). This institutional form has enhanced the system's capacity to improve agricultural productivity.

ACKNOWLEDGMENTS

A number of other names belong on the cover of this work as much as the author's. Jim Bonnen's advice on the selection and conduct of this research are responsible for much of its value. Any graduate student who has worked with Dr. Bonnen knows that the following quote, written about a nineteenth century agricultural educator and discovered in the process of this research, describes precisely his contribution to his students' work:

> His patience in listening to our crude papers and in flooding with light our ignorant discussions was heroic, not to say fairly sublime; while his delicacy and tact in concealing our imperfections from ourselves and stimulating us to higher attainments were as beautiful as they were helpful (186, p. 17).

Julia McKay, Sherry Rich, and Cindy Spiegel typed the original draft with remarkable speed and accuracy. Judy Brown, Glenn Johnson, Larry Libby, Wayne Rasmussen, and Warren Samuels made numerous comments that improved the final product. The Michigan Agricultural Experiment Station provided generous financial support. Among graduate students, John and Leslie Ross have been my intellectual and philosophical brother and sister, and I am grateful for their friendship.

Finally, the author owes his greatest debt to his parents, Richard and Emma Schweikhardt. Through personal example, they have proven that there need never be a shortage of honesty, hard work, and courage, so long as one is willing to pay the equilibrium price.

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CHAPTER I

INTRODUCTION

"Individualities may form communities, but it is institutions alone that can create a nation."

Benjamin Disraeli (155, p. 318)

Problem Setting

Perhaps it is more accurate to say that it is changes in institutions that develop a nation. National economies are developed, in part, through changes in institutional arrangements. The development of American agriculture from a subsistence to an industrial level has been facilitated by a system of development institutions that channeled the forces of invention and adoption toward the industry of agriculture.

The state agricultural experiment stations have been an integral part of this system of development institutions. The experiment stations are unique in that they combine (1) public financing for research that could not be supported by private interests, (2) an emphasis on applied research, (3) cooperation between the research of the stations and the education and extension branches of the land-grant system, and (4) a geographically and administratively decentralized system that has concentrated on the research needs of farmers facing a wide spectrum of ecological conditions.

In retrospect, the choice of such a system appears quite logical. There were, however, several institutional forms that could have been chosen and none of them appeared intrinsically superior to all others. Any decision to build an institution involves a choice among prescriptions--statements of what ought to be done to achieve society's goals. Such decisions depend on both positive and normative knowledge. Thus, as society chooses among prescriptions in the public policy decision process, it is selecting the normative values that undergird the new institution. In this manner, some values are legitimized by being fulfilled, while others are subordinated.

The creation of the state agricultural experiment stations was such a policy decision. Different prescriptions, based primarily on different sets of values, were offered. This thesis examines the public policy decisions that created the state agricultural experiment stations and, in particular, the role that nonmonetary values played in the institutional form chosen.

To determine the role of nonmonetary values in the creation of these institutions, the Hatch Act of 1887 and the Smith-Lever Act of 1914 will be examined in detail. The Hatch Act was the organic legislation that established the experiment stations. However, early development of the stations was not completed until the Smith-Lever Act drew a boundary between research and extension work, thereby allowing the stations to specialize in the development of agricultural science. In order to understand the origin of the institution now recognized as the agricultural experiment station, both acts must be considered.

The Theory of Induced Innovation

To understand the theory of induced innovation, one must understand Ruttan's definition of institutional innovation as a change "(1) in the behavior of a particular organization, (2) in the relationship between such an organization and its environment, or (3) in the rules that govern behavior and relationships in an organization's environment" (29, p. 329). Ruttan's theory is lengthy, but worth repeating here. Technical and institutional change, he argues, "are highly interdependent and therefore must be analyzed within a context of continuing interaction." Furthermore,

> the sources of demand for technical and institutional change are very similar. A rise in the price of land (or natural resources) in relation to the price of labor induces technical changes designed to release the constraints on production that result from the inelastic supply of land and, at the same time, induces institutional changes that lead to greater precision in the definition and allocation of property rights in land . . . .
>
> Shifts in the supply of technical and institutional change are generated by similar forces. Advances in knowledge in science and technology reduce the cost of the new income streams that are generated by technical change. Advances in knowledge in the social sciences and related professions reduce the cost of new income streams that are generated by gains in institutional efficiency, including improved skills in conflict resolution (29, pp. 334-41).

To summarize, the induced innovation theory holds that changes in relative factor prices will result in research efforts that will produce changes in technical (social science) knowledge. Such new knowledge will generate potential new income streams and will shift the demand for (supply of) institutional change to the right. These changes in institutional arrangements will redistribute the new income streams among factors of production, resulting in a new round of changes in relative

prices and further technical and social science research. Simply put, technical and institutional change result from an iterative and interactive process, driven by changing market values.

The theoretical development and empirical verification of the induced innovation theory have been a substantial contribution to economists' understanding of the development of economies (73, pp. 52-62, 122-135). However, while the induced innovation theory recognizes that political decisions determine the institutional arrangement selected, relatively little work has been done on the political decisions that produce institutional innovations (29, pp. 345-46; 135, p. 112). This thesis attempts to contribute to the theory of induced institutional innovation by examining the political process of institutional innovation and, in particular, the role of nonmonetary values in institutional innovation.

A failure to consider nonmonetary values would imply that an "invisible hand," free of all nonmonetary values, will somehow guide the process of institutional change and the redistribution of income streams. Instead, it is the contention of this thesis that, while changing monetary values may drive an economy to the point where an institutional innovation is needed (i.e., potentially profitable), nonmonetary values help determine the form of the institution and, ultimately, the performance of the institution at creating and distributing future income streams.

Historical Significance of the Establishment of Experiment Stations

The American land-grant system of agricultural education, research, and extension is a unique experiment in institutional innovation. Indeed,

the system seems so logical to the modern-day observer that its simplicity is deceiving. Embodied in the system's design, however, are choices among nonmonetary values (and thus organizational forms) which shaped the land-grant system and determined the system's ability to serve agriculture and society. This thesis examines systematically the nonmonetary values expressed in the decisions that created the research dimension of the land-grant system, the state agricultural experiment stations.

The agricultural college was a bold idea; that farmers and laborers should be educated in nonclassical areas was a radical notion. A clash of values occurred. Many at the time believed higher education was a religious and private responsibility. The idea that agriculture could be scientifically taught was met by disbelief, even by the farmers it was intended to benefit.

The decision to add the research side of the land-grant system was shaped by another clash of values. Some scientists, in search of the resources and freedom to pursue science, advocated independent experiment stations similar to those in Europe. The deans and presidents of the land-grant colleges, seeking to provide practical research results to their farm constituency and not wishing to see a competing institution created, sought these resources for the colleges. Questions arose about the relationship between the federal and state governments in funding and supervising research. Values about the appropriate relations of different levels of government played a significant role in the institutional form chosen.

The addition of the extension service completed the early development of the land-grant system. Again, nonmonetary values affected the

outcome of the final decision. Scientists, wanting to devote full time to research, sought to lighten their work load by shifting adult education to a full-time extension staff. University administrators, wishing to strengthen the colleges' ability to deliver practical results to a growing farm constituency and fearing an independent extension service would threaten the financial support of the colleges and stations, sought to bring the extension service under the control of the universities. As with the Hatch Act, conflicts arose over the proper relations between the federal and state levels of government.

The creation of the experiment stations was of historical significance for another reason. The Hatch Act expanded the range of state and federal relations, as explained by Director E. W. Allen at the semicentennial of the Connecticut experiment station:

> This nation-wide subsidizing of research in agriculture was evidence of change which had come in the conception of the relationship of the Federal Government and the states. It was a recognition of a joint responsibility in developing the industry of agriculture on a high stage of effiency, and it was a new expression of what the general Government may do under the Constitution for the promotion of public welfare (158, p. 130).

It is important to note, in this regard, the difference between the Morrill Act of 1862, which established the colleges of agriculture, and the Hatch Act of 1887, which established the experiment stations. Being a one-time grant, the Morrill Act shifted control of the colleges to the states once the grant was made. However, since the Hatch funds were appropriated annually, federal control of the money was possible. As J. W. Holcombe, chief clerk of the Bureau of Education, observed in 1892:

> A great and radical step beyond previous legislation must be recognized here. The land-grant of 1862 amounted to an absolute gift. If the institutions established did not teach agriculture or military tactics (and some of them

> did not do so for years) the President and his Cabinet and the entire judiciary of the United States might whistle to the wind for redress. But this last act establishes, to put it plainly, federal control and supervision over the use of the fund created. If any dangers, therefore, lurk in the possibility of Federal interference and Federal dictation, the beneficiaries of this last Congressional grant are liable thereto . . . . The cordial acceptance of such a measure by the legislatures indicates that there is no real danger from Federal interference and that jealousy of the Federal power on that score has disappeared (7, p. 114).

Finally, the relevance of this thesis to the land-grant colleges today should be explained. First, it is useful in helping restore some of the institutional memory of the land-grant system. Without a memory--an awareness of an institution's past and the values embodied in that past--administrators are unlikely to preserve those values, many which appear to have served the system and society quite well. Second, as mentioned earlier, the land-grant system, and the experiment station in particular, contributed to the transformation of the United States from an agrarian to an industrialized, urban society. Having done so, it is an obvious fact of life that these agrarian institutions now exist in a society with different values. Recognizing this, it is essential to understand the values embodied in these institutions and how they conflict with newly emerging values.

Research Objectives and Thesis Organization

The intent of this thesis is to examine the nonmonetary values expressed by the decision makers--farmers, legislators, scientists, college administrators, and the media--during the creation of the agricultural experiment stations. An examination of these values, and the relative power of the groups that expressed them, should improve our

understanding of their impact on the design and the intended as well as actual performance of the land-grant system.

In general, this work addresses the question, Do nonmonetary values matter in the process of institutional innovation? More specifically, the objectives of this research are:

(1) To develop a conceptual framework for understanding the role of nonmonetary values in public policy decisions;

(2) To review the history of the farm economy and the land-grant system from 1870 to 1914;

(3) To identify the major nonmonetary values expressed during the political decisions establishing the state agricultural experiment stations, namely, the Hatch Act of 1887 and the Smith-Lever Act of 1914;

(4) To apply the framework developed in (1) to information discussed in (2) and (3) in order to understand the role of nonmonetary values in the decisions that established the state agricultural experiment stations;

(5) To draw conclusions about the role of nonmonetary values in institutional innovations, the effectiveness of the conceptual framework, further research that is needed, and the importance of the findings of this research for the future of the agricultural experiment stations.

This thesis is organized around these objectives. Chapter II develops a conceptual framework from literature in industrial organization theory, decision theory, political science, and public choice economics. Chapter III examines the history of the farm economy and the land-grant system from 1870 to 1914. Chapter IV identifies the major

nonmonetary values expressed during the decisions establishing the experiment stations. Chapter V applies the framework developed in Chapter II to the information in the two preceding chapters. Chapter VI draws conclusions from the findings, relates these conclusions to the theory of induced innovation, and comments on the importance of these findings for the future of the agricultural experiment stations.

CHAPTER II

CONCEPTUAL FRAMEWORK

Institutional innovations are the product of political decisions. Policy decisions are choices made among proposed prescriptions regarding what ought to be done to solve a problem. This chapter develops a conceptual framework for analyzing such public policy decisions and, in particular, for allowing a more explicit accounting of the role of nonmonetary values in the political decision process.

The skelatal configuration of the framework is borrowed from the structure-conduct-performance paradigm of industrial organization theory. However, "decision" is substituted for "conduct" since the emphasis here is on political decision making, which usually involves discrete, one-time decisions; conduct usually implies a type of behavior that persists over time and may involve a series of decisions. Within this configuration, the framework borrows from the theories of institutional economics, political science, and decision making. The next three sections of this chapter develop the structure, decision, and performance elements of the framework. The final section restates the framework in general terms.

Structure

Introduction

Structure is defined in this framework as the interacting set of decision-making institutions and their environment. Although the word institution may have several meanings, the emphasis here is on institutions as decision-making organizations. Each institution can, therefore, be described in terms of the characteristics that affect its decisions--its objectives, resources, sources of power, and means of preference articulation.

Institutional Characteristics

Figure 1 shows the four characteristics that determine the role of each institution in the decision process and the resources available to carry out that role. These characteristics define who is represented in the institution, the resources the institution controls, and the means the institution has for expressing preferences in the decision process.

Institutional Objectives: Institutions are decision-making organizations. The objectives of each institution are those ends to which effort is directed. While individuals in an institution may have personal aims, their membership in the institution implies some agreement on the objectives of the institution, or as Simon puts it, "The organization objective is, indirectly, a personal objective of all the participants. It is the means whereby their organizational activity is bound together to achieve a satisfaction of their own diverse personal motives" (148, p. 17).

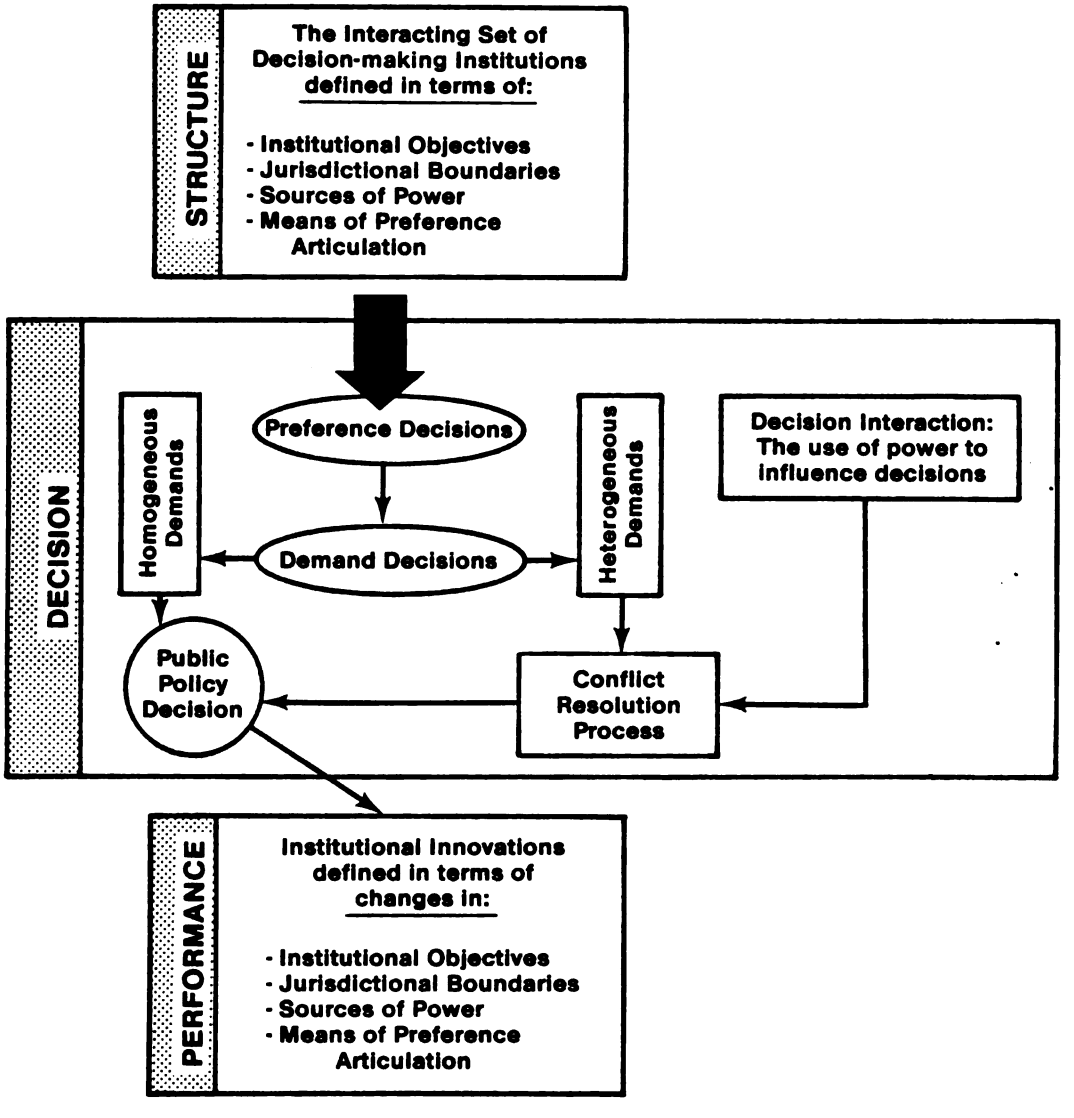

Figure 1

Schematic Presentation of the Concceptual Framework

Presthus has divided this diversity of motives into manifest or official objectives and latent or unofficial objectives. According to his example, the manifest objective of the firm is to produce and sell goods at a profit. The latent objectives include the aspirations of all members of the firm for security, recognition, and self-realization.

This diversity of objectives may lead to conflicts. As Presthus puts it, "Such latent goals and the methods used to gain them are often regarded as aberrations. They seem to subvert organizational ends." However, an assumption in this analysis, as in Presthus', is "not only that such [latent] aspirations and methods are legitimate, but that they often help the organization achieve its manifest goals" (121, p. 4). That is, the aspiration of the individual for security will lead him to perform certain tasks that will contribute to the profit-making objective of the firm.

Jurisdictional Boundaries: A second institutional characteristic is the set of jurisdictional boundaries that define the responsibilities and rights within the control of the institution. Jurisdictional boundaries may refer, of course, to geographic areas, but, more importantly, they refer to the delineation of authority over resources and responsibilities within that area (145, p. 7). As such, boundaries may overlap. Schmid and Shaffer outline at least eight overlapping sets of boundaries involved in the execution of U.S. education policy (145, p. 8). Four factors determine the width of jurisdictional boundaries:

(1) Sense of community--defined as an individual's sense of belonging to a certain institution;

(2) Existence of external effects--defined as the existence of costs or benefits that may be negligibly relevant to decision makers;

(3) Homogeneity of preferences--defined as agreement on the goodness or badness of situations, conditions, or things;

(4) Economies of scale--defined as changes in per unit cost of production or decision making that result from different jurisdictional boundaries (145, p. 8).

Sense of community has two dimensions: who is included in the institution and the character of their commitment to others (145, p. 12). These two dimensions are partly determined, of course, by geographic boundaries. More importantly, they are determined by learned values, shared interests and backgrounds, past experiences and associations, and, quite simply, benevolence toward others. It is, as Robinson wrote, "the greatest of all moral questions, 'Who is my neighbor?'" (128, p. 127). As a general rule, the more widespread the sense of community, the broader will be jurisdictional boundaries.

Every transaction involves effects, i.e., costs and benefits. Some effects are internal, or taken into account by decision makers. Others are external, or ignored by decision makers. When costs are ignored, a greater quantity of good or service will be produced and consumed than would be if decision makers accepted responsibility for all the costs created. Conversely, if benefits are ignored, a smaller quantity will be produced and consumed (107, p. 106). The more pervasive are externalities, the broader jurisdictional boundaries must be to internalize external effects.

Some similarity of preferences is required for any institution to exist. As Ostrom discovered, the quality of police service provided was determined partially by the homogeneity of the community as measured by such indicators as race, religion, income, and home ownership patterns. These factors led to agreement on normative values and, therefore, similarity in the quality of police services demanded (11?, p. 6). The more homogeneous are the preferences of individuals, the broader the jurisdictional boundaries of an institution may be drawn.

Average production costs vary with the quantity produced. The cost curves (average variable or average total) of microeconomic theory show that, as additional units are produced, per unit costs decline up to some point, then begin to increase. The phenomena of economies and diseconomies of scale (i.e., changes in average costs) can be a determinant of institutional boundaries.

Economies and diseconomies of scale can be attributed to several sources. Economies may derive from the spreading of constant fixed costs over a greater number of units of output. Economies (diseconomies) may also arise when a decrease (increase) in the demand for an industry's inputs decreases (increases) the cost for an individual producer. Finally, economies or diseconomies may result from the law of diminishing returns. If one or more inputs are held constant, increasing amounts of some variable input may produce increasing marginal quantities of output over some range of variable input (economies of scale), but will eventually yield diminishing marginal units of output. The existence of diminishing marginal returns implies that marginal and, therefore, average costs must ultimately rise (diseconomies of scale).

When considering economies of scale, it is necessary to include decision costs in the calculation of costs. A strict engineering study may imply that significant economies of scale exist. However, with the inclusion of decision-making costs, which are likely to increase with an increasing number of persons involved, diseconomies of scale may appear at an earlier point.

Sources and Uses of Power: Power is the ability to execute one's own decisions and influence the decisions of others. Johnson has identified seven sources of power:

(1) Market power--control over relative prices of goods and services;

(2) Political power--control over political rights and privileges;

(3) Military power--control over armed forces;

(4) Social power--control over the security or sense of belonging or others;

(5) Religious power--control over the moral values of oneself and others;

(6) Police power--control over persons and property in the interest of the general security, health, safety, and welfare;

(7) Knowledge power--control over information (89).

Power has two primary uses. Johnson identifies one use as the substitution of other kinds of power for knowledge in the decision process (88, pp. 12-13). Decision makers function in an uncertain world where knowledge is costly to assemble and analyze. Given the uncertainty of

information, decision makers may use power as the basis of decisions rather than knowledge.

Bartlett identifies a similar use of power, the provision of subsidized information to decision makers (24, pp. 32-142). All decision makers require costly information to function. Much of this information, provided by other decision makers, takes the form of subsidized knowledge purported to show the consequences of various opportunities. The unequal distribution of power needed to produce and disseminate costly information suggests that power influences decision makers and is an important characteristic of the institutional structure of society.

Means of Preference Articulation: Preferences are the goodness or badness of situations, conditions, or things. Institutions have two forums in which to express their preferences: the economic marketplace and the political arena. When an undesirable condition exists, a decision-making institution has two options for expressing a preferred condition. It may escape the condition via the exit option or petition for a change of the condition via the voice option.

Exercising the exit option involves the refusal to interact with another party (such as the dissatisfied consumer refusing to patronize a certain firm). Such a refusal transmits information of the dissatisfaction from the refusing to the refused party (in the form of diminished revenues for the firm). The refused party, sensing the dissatisfaction with existing conditions, may take actions to improve conditions (such as improving the quality of their goods) (80, pp. 21-29).

The use of voice is an attempt to improve undesirable conditions by petitioning another party with the intent of forcing a change. The

information transmitted by the use of voice and the consequences of failing to correct the unsatisfactory condition become an information input for the recipient (80, pp. 30-43).

The intent at the conceptual level is to provide a set of descriptive characteristics that will aid in assessing the effectiveness of alternative means of preference articulation. These characteristics include:

(1) Barriers to exit--the presence of a barrier to exit (such as a monopolist that effectively prevents use of the exit option) makes voice a more viable option;

(2) Information level of parties--a mix of alert, informed parties (who will use a voice option) and inert, uninformed parties (who will temporarily accept the unsatisfactory condition) will give the recipient an opportunity to respond and make voice more effective;

(3) Existence of loyalty--a special attachment to others that convinces individuals to stay and correct the condition will make voice more effective (80, pp. 76-105);

(4) Existence of political entrepreneurs--existence of Salisbury's political entrepreneurs that invest in organizing interest groups make voice more effective (136, pp. 32-67);

(5) Responsiveness of the receipient to information--lags in interpreting information, specialization of assets or production processes, and external sources of dissatisfaction (the cause of the dissatisfaction is beyond the control of the recipient) may reduce the effectiveness of

> both exit and voice since these conditions may prevent the recipient from correcting the unsatisfactory condition.

The means of preference articulation provide the link between the structure and decision components of the conceptual framework. By providing the conduit through which preferences may be expressed, they bring institutions to interact in the decision process.

To summarize, society is structured as an interacting set of decision-making institutions. Each institution can be described in terms of its characteristics. The characteristics define each institution's objectives; resources, power, and means of expressing preferences in the decision process. These characteristics determine which institutions will be involved in the decision process, the preferences each will express in the process, and the ability of each to sacrifice in order to assure a favorable outcome to the process.

Decision

Introduction

A sometimes unpleasant fact of life is that decisions must be made; unpleasant because making decisions, particularly political decisions, may mean someone's demand must be denied in order that another's may be satisfied. The decision-making process is the scheme used to determine whose demands are satisfied and whose denied.

Decision making is defined here as the process of narrowing down a set of opportunities to that one which will be acted out (148, p. 4).

The political decision process involves the observation and analysis of information to determine the possible existence of a condition that is undesirable, decision on preferences (the goodness or badness of situations, conditions, or things), expression of a demand (a prescription of what ought to be done) and, when demands are incompatible, resolution of conflicts.

The Decision Process

As outlined by Cahill and Goldstein, the decision process occurs in three phases: the preference decision phase, the demand decision phase, and the conflict resolution phase (40, pp. 359-82).

The Preference Decision Phase: The first phase of the decision process involves the assessment of preferences by each decision-making institution. Preferences are normative knowledge describing the goodness or badness of situations, conditions, or things. Preferences, or value assessments, may be expressed in monetary or nonmonetary terms. Monetary values include product prices, input costs, income, and other variables that can be expressed in terms of a unit of currency. Nonmonetary values are assessments of goodness or badness expressed in terms other than units of currency.

Normative knowledge should not be confused with prescriptive knowledge. Normative knowledge defines the goodness or badness of situations, conditions, and things; prescriptive knowledge defines the rightness or wrongness of what ought or ought not to be done. It should be mentioned that, as Lewis discussed, it is not always right to take an action that leads to good consequences; nor is it always wrong to take an action that

leads to bad consequences (102, pp. 58-77). For instance, although a profit-maximizing firm may take an action that produces a profit (a good condition), it has taken the wrong action if it could have achieved a greater profit using the same resources. On the other hand, although it may be bad to inject a drug into one's body, it is the right action if it prevents a disease which is worse. It should be clear, therefore, that normative knowledge deals with goodness and badness. Prescriptive knowledge deals with what ought or ought not to be done.

Preferences, expressed as both monetary and nonmonetary values, provide an assessment of the consequences of each opportunity considered in the decision process. This knowledge is an input to the demand decision phase.

The Demand Decision Phase: In the second phase of the decision-making process, each institution arrives at a demand or a statement of what ought to be done. Arriving at a demand decision involves choosing among alternative opportunities under conditions of uncertainty.

The decision maker is aided in this task by an ability to anticipate the consequences of each opportunity. He is also assisted in this process by an ability to develop probabilities of each potential consequence. Given the predicted consequences, the decision rule establishes a criterion for selecting one opportunity, i.e., a prescription of what ought to be done. To simplify, decisions are determined by the interaction of knowledge, probabilities, and a decision rule within an opportunity set.

The opportunity set is the specific combination of alternatives taken into account in the course of arriving at a decision (40, p. 367). Before a demand can be expressed, it must first come into the opportunity

set of the decision maker. Not all decision makers will have the same opportunity set since uncertainty, jurisdictional boundaries, distributions of power (including knowledge), and moral, legal, and technological constraints may limit the opportunity sets of some decision makers.

Decision makers deal with two kinds of knowledge. Positive knowledge, as defined by Johnson and used here, is "knowledge which purports to deal with the characteristics of conditions, situations, and things other than goodness or badness" (88, p. 4). Normative knowledge, on the other hand, "deals with the goodness and badness per se of conditions, situations, and things" (88, p. 5). Both positive and normative knowledge are necessary for decision making. Positive knowledge may rule out some opportunities as incorrect since they will not solve the problem at hand (the chemist wishing to produce sugar quickly rules out the opportunity of combining sodium and chlorine). Normative knowledge assigns measures of goodness and badness to the consequences of each opportunity. Without normative knowledge, the decision maker cannot determine which opportunity will best achieve the desired objective. Thus, demands are prescriptive statements of what out to be done and, as such, cannot be judged to be only positive or normative (88, p. 5).

Part of the knowledge the decision maker must consider is his ability and willingness to sacrifice in order to fulfill his demand. Ability to sacrifice, or ability to pay in Shaffer's terminology (144, p. 5), may limit the decision maker's opportunity set by preventing him from choosing some opportunities. Similarly, when the demands of decision makers conflict, one decision maker's demand may be frustrated by another willing to sacrifice more to have a conflicting demand fulfilled.

The decision rule establishes a criterion for choosing among a set of opportunities. In neoclassical theory, for instance, economic institutions (firms or households) subtract bad from good and maximize the difference (profit or utility). Other possibilities might be a rule that minimizes a bad condition or a satisficing rule that provides some minimum satisfactory level of the difference between good and bad. Regardless of the rule used, the process is identical. The decision maker processes positive and normative knowledge through the decision rule to arrive at a prescription of what ought to be done, in this case, a demand.

To summarize, demand decisions, or statements of what ought to be done, are reached by the interaction of knowledge, probabilities, and a decision rule within the decision maker's opportunity set. Opportunity sets are determined by positive and normative knowledge. The decision-making institution determines the expected consequences of each opportunity and processes this information through a decision rule to arrive at a demand decision. If demands are unanimous, or homogeneous across all decision makers, the decision becomes binding on all parties by consensus. If, on the other hand, demands are heterogenous, a conflict is created and a conflict resolution process must be enacted.

The Conflict Resolution Phase: Conflicts arise because reasonable people disagree. Rarely are the demands of interdependent parties perfectly coordinated. Boulding's definition of conflict is used here. In his work, conflict is "a situation of competition in which the parties are aware of the incompatibility of potential future positions and in

which each party wishes to occupy a position that is incompatible with the wishes of others" (34, p. 5).

It is important to realize, as Deutsch points out, that conflicts can arise despite common objectives. It is completely reasonable to expect conflicts to arise over different prescriptions (means) intended to meet the same objective (end) (55, pp. 1076-92). When conflicts arise, certain agreed upon procedures are used for resolving them. Briefly, these procedures determine which conflicts will be decided, what agreements (coalitions) must be made for resolving the conflict, and what voting rules will be used to make the resolution binding on the group.

At any point in time, a nearly infinite number of conflicts can require attention. The limitations of the human mind prevent all conflicts from being resolved at once; the list of conflicts to be resolved must be organized in some manner to lend order to the resolution process. Determination of this list is the agenda-setting stage of the conflict resolution phase.

Control of the agenda determines which issues will be presented for consideration and which alternatives will be considered for resolving the conflict. By preventing consideration of some issues and solutions, or by controlling the combination of alternatives necessary to build a ruling coalition, those who control the agenda can control the outcome of the decision process. This is not a condemnation of the controllers of the agenda. As Paarlberg has pointed out, the question is never will there be control of the agenda, but always who will control the agenda: "There is an almost infinite number of . . . issues and they cannot all be addressed. The alternative to an . . . agenda would be chaos" (118, p. 158).

Once the agenda has been set, participants must assess the demands expressed in the demand decision phase. The demand-assessment stage involves assessing two dimensions of demand--the compatibility of demands and the willingness to sacrifice of the demanding institution.

Compatible demands exist when parties agree on what ought to be done. Rarely, of course, will all parties agree on the proper prescription. Thus, decision makers must make an assessment among the various proposals to determine which are most and least compatible with their own demands. This information will be critical in building a ruling coalition.

The willingness of others to sacrifice may be difficult to judge. However, the decision maker may use some rough measures for determining others' willingness to sacrifice, including displays of willingness in past conflicts and the sources of power available to each party expressing a demand.

Completion of demand assessment leads to the coalition-building stage. Riker defines a coalition as

> some part of the authority-possessing group [which] comes together in alliance to render a decision binding on the group as a whole and on all who recognize its authority. This decisive 'part' may be more or less than one-half, indeed it may be two persons or the whole group itself. But regardless of the persons conventionally believed to be decisive, the process of reaching a decision in a group is a process of forming a subgroup which, by the rules accepted by all members, can decide for the whole group. This subgroup is a coalition (126, p. 12).

Coalitions are based on the information gained at the demand-assessment stage. By determining the compatibility of demands, decision makers can decide which opportunity will provide a ruling coalition. By determining the willingness of others to sacrifice to satisfy their demands, decision

makers can assess the costs that must be paid if one demand is to be fulfilled rather than another.

Once various coalitions are aligned, the voting stage begins. By combining voting rules (or interinstitutional decision-making rules) with agenda control, a taxonomy of probable decision outcomes can be developed.

Voting is costly. Time and money is required to assemble and analyze information and reach agreements. Decisions also impose external effects on third parties. As more parties become involved in the voting process, they will attempt to protect themselves by internalizing previously external effects. Therefore, as the group approaches a unanimous voting rule, the marginal cost of reaching agreements increases dramatically since no voter will approve a decision that imposes costs on himself that are greater than the benefits he receives. Thus, when a unanimous voting rule prevails, a ruling coalition will be difficult to build and a continuation of the status-quo will likely result. The high cost of unanimous consent will likely prevent any decision changing the status-quo (37, pp. 43-96).

Less-than-unanimous voting rules favor the demands of those who control the agenda. As Paarlberg points out, control of the agenda "operates by putting on the agenda those undertakings which [the controllers] consider desirable, the favourable outcome of which is felt to be assured; those issues which, if enacted, might be hurtful to the [controllers] are kept off the agenda" (118, p. 158). The controllers of the agenda will present those issues they feel desirable and, when necessary to build a binding coalition, will provide additional alternatives or incentives to attract a ruling coalition. In any case,

the demands of the agenda setters will likely dominate the decision process.

Decision Interaction--The Use of Power in the Decision Process: As decision makers work through the decision process, some will attempt to influence the outcome by bringing power to bear on the decisions of others. Parsons has identified four types of influence that might be used--inducement, persuasion, activation of commitments, and deterrence (119, pp. 37-62).

Inducements involve rewards for compliant decisions rather than punishments for noncompliant decisions. Deterrence, on the other hand, involves the threat of punishments for noncompliance. Persuasion restructures the objectives, preferences, or demands of other decision makers through the use of argument, propaganda, or technical knowledge. The target of the persuasive pitch complies because it believes the request is in its own best interest. Finally, an activation of commitments involves an attempt to influence others by invoking ethical standards (154, p. 31).

These methods of influence may be used in many combinations. The analyst must realize that power can be used to influence others' decisions by introducing new choices into their opportunity sets, advocating other opportunities, or increasing the costs and benefits of still others. To understand the decision process, the analyst must recognize that power may influence decision makers.

To summarize, the political decision process produces a prescription of what ought to be done. It commences with the making of a preference decision by each institution. Next, each institution makes a demand decision--a prescriptive statement of what ought to be done. When

demands are unanimous, the decision is automatically binding. However, when demands differ, a conflict resolution process must build a coalition that can impose a final prescription on the entire group. This prescription is a public policy decision.

Performance

Introduction

Performance is defined in this framework as the aggregate change in the institutional structure that results from the outcome of the decision process. These changes, which are institutional innovations, may affect the performance of an economy and become part of the institutional structure for future decisions.

Changes in Institutional Structure

A decision results in changes in one or all of the four institutional characteristics: objectives, jurisdictional boundaries, sources of power, and means of preference articulation. Some of these changes will be made voluntarily by the institution, while others will be imposed on it by the decision.

Voluntary changes in objectives result from observation of the decision process and reevaluation of positive and normative knowledge regarding the proper ends of institutional action. Other changes in objectives will be imposed on the institution by the decision itself; certain objectives will be required of the institution by the enforcement of the decision and others may be forbidden.

Decisions often produce changes in jurisdictional boundaries since resources and responsibilities are often transferred across such

boundaries. This transfer results in the boundaries being redrawn to recognize the reorganization of resources and responsibilities of each institution. Such transfers may be voluntary, or they may be imposed on the institution by the decision (a tax for example).

Closely related to changes in jurisdictional boundaries are changes in each institution's sources of power. Transferring the control of resources from one institution to another may result in a redistribution of power. Changes in boundaries and redistributions of power often produce changes in the means of preference articulation. Changes in boundaries may bring new members into the institution or may create new means of articulation for the original members. Redistributions of power may provide some decision makers with new resources to devote to preference articulation or to influencing the decisions of others.

There is also, of course, the possibility of the decision resulting in the creation of an entirely new institution, complete with its own characteristics. These changes in or creation of institutions are institutional innovations. These innovations--which result in changes in the behavior and performance of institutions--are, as Ruttan and others have argued, a major force driving the development of economies.

Nonmonetary Values as an Aspect of Performance

Since this research deals with nonmonetary values, a word is needed on their use as an aspect of performance. Nonmonetary values are part of the normative knowledge decision makers use in arriving at demands. They are knowledge about the goodness or badness of situations, conditions, or things expressed in nonmonetary terms. Decision makers are

likely to have differing values of what is good or bad and, therefore, are likely to arrive at different demands.

If these different demands are incompatible, that is, they cannot all be fulfilled, the conflict must be resolved. With the resolution comes the acceptance of some values since the fulfillment of a demand provides (avoids) the goodness (badness) of the values associated with that demand. Conversely, the values associated with demands that go unfulfilled are rejected. This is not to imply that the decision process somehow reaches a state of unanimity with regard to nonmonetary values. Instead, it simply recognizes that nonmonetary values will be involved in the political decision process and some of them will be chosen over others; by examining the decision process, the analyst should be able to determine which nonmonetary values were accepted and which were rejected.

Summary

Society is structured as an interacting set of decision-making institutions. Each institution can be described in terms of its objectives (what it wants to do), jurisdictional boundaries (what resources and responsibilities it controls), sources of power (what methods it can use to execute its decisions or influence the decisions of others), and means of preference articulation (how it tells others what it wants).

When faced with a decision making situation, each institution makes a preference decision--an assessment of the goodness or badness of the consequences of each opportunity in its opportunity set. Each institution then expresses a demand--a statement of what ought to be done.

It reaches a demand decision by searching its opportunity set for some best alternative to achieve its objective. By processing positive and normative knowledge through a decision rule, each institution arrives at a demand decision.

When all decision makers have similar demands, a decision is reached by consensus. However, when demands differ, a conflict resolution process must be completed. Conflicts are resolved in a four stage process. First, an agenda of conflicts and possible resolutions must be set. Second, decision makers must assess the similarities and strengths of the demands of others. Third, based on this assessment of demands, a ruling coalition must be constructed. Fourth, a vote must be taken within the voting guidelines of the resolution process. The framework also recognizes that decision makers will attempt to influence the decisions of others by exercising their sources of power.

Performance can be described in terms of institutional innovations, or changes in the original institutional structure (the objectives, jurisdictional boundaries, sources of power, and means of preference articulation of each institution). Performance can also be described in terms of the nonmonetary values involved in the decision process. Some values will be accepted in the sense that the fulfillment of a demand will, presumably, fulfill the values associated with that demand. Conversely, those demands that go unfulfilled will likely be associated with values that go unfulfilled. This does not imply all parties will come to a unanimous agreement on nonmonetary values. It simply recognizes that such values exist and can be described, as can acceptance or rejection of those values when decisions can be observed.

CHAPTER III

HISTORICAL DEVELOPMENT OF THE STATE AGRICULTURAL EXPERIMENT STATIONS: 1870-1914

"History never looks like history when you are living through it. It always looks confusing and messy and it always feels uncomfortable."

John Gardner (155, p. 280)

This chapter traces the early development of the state agricultural experiment stations. The objective is to impose some order on a period which, nearly a century later, still looks somewhat confusing and messy. In the process, this chapter prepares for a closer examination of the writing of the Hatch Act of 1887 and the Smith-Lever Act of 1914 in Chapters IV and V. The beginning and ending points of this survey are arbitrary, yet logical. In 1871, the Convention of the Friends of Agricultural Education first met to discuss the creation of experiment stations. The passage of the Smith-Lever Act in 1914 completed the era by drawing the jurisdictional boundaries between the scientific work of the stations and the technology transfer responsibilities of the extension service. The break at 1887 follows from the passage of the Hatch Act in that year. Both periods are examined from two perspectives: the state of the farm economy and the development of the land-grant system.

From the Morrill Act of 1862 to the Hatch Act of 1887

The Farm Economy: 1870-1887

Information about the farm economy prior to 1914 is, in a word, sketchy. At best, a few indexes of prices and output can be compared to determine if a consistent pattern emerges. Very little data about farm production costs exists, making reliable information about net income even more scarce. To add to the confusion, a number of historical revisionists have done economic analyses that contradict the claims of earlier historians. Still, by cross-checking data sources and comparing historical works, it is possible to make some conclusive statements about the condition of the farm economy in this period.

The General Economy: 1870-1887: It is not possible to understand the farm economy in this period without understanding the impact of the banking system on the farm sector. Indeed, Warren and Pearson later commented that "fluctuations in the amount of yellow metal rather than the amount of yellow corn explain most of the changes in corn prices" (183, p. 34). Macroeconomic policy in this period was dominated by (1) the lack of a strong central bank and (2) the adherence of most nations to the gold standard.

From 1863 to 1913, banking in the U.S. was controlled by the National Bank Act of 1863. This legislation authorized the establishment of nationally chartered banks, allowed these banks to issue a new paper currency, the National Bank Note, and imposed a 10 percent tax on bank notes issued by state-chartered banks (86, pp. 61-66). These National Bank Notes were essentially IOU's given in exchange for gold deposits and

promised to pay the holder gold on demand. In addition, national banks were required to purchase and deposit U.S. securities with the Comptroller of the Currency as backing for their outstanding notes. Thus, the National Bank Notes were an extremely safe form of currency.

However, there was no central mechanism for controlling the money supply and, therefore, the level of prices and economic activity. Instead, the money supply was determined primarily by (1) the availability of government securities, (2) the discovery of new gold supplies, and (3) increases (decreases) in the money supply resulting from balance of trade surpluses (deficits).

The first factor, the availability of government securities, restricted the supply of money since the government steadily retired its debt from the years 1866 to 1890, thereby reducing the quantity of securities available. The second, the discovery of new gold, limited the growth of the money supply until large gold discoveries were made in South Africa, Colorado, and Alaska just before 1900 (183, p. 122).

The third mechanism--transfers of gold between countries via their balance of payments--was intended to help ensure full employment, but did so at the expense of price stability. If a country ran a trade deficit (surplus), gold was shipped out of (into) the country to pay for the excess imports (exports). As this transfer occurred, the money supply decreased (increased), interest rates increased (decreased), economic activity decreased (increased), and prices and incomes fell (rose). This adjustment in prices and incomes resulted in a decrease in imports (exports) and an increase in exports (imports) as domestic goods became more (less) competitive. Thus, through the price and income adjustment mechanisms, the balance of payments was maintained in

the long run. However, this was accomplished at the expense of domestic price stability.

Besides price instability, other problems plagued the system. First, the requirement to hold government securities left little slack in the system to meet seasonal, cyclical, or panic-induced demands for money. Second, the holding of country (actually small city) bank reserves in city banks contributed to periodic bank panics. Seasonal demands for money in agricultural areas frequently set off a chain of reserve calls, ultimately forcing city bankers to recall loans and setting a panic in motion that spread to the stock markets. Finally, because of the risk of panics, it became clear that no individual bank could act as a lender of last resort to bail out another in need of reserves for fear of endangering its own financial position. For this, a central bank was needed (86, pp. 61-66).

What was the effect of the banking system on agriculture? While it may have resulted in interest rate instability, the major impact was to increase the instability of farm commodity prices. As agriculture became a more commercialized venture, the instability of prices became a greater problem. To understand the determination of farm prices in such a gold-based banking system, the price of wheat can be roughly expressed as the following ratio (183, p. 82):

$$\text{Price of wheat} = \frac{\frac{\text{Demand for wheat}}{\text{Supply of wheat}}}{\frac{\text{Demand for gold}}{\text{Supply of gold}}}$$

Considered in these terms, the impact of changes in the money supply (via gold) on farm prices becomes clear. An increase in the demand for

(supply of) gold resulting from a balance of trade deficit (surplus or new discovery of gold) resulted in a decrease (increase) in the price of wheat. Thus, instability of the general price level compounded the instability of farm commodity markets. This high level of price uncertainty led farmers to be concerned about down-side price risk and unstable land values. This concern contributed to some of the most widespread agrarian unrest in American history, a topic discussed later in this chapter.

The Changing Farm Economy: The twenty-five years following the Civil War were marked by a number of emerging trands in the farm economy. In 1860, nearly 60 percent of the U.S. labor force worked on farms. The figure was 7 percent smaller in 1870, and by 1890 the figures were reversed--only 40 percent of the work force was employed in farming (23, p. 299). The mechanization of farms and the growth of the manufacturing economy made off-farm employment both plausible and attractive. Annual per capita income in agriculture was $252 in 1880; compared to the $572 average for non-farm workers, a strong incentive for urban migration existed (62, p. 15). In 1890, for the first time, a larger portion of national income came from the manufacturing sector than the agricultural sector (61, p. 314).

American farmers were also entering the international market during this period. From 1870 to 1890, the quantity of beef, pork, cotton, corn, and wheat exported increased 661 percent, 447 percent, 118 percent, 444 percent, and 246 percent, respectively (165, pp. 962-64). While the export market was an important release valve for growing domestic supplies, it also introduced new risks into agricultural

markets. Just as the U.S. was opening its western frontier, other countries--Argentina, Australia, South Africa, and the Russian Ukraine--were also becoming major suppliers. Variations in foreign supply and demand led to wider fluctuations in domestic prices, particularly in years of poor domestic crops coincidental with bumper foreign harvests (113, p. 135).

Concurrent with growing foreign demand was a growing domestic demand. The population of the U.S. grew 23 percent--from 40 million to 63 million--between 1870 and 1890. A major portion of this growth came from an influx of immigrants--an annual average of 420,000 per year (176, pp. 8, 115-16). Furthermore, changes in food processing technology now allowed farmers to serve distant urban markets. The development of refrigerated railcars by Gustavas F. Swift in 1880 expanded the market for meats, fruits, vegetables, and dairy products. The development of "New Process" milling allowed millers to grind hard spring wheats without discoloring the flour. Spring wheat, which could withstand midwestern winters better than the softer winter wheats, expanded the area in which wheat could be grown. Machine-made cans were invented in 1885, allowing the expansion of the canned food industry. Furthermore, Civil War soldiers had acquired a taste for condensed milk and other canned foods, giving processed food a popularity it might otherwise have taken years to develop (97, pp. 432-50).

Improvements in the transportation system, particularly railroads, allowed farmers to supply these growing, distant markets. Miles of railroad track in the U.S. increased from 47,000 in 1869 to 161,000 in 1889, a 242 percent increase (76, p. 34). The volume of freight per capita increased from 78 ton-miles per year in 1859 to 1,256 ton-miles in

1890 (122, p. 245). Despite farmers' claims to the contrary, railroad rates were, over the period as a whole, about constant relative to farm product prices (76, p. 88). Ocean freight rates were also declining during the period, another factor that contributed to growing foreign demand (113, p. 132).

Finally, a word is needed about the expansion and regionalization of U.S. agriculture. Land area in farms increased about 50 percent from 1870 to 1890 to 623 million acres (176, p. 433). In 1869, about 6 percent of the nation's farm output was produced west of the ninety-fifth meridian (which runs just west of the Mississippi River). Forty years later, one-third of all farm production came from that region (76, p. 82).

Production also began to concentrate in areas that had a comparative advantage for particular commodities. Rice was introduced in the 1880's and moved into the coastal areas of southeast Texas and southwest Louisiana. Fruit shipments eastward from California began in 1867 and fruit and vegetable production expanded in California through 1890. Cotton continued to dominate the old South and spread to Texas and Oklahoma. Winter wheat production centered in Kansas and Nebraska, while spring wheat dominated in Minnesota and the Dakotas. The corn and hog belt reached from Ohio to eastern Nebraska and beef cattle were produced in an area reaching from Chicago to southern Texas. Having lost their competitive advantage in grains, New England, Wisconsin, and Minnesota concentrated on dairy production (35, p. 110).

The Mechanization of Agriculture: The second half of the nineteenth century was a period of adoption and refinement of farm technology rather than a period of new inventions. The emphasis was on improving and

enlarging much of the equipment invented prior to the Civil War (44, p. 196). Furthermore, the migration of persons to the city encouraged (and was made possible by) the replacement of hand power with horse power. The replacement of human labor with horse-drawn equipment allowed agriculture to "break through the limit imposed by hand power technology and thus shifted productivity to a new S-shaped curve . . . . Productivity accelerated after the Civil War until about 1880 and then tapered off toward the beginning of World War I as the full potential of horse power was reached" (103, p. 9). The replacement of hand power by horse power resulted in a doubling of the number of horses and mules on U.S. farms between 1870 and 1890, reaching 17 million head (61, p. 418).

Over 3.5 million acres were being irrigated by 1890, mostly in western states. Commercial fertilizer use increased fourfold in twenty years, reaching nearly 1.4 million tons in 1890 (176, pp. 433, 469). By 1869, about 35,000 harvesting reapers were produced annually in the U.S. The invention of the twine binder in the late 1870's, which cut and tied grain into bundles, led to the development of a combination harvester-binder in 1880. By 1885, 250,000 grain harvesters were produced annually. By 1880, nearly 80 percent of total U.S. wheat production was harvested by mechanical reapers (61, p. 416; 35, p. 108). Overall, the inventory of implements on farms rose from $246 million in 1869 to $1.2 billion in 1909. This translated into an increase in the average per-farm investment from $120 to $190, or an increase in the average per-acre investment from $1.51 to $2.64 (61, p. 416). The annual value of farm equipment produced increased from $50 million in 1869 to $89 million in 1890 (176, p. 701).

Farmer reaction to these developments was mixed. On one hand, the agricultural community went through a series of "crazes" prior to 1860 which indicated some willingness among farmers to apply science to agriculture. These included the "Merino [sheep] mania," "Saxony [sheep] craze," "Moris Multicaulis [mulberry tree] mania," "Berkshire [hog] fever," hen fever, and other crazes for Rohan Potatoes, broomcorn, Chinese treecorn, and various strains of wheat.

The typical pattern for such crazes was to begin with exorbitant claims about the crop's productivity in the farm journals of the day (each Rohan potato, it was claimed, "was as big as a Bible, and could be cut into twenty pieces, and each piece would plant a hill, and each hill would yield a bushel"). This was followed by an inevitable increase in price of the input (the demand for Rohans, according to one journal, could not be set within "any conjectural limits"). The craze concluded when farmers found the claims untrue (one Rohan farmer lamented, "In my catalogue of humbugs this year, I place the Rohan potato at the top . . . . The yield was grieviously disappointing, the potatoes small and few, and the quality thereof abominable") (45, pp. 622-39). The number and intensity of these crazes shows that farmers were not totally averse to new production methods.

Despite these episodes (or perhaps because of them), many farmers remained skeptical of new technologies. The cast iron plow, some claimed, poisoned the soil and caused weeds to grow (51, p. 118). Moreover, the growth of the agricultural input sector led farmers to be suspicious of large equipment suppliers, claiming that the "Harvester Ring" and the "Plow Ring" were monopolizing the input sector at the expense of the farmer (153, p. 157). Despite these claims, the retail

margin for farm implement stores fell from 23 percent in 1869 to 19 percent in 1899 (176, p. 848).

Farm Prices, Output, and Income: Due to the instability of the general price level in the nineteenth century, it is important to look at farm prices in real terms. Figure 2 shows the real price of corn, wheat and cotton (deflated by the wholesale price index, 1910-1914 = 100). Also shown is the index of all farm product prices deflated by the wholesale price index to give a real farm price index (152, p. 143; 182, pp. 26-27).

The real farm price index stood at 83 in 1870. After declining to 77 in 1873, farm prices rose to 84 in 1877. Following a three year slump, farm prices rebounded and the farm price index reached 92 in 1882; prices again declined, this time reaching a low of 83 in 1886. The prices of individual farm products followed much the same pattern.

Two comments should be made about farm prices during this period. First, the average index for the period was 82.7, compared to an index of 83 in 1870 and of 84 in 1887. This indicates that real farm prices were nearly constant over time. However, this average hides the instability in farm prices during the period. Three pairs of peaks and troughs occurred during the period and about six years passed from price peak to price peak. Thus, while prices were about constant over time, there was considerable short-term instability.

Productivity is defined as output divided by input. Table 1 shows two agricultural productivity indexes, one by Kendrick, the other a USDA estimate (93, pp. 362-63; 169, p. 90). The USDA productivity index stood at 78 in 1870 (1929=100) and increased to 94 in 1880. Ten years

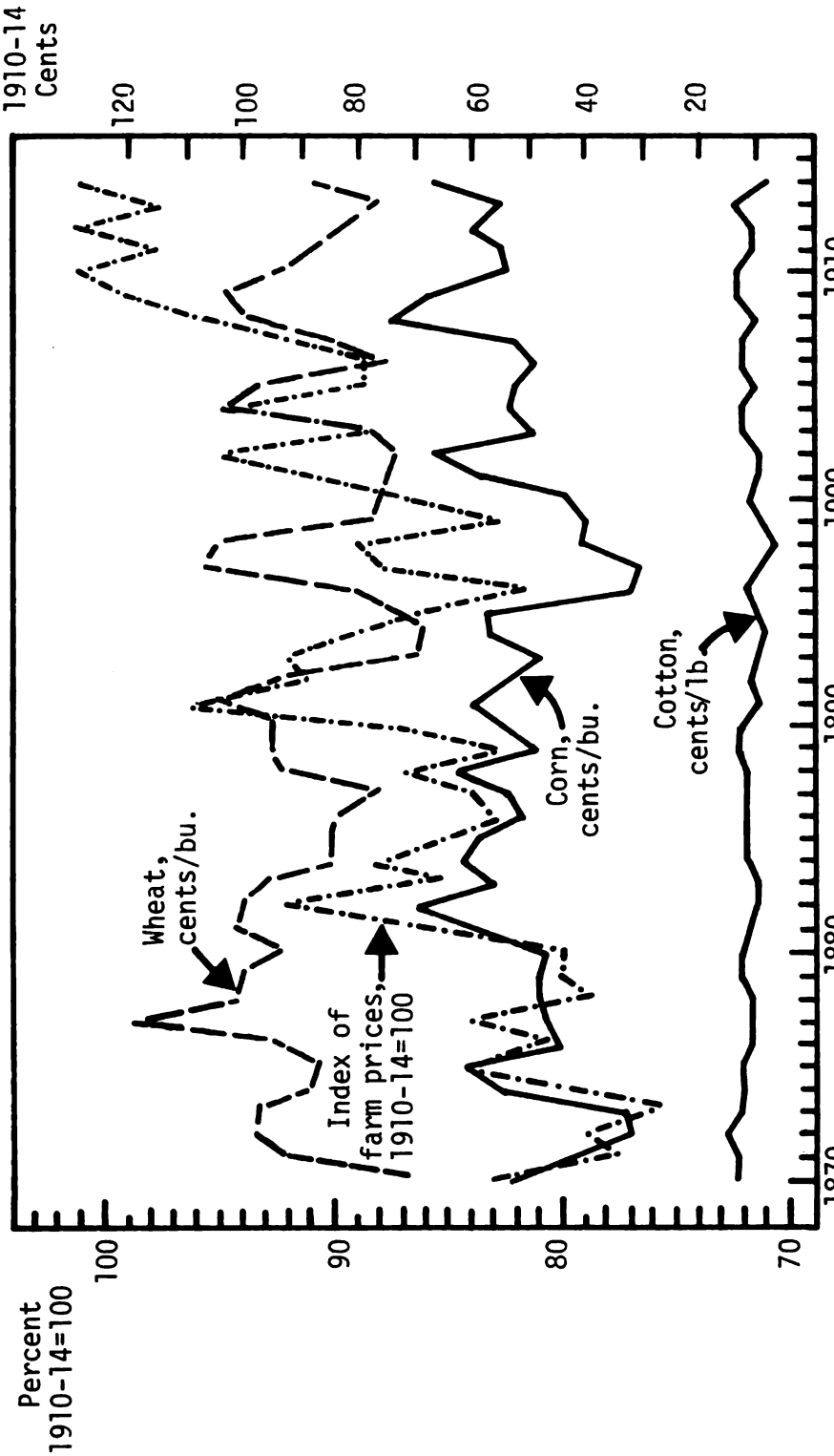

Figure 2

Real Prices of Farm Products, 1870-1914

Sources: 152, p. 143; 182, pp. 26-27.

Table 1

Indexes of Productivity for the Farm Sector, 1870-1914

(1929 = 100)

Year	USDA Index	Kendrick Index
1870	78	68
1880	94	79
1890	94	83
1900	105	92
1910	96	92
1914	98	95

Sources: 93, pp. 362-63 and 169, p. 90.

later, the productivity index still stood at 94. Since data are only available at ten-year intervals prior to 1890, it is impossible to determine whether productivity varied widely between 1880 and 1890. However, the work of Lu, Cline, and Quance and the Kendrick index also confirm the idea that productivity growth slowed during the 1880's (93, pp. 361-62; 103, p. 9).

Figure 3 shows real gross farm output for the years 1870 to 1914. Gross farm output, as used here, is the real value of farm products less the value of grain fed to livestock and seed used for production (152, p. 7). Real gross farm output (1910-14 dollars) stood at $1.7 billion in 1870 and grew steadily to $2.4 billion in 1879, an increase of 39 percent. From 1880 to 1887, however, gross output grew only 12 percent to $3 billion (152, p. 7).

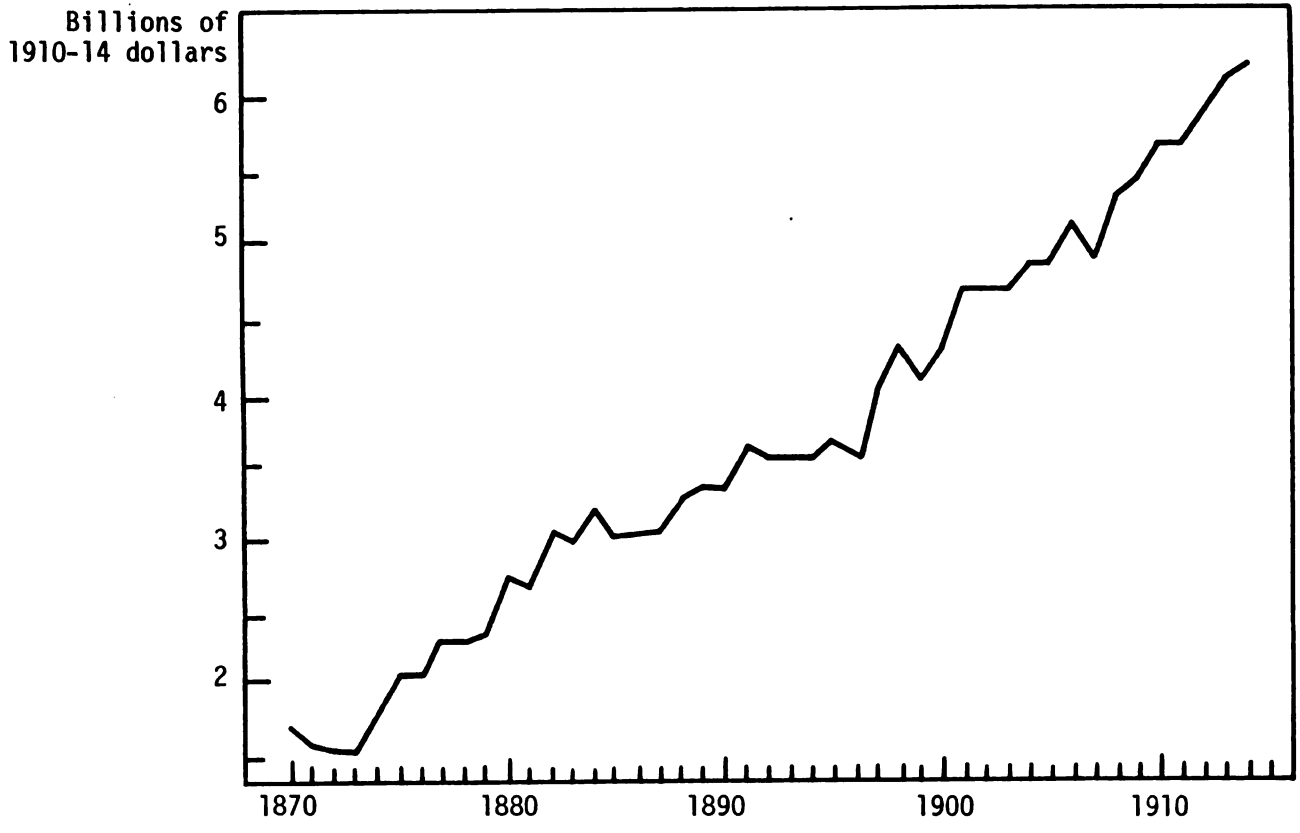

Figure 3

Real Gross Farm Output, 1870-1914

Sources: 152, p. 7; 182, pp. 26-27.

Of course, it is net rather than gross income that is most relevant, especially as more purchased inputs are used in the production process. Little data on net farm income exists for this period. The best data appears to be that of Kendrick (93, p. 347). He defines net farm output as gross output less purchased inputs of feed, seed, fertilizer, fuel, irrigation, insecticides, veterinary services, and other current expenses. Table 2 shows real net farm output to be $5.4 billion in 1879, 55 percent higher than the $3.5 billion figure of 1869 (1929 dollars). By 1889, the figure was only 25 percent higher, $6.8 billion.

Table 2

Real Net Farm Output, 1869-1919
(Millions of 1929 Dollars)

Year	Real Net Farm Output
1869	$3,510
1879	5,450
1889	6,820
1899	8,560
1909	9,150
1919	9,680

Source: 93, p. 347.

These numbers are rather crude, but they do show a trend of slow growth in real farm income in the 1880's. As final support for this conclusion, consider land values during the period. The average real price of land was $13 per acre in 1870 (1910-1914 dollars). This figure rose 40 percent to $19 in 1880, but grew only 35 percent to $26 in 1890.[1]

If land values are reflective of the earning potential of the land, then these prices also indicate that net farm income grew more slowly in the 1880's.

Farmer Unrest and Political Activity: As farming became more economically sophisticated on both the output and input side, farmers became more interested in the political decisions that affected their economic status. A natural result of this growing consciousness was an increase in political activity by farmers.

The first major farm organization in the U.S. was the National Order of the Patrons of Husbandry, better known as the Grange. Organized by a temporary employee of the USDA, the Grange's three original purposes were to improve farming practices, provide wholesome recreation, and broaden the knowledge and acquaintance among farmers (65, pp. 517-20).

Founded during the post-Civil War discontent over low farm prices, the Grange was seen as a means to fill the social and educational void in many rural communities. By 1873, Granges existed in all but four states. National membership reached 850,000 two years later (65, p. 497).

Despite the founders' wish that it remain a social organization, farmers saw the Grange as a means of political and economic improvement. Farmers foresaw two methods for the Grange to improve rural life: (1) political activity promoting legislation to regulate railroads and (2) cooperative economic activity in marketing, processing, manufacturing, and purchasing.

In 1871, the Grange began buying household and farm supplies cooperatively. This led to special agreements for the manufacturing of machinery and, eventually, to the purchase of machinery manufacturing

plants. Following the initial enthusiasm of the venture, the cooperative efforts of the Grange were, by and large, a failure. Members had little business experience and little patience for long term results. Some economic ventures did survive, namely, their cooperative shipping associations and their cooperative fire insurance companies, but the Grange did not provide economic solutions to farmers' problems.

Politically, the Grange was more effective. Their political influence in Illinois led to a section of the state constitution allowing the General Assembly to pass laws establishing maximum shipping rates for railroad traffic in the state. Later legislation also controlled the practices of warehouses. The Grange was also active in establishing railroad regulations in other states, particularly Wisconsin, Minnesota, Iowa, Missouri, and California. Faulkner identifies four common principles of Granger laws: the establishment of maximum freight rates; the prohibition of higher rates for short hauls than for long hauls; the preservation of competition by forbidding certain mergers; and the elimination of free passes for public officials (60, p. 488).

Granger activity peaked during the years 1873 to 1876. During this time, independent parties ran in eleven western and midwestern states under a variety of labels. Usually called Anti-monopoly parties, they all favored regulation of railroads, monopolies, and corporations, and most favored reduced taxes, economy in government spending, tariff revisions, and establishment of a civil service system. In their most successful year, the election of 1873, the independent parties elected one governor, two U.S. senators, held control or the balance of control in four state legislatures, elected two state officials, and had

"outstanding success" in local elections in another state (26, p. 99). Following 1873, their electoral support gradually eroded.

Still, the impact of the Grangers should not be underestimated. The upholding of states' rights to regulate railroads, as established in the historic Munn v. Illinois case, was a major precedent in property law. It established the legal opinion that when "one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in the use, and must submit to be controlled by the public for the common good"(60, p. 488). This precedent was reaffirmed by the Interstate Commerce Act of 1887, a law supported in Congress by farmers, eastern shippers wishing to end discimination, investors wishing to eliminate mismangement, and parts of the railroad industry seeking to eliminate "competitive anarchy" (122, p. 251).

Following some of their economic setbacks, the membership of the Grange declined to around 115,000 in the late 1880's. The Grange again became a social organization, especially active in the Midwest and New England.

Succeeding the Granger movement was the Greenback movement. The two did share some issues, especially the issue of railroad regulation, but the Greenback party was political rather than social in its orientation, and the Greenbackers' dominant issue was inflation.

The Civil War effort had forced the federal government to finance deficits with non-interest-bearing tender known as greenbacks. This was contradictory to the nation's earlier adherance to the gold standard and led to a doubling of the per capita money supply between 1860 and 1865. The demands of the war effort for products, the growth of the manufacturing economy, and this increase in the money supply combined to

increase wholesale prices from 92 in 1860 to 200 in 1865 (1910-1914 = 100) (26, pp. 36-37).

Following the close of the war, the government attempted to return to a "sound money" position by retiring the greenbacks. Thus, the quantity of greenbacks in circulation fell from $428 million in 1865 to $365 million in 1868. Since greenbacks represented nearly one-half the money supply, this was a substantial contraction. Following a decade of stop-and-go policies, the quantity of greenbacks was frozen at precisely $346,681,016 in 1878 (26, p. 32; 61, p. 478).

As debtors who had benefited from the wartime inflation, farmers now faced the prospect of repaying loans in expensive rather than cheap dollars. Farmers became exponents of the quantity theory of money: since output was expanding, prices could only be maintained by increasing the money supply. An actual contraction would exacerbate the problem by forcing an even sharper decline in prices. The only solution, in their opinion, was an expansion of the supply of paper money.

Finding little sympathy among Democrats and Republicans (President Grant vetoed an 1873 bill that would have increased the quantity of greenbacks), farmers again set out on a political course of action. In 1874, the Independent party of Indiana called a convention of industrial and agrarian classes of eight midwestern and northeastern states. The result was "a new political organization of the people, by the people, and for the people, to restrain the aggressions of combined capital upon the rights and interests of the masses" (153, p. 185).

Two years later, representatives from eighteen states made Peter Cooper the Greenback nominee for president. Their platform had only a preamble and five planks, all relating to the expansion of the money

supply. The party polled only 81,000 popular votes, or 1 percent of the total, and received no electoral votes. Sixty-five percent of their votes came from five midwestern states, mostly from poor agrarian counties. Still, the party controlled the balance of power in the Illinois legislature and elected one U.S. senator in 1877. The movement spread south, and the Greenback party elected fifteen congressmen in 1878.

In 1880, the Greenbackers nominated General James Weaver for president. The platform had fifteen planks, the first being that "the right to make and issue money is a sovereign power, to be maintained by the people for their common benefit" (i.e., greenbacks should be increased, banking regulations should allow more issuance of state notes, or silver should be coined) (153, p. 189). Weaver waged the most aggressive campaign of his day, traveling 2,000 miles and addressing 500,000 people. Still, he polled only 308,000 votes out of 9 million cast; half his support came from six midwestern states. A modest recovery of the farm economy hurt their cause and the Greenbackers polled only 175,000 votes in 1884 (153, pp. 184-91).

While agrarian activism during the 1870's and 80's may seem to have been futile, it was not without its lasting effects. As mentioned, the Grange contributed to political and legal decisions that were precedents in property law. While unsuccessful, the Greenback movement set the stage for the silver movement of the 1890's. These political movements were interested in the establishment of agricultural experiment stations, but other issues dominated their thinking. And, as discussed later, the Grange actually became something of an antagonist of the land-grant colleges in several states.

The Land-Grant System: 1870-1887

Following the rush of optimism felt after the passage of the Morrill Act in 1862, the administrators in the land-grant system were absorbed by the problems of building a new institution. By 1870, 35 land-grant colleges were in existence; by 1887, 9 more would be added. During this period, the colleges had several problems to face: the initial lack of an organized curriculum, a shortage of faculty, the underdevelopment of agricultural science, the dissatisfaction of farmers with the colleges, and financial problems in almost every state. This section looks at these and other problems, the progress that was made in solving them, and concludes with a summary of the Hatch Act of 1887, the organic legislation of the state agricultural experiment stations.

Internal Organization of the Colleges: Throughout this period, the colleges struggled to put their own house in order. The lack of money, students, faculty, and science led Bonnen to observe that "long before the colleges increased the mobility of the rural population, they vastly accelerated that of college professors and presidents" (31, p. 1282). The Virginia Agricultural and Mechanical College was an example of such presidential mobility. In its first nineteen years of existence, the institution had seven presidents. The longest term of office was seven years; the shortest was one day (187, p. 11).

The colleges were charged with the responsibility of teaching "such branches of learning as are related to agriculture and the mechanic arts," but not to the exclusion of "other scientific and classical studies, and including military tactics." The major problem they faced was the lack of agricultural science to teach.

Some teachers limited their discussions to the best farming practices of the day. This led to disillusionment among students, one who described a class on corn production in less than glowing terms:

> 'Now we are going to raise a crop of corn on this field. Of course we will have to plow it first, and this is the way to plow it.' There wasn't much discussion on this point, but when we came to cutting the corn and putting it in a shock, there was a big discussion as to whether we should tie two [or four] hills together . . . . Here discussion waxed hot. There was also some discussion about cultivation, because the people who lived on clay had learned to cultivate the land differently than those who had lived on sandy land (111, pp. 57-58).

Another professor, desperate for teaching material about horses, and

> hearing that many rather young horses had died recently of an epidemic, . . . I had two farm hands dig them up and preserved the heads . . . . Arranging my material on a workbench in the open, I placed my class on the windward side and taught them the principles of horse dentition (127, p. 162).

This situation led President John Gregory of the University of Illinois to declare, "We have no <u>science of agriculture</u>. . . . Agriculture is not a science in any sense . . . . It is simply a mass of empiricism" (emphasis in original) (112, p. 57).

It should not be surprising that educators filled this void with subjects they were familiar with, namely, classical studies. The curriculum at the Michigan Agricultural College served as a model for many others. In 1872, the curriculum included history, algebra, geography, botany, chemistry, rhetoric, French, landscape gardening, moral philosophy, political economy, physics, and two classes in agriculture, one during both the freshman and senior years. During the afternoon hours, all students were required to perform manual labor on the college farm (25, pp. 138-40). With such an emphasis on classical topics, the colleges soon were criticized by farmers as "literary kites with

agricultural tails" (181, p. 14). The situation remained unchanged in many schools until after 1890.

Another problem plaguing the colleges during this era was a serious lack of qualified instructors. There was, of course, no training for agricultural faculty prior to the Morrill Act. Thus, when positions needed to be filled, they were filled by men with classical backgrounds. Occasionally, a chemist or botanist with an interest in agriculture could be found. Even when such men could be found, they were greeted with the dismal prospect of overwork. At the Michigan Agricultural College, one professor complained that no member was asked to fill a chair, but "occupied an entire settee" (25, pp. 68-69). At the University of Wyoming, the first president was also professor of eighteen subjects, including such diverse topics as metaphysics, agriculture, and the history of mining and metallurgy (56, p. 83). Equally discouraging was the low pay and uncertainty of tenure at many schools.

Especially disastrous, from a public relations perspective, was the lack of students at many schools. In 1874, Cornell had only three seniors in agriculture. No student at Minnesota studied agriculture before 1889. One agriculture student graduated from Wisconsin before 1880. Illinois had 45 agriculture students in 1875; by 1879, the number was 23 (56, p. 67). Illinois did not award a bachelor of science in agriculture until 1878 (150, p. 301). By 1886, the land-grant colleges had 7,800 students; only 2,000 were studying subjects related to agriculture (159, pp. 1041-42). Even these numbers may have been inflated. For instance, Cornell's president interpreted the phrase "related to agriculture" broadly and reported all students to be enrolled in "branches related to agriculture." Another administrator later

admitted this was true only because students were required to attend a series of agricultural lectures "given in the spring term during the noon hour to disinterested seniors and had little more than a soporific effect" (46, p. 203).

These disastrous numbers simply meant even more abuse for educators. When Wisconsin's professor of agriculture begged farmers, "Let all your energies boil over in the direction of helping me get some students, [because] I can't furnish the boys," one critic responded, "Ain't you married?" (68, pp. 99-100). According to historian Richard Moores, "The dream of agricultural education . . . had become a prolonged, vaguely shameful nightmare" (111, p. 57).

The Morrill Act intended that the rent from the land grants would provide sufficient support for the agricultural colleges. This was actually a rather old idea, having originated in sixteenth century Europe (124, pp. 3-14). However, a number of problems arose that would plague the colleges throughout this period.

The Morrill Act granted each state 30,000 acres per senator and congressman. Unfamiliar with the land market, several states delayed selling the land until after 1870. Since most states received land scrip valued by the federal government at $1.25 per acre, most state officials felt this was the accurate value of the scrip.

However, the laws of supply and demand were working against the colleges. The Homestead Act had also passed in 1862, allowing settlers to claim western lands, thereby depressing the price of land. Among the northern states, Vermont did the best, selling its scrip for 81.8 cents per acre. Ohio tried to get other states to fix prices at a higher level, but then sold its land for 80 cents. Others did much worse:

Maine, West Virginia, Pennsylvania, New Hampshire, Indiana, Maryland, and North Carolina all sold for about 50 cents. Only a handful of southern states did better, Virginia doing best at 90 cents.

There were also hints of scandal during the disposal process. Massachusetts officials were accused of trying to get high prices in exchange for kickbacks to the buyers. Kentucky officials were accused of selling scrip to persons other than the highest bidder. One man bought 5 million acres of scrip, or 67 percent of all the college scrip sold between 1866 and 1873. While he never owned an acre of land, he was the largest dealer of scrip in the U.S., leading many to believe something was amiss. These accusations, true or not, left a cloud of suspicion over some of the colleges (101, pp. 99-107).

More importantly, the low prices of the scrip sales yielded a smaller than expected income, a constraint that limited the quality of the colleges' work for several years. The unwillingness of the states to allocate money to the colleges (which may have led several states to sell their land scrip hurriedly at low prices) left many colleges in poor financial condition.

Early Efforts at Agricultural Research: Agricultural research was a natural outgrowth of the educational function of the college. First, research was needed to provide material for classroom instruction. Second, some farmers began to ask questions of the faculty that needed answering. Third, because students were scarce, in at least one case (Wisconsin) faculty did research for lack of anything else to do (68, p. 98).

In many states, research was done on the "experimental" or "model" farm. These farms were the predecessors of the experiment stations and, because they came prior to the Hatch Act, faced a number of problems.

The major problem was the widely held philosophy that these model farms should provide an example for farmers to follow and, therefore, should be judged by their profitability. This led to a number of unfortunate decisions. Manley Miles, one of the research leaders of his day, was forced to resign at Illinois because the college farm did not show a profit (111, p. 54). At Wisconsin, faculty in charge of the dairy herd and sheep flock refused to allow others to perform experiments on their animals for fear of reducing their profitability (49, pp. 381-82).

A second problem was a lack of money to finance the farms' operations. Since the farms were supposed to be profitable ventures, little funding was provided by the states. This led to many farms being something less than a model for farmers to follow. Arriving at Cornell to supervise their farm in 1874, Isaac Roberts found

> ten milk cows that had among them only twenty-two milkable teats and the veterinarian did not have to be called to know that the herd was infected with tuberculosis. One of the work oxen was sound and strong but it took most of its strength to hold up his mate. There was a stallion of noted Arabian lineage. . . . He had not been out of his box stall for two years. . . . When we took that Arab of the Desert out of his stall and rode him, he fell dead (121, pp. 184-85).

At Rutgers College, the manager reported, "The crop ofwheat in 1864 averaged only 6 bushels an acre, . . . the small area in grass yielded less than a ton per acre of weedy and unsalable hay, and most of the land was entirely unproductive" (186, p. 26). The conditions led to more unhappiness on the part of farmers. At Minnesota, one farmer complained he had found pigeon grass in the beans and "a hens nest--two or three of

them--right in the side of the grain stack." The situation was regarded as "inadequate to the point of absurdity" by the farming community (69, p. 94).

Still, the farms did serve some useful functions. First, the colleges required most students to work on the farm, a practice that helped stifle farmers' criticisms about "book farming." Second, crude as they were, these farms provided the basis for early research. Administrators and legislators eventually realized the institution should be an experimental station, not a profit-seeking farm. Experiments had to be long-term ventures performed with special equipment; some experiments, successful or not, simply could not be made profitable (186, pp. 29-34).

In 1875, Connecticut and California founded the first experiment stations in the United States. California's station was a department of the University of California, while Connecticut's was a free-standing institution. Stations founded next included North Carolina (1877), New York (1879), New Jersey (1881), Wisconsin (1881), and Ohio (1882). Of these, only Ohio's was a free-standing entity. By 1881, eight states had founded experiment stations and 13 others were doing various forms of experimental work (158, pp. 67-118). Some common types of early work included soil, fertilizer, and feed analysis, crop rotation, meteorological observations, plant population tests, and work on milk quality and a number of plant and animal diseases. With the exception of fertilizer analysis, much of the work was rather crudely "experimental", much of it being observational. It did, however, provide the basis for more advanced work following the passage of the Hatch Act.

College Relations with the Farm Community: The poor relations between the colleges and the farmers during this period have been well

documented and need little repetition here (84, pp. 274-81; 111, pp. 8-12; 125, p. 53). Farmers were disappointed with the curriculum, skeptical that anything could be learned from "book farming," and distressed that the colleges were educating their children "away from the farm" and into the traditional professions.

This disappointment among farmers led to political actions by the Grangers against several colleges. Dissatisfied with the conditions at the colleges, especially those that were attached to the state universities, the Grange lobbied for separation of the agricultural colleges from these general universities. In at least four states--Mississippi, North Carolina, Rhode Island, and Connecticut--they were successful in doing so (49, pp. 470-71; 58, pp. 17-43; 131, p. 31; 141, pp. 52-59). A resolution passed by the National Grange in 1876 declared the colleges ought to be "under the exclusive control" of farmers and ought to be "as far as possible, separate and distinct schools" (38, p. 292). This dissatisfaction eventually led to an amendment to the Hatch Act that allowed states to establish independent experiment stations, a topic discussed in Chapter V.

College Relations with the USDA: Founded in 1862, the Department of Agriculture's charter directed it to "acquire and diffuse among the people of the United States useful information on subjects connected with agriculture" (22, pp. 12-25). During the years 1870 to 1887, the department (which was not actually a cabinet level department) was headed by five different commissioners. While these were men of widely differing backgrounds and personalities, they all took the scientific responsibility of the department seriously.

White identifies two important characteristics of the USDA during this period. First, it was strongly client-oriented: the work of the USDA was intended to benefit farmers. Scientists were not only to work out solutions to problems, they were to translate the results into usable terms. The department's Yearbook, filled with agricultural information, was the government's largest publication; over 500,000 were distributed annually.

Second, the USDA had a clear mission: the application of science to agriculture. Its organic charter provided for the hiring of scientists. Many congressmen and farmers were more concerned with the department's distribution of free seeds, but department personnel remained dedicated to the long run usefulness of science (184, pp. 232-47).

A third characteristic was the amiable relations between the USDA and the land-grant colleges. Although the USDA had no control over or formal relationship with the colleges, the two remained close out of their shared interest in science and their shared instinct for survival. The USDA's role with respect to the colleges was mainly one of facilitator. By calling meetings of land-grant representatives in 1872, 1881, 1883, and 1885, the department opened lines of discussion on administrative problems, research progress, and legislative proposals. Out of these meetings came the proposals and organized political effort that led to the Hatch Act of 1887. A similar meeting in 1887 also led to the formation of the Association of American Agricultural Colleges and Experiment Stations, an organization of great importance to the colleges during the next twenty-five years.

Provisions of the Hatch Act of 1887: While the writing of the Hatch Act will be discussed in detail in Chapter V, the basic provisions of the act need attention here. The overall objective of the act was to "aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science." To accomplish this objective, the act provided that:

(1) Each land-grant college was to receive $15,000 for the establishment of a department known as an agricultural experiment station;

(2) These stations were to carry out "researches and experiments bearing directly on the agricultural industry of the United States" (Section 2);

(3) The Secretary of Agriculture was to provide forms necessary for reporting the results of experiments; the stations were also to report all receipts and expenditures to the secretary (Section 3);

(4) Stations were to mail to farmers, free of charge, bulletins describing their research (Section 4);

(5) No more than one-fifth of the original appropriation could be used to build or expand buildings for station use (Section 5);

(6) Nothing in the Hatch Act was intended to alter the original relationship between the colleges and the state governments (Section 7);

(7) Any state already having an independent experiment station or founding an independent station in the future could apply Hatch funds toward that independent station; furthermore, any state which severed its relationship between the agriculture college and a university which was "not distinctly an agricultural school" could apply the Hatch funds toward that independent agricultural college (Section 8).

A complete version of the original Hatch Act appears in Appendix B.

From the Hatch Act of 1887 to the Smith-Lever Act of 1914

The Farm Economy: 1888-1914

This twenty-seven year period is composed of two different economic phases. From 1887 to 1900, the farm economy continued to languish. From 1900 to 1914, agriculture was on an uptrend. Indeed, this latter period became known as the "Golden Age of Agriculture," since 1910 to 1914 was so prosperous as to become the base period for twentieth century parity calculations. Many of the trends of the previous twenty-five years continued. The relative size of the farm population declined, mechanization increased, and the transition from subsistence to commercial agriculture, accompanied by regional specialization, continued.

The Changing Farm Economy: The movement of the farm population to urban areas continued. Although the farm population grew from 24 million persons in 1890 to 32 million in 1914, it fell from 42 percent to 32 percent of the total population of the nation (176, p. 457). The total

population increased nearly 60 percent during this period, reaching 99 million persons in 1914. The influx of immigrants accelerated during this period, averaging 640,000 persons annually. Immigration topped one million persons a year six times during the decade from 1905 to 1914, the only time in U.S. history this mark had been reached (176, pp. 8, 105-06).

Exports remained an important part of the market for farm products. However, protectionist actions in other countries began to limit the quantity of goods exported. Exports of beef, pork, corn and wheat peaked during the years 1897 to 1901. The quantities exported had increased 54 percent, 63 percent, 250 percent, and 62 percent, respectively during the previous decade. Turn of the century tariff increases in Europe, combined with increased foreign competition, reduced exports of beef (-55%), pork (-27%), corn (-80%), and wheat (-5%) by 1914. Only cotton increased steadily throughout this period, rising from 1.9 million pounds in 1887 to 3.4 million pounds in 1900 to 4.4 million pounds in 1914 (167, pp. 962-64).

The regionalization of production also continued. California began to concentrate more on production of fruits and vegetables, shifting wheat production eastward from California to Kansas and Nebraska during the years 1900 to 1915 (23, pp. 110-11; 76, pp. 82-85). Tobacco expanded and was regionalized in the South. Production of truck crops for sale in the urbanized Northeast spread along the Atlantic coast (132, pp. 395-98).

The changing structure of agriculture in this sixty year period is visible when one looks at the proportion of gross farm income coming from each enterprise. The share of income from staple foodstuffs and

livestock declined by 4 percent and 14 percent, respectively (to 11 percent and 26 percent) from 1869 to 1929. Income from cotton and wool remained constant at 15 percent during the period. The share of income from fruits increased from 2 percent to 5 percent; the share from dairy and poultry products increased from 16 percent to 33 percent (152, p. 6).

The centralization of food processing continued during this period. In 1890, four of the five leading centers for livestock packing were located east of the Mississippi River; by 1915, three of the five leaders were located west of the river. Following a 1901 ruling by the Interstate Commerce Commission which prohibited the railroads from giving western millers free storage in the East, milling shifted slowly from Minneapolis to Buffalo. Declining railroad rates and a decrease in home baking (which hurt the heavily advertised western brands) also contributed to the shift in milling. The baking industry was dominated by a few national companies and a large number of local bakers. Improved preservation processes and an increased variety of foods (such as Hawaiian pineapple) made canning the fastest growing food processing industry after 1900 (97, pp. 437-49).

The availability of rail transportation continued to increase. Miles of railroad track in service reached 238,100 miles in 1909, 5.8 percent more than in 1889 (76, p. 34). Freight volume increased 48 percent in the same period to 1,861 ton-miles per capita annually (122, p. 245). Agriculture's terms of trade relative to railroad rates improved substantially from 1895 to 1914 for corn, wheat, and cotton (76, p. 88). Ocean freight rates continued to decline in real terms (and relative to agricultural prices). Real export freight rates declined nearly 50 percent in the decade following 1900 (113, p. 106).

Finally, it is worth noting that the settlement of the American west was effectively completed during this period. From 1870 to 1880, 135,000 acres of new land were put into farms each year. During the 1880's and 1890's, this figure reached 187,000 and 117,000, respectively. Between 1900 and 1910, 66,000 new acres were put into farms each year. From 1910 to 1914, only 10,000 new acres were put into farms each year (113, p. 139). This slowdown in the expansion of production capacity had a stabilizing effect on agriculture and contributed to the prosperity of farmers in the early twentieth century.

The Continued Mechanization of Agriculture: The transition from hand power to horse power was completed by 1914. The number of horses and mules increased 45 percent between 1890 and 1914, reaching an all time high of 26 million head (176, pp. 517-18). By 1914 there were 17,000 gasoline powered tractors on U.S. farms and the age of mechanical power was dawning (176, p. 469). Moreover, non-animal horsepower on farms increased 13-fold from 1890 to 1919, reaching nearly 21 million horsepower. The number of windmills increased to 180,000 in 1919, a 125 percent increase over 1890 (176, p. 818). After 1914, horses would never again provide so much power on American farms.

Farmers continued to use more chemical inputs. Producers purchased more than 7 million tons of commercial fertilizer in 1914, a fourfold increase over 1890. The consumption of lime increased also, reaching 1.6 million tons in 1914, a 72 percent increase over 1910 (the first year for which data are available) (176, p. 469). Irrigation practices continued to spread. By 1910 nearly 12 million acres were irrigated, about 2.5 times that under irrigation in 1890. Land drainage also

became more common at the end of the period. By 1920, over 924,000 farmers had some form of artificial drainage in use on over 53 million acres (176, p. 433).

The value of farm equipment produced annually in the U.S. rose from $87.3 million in 1890 to $187.8 million in 1914 (176, p. 701). As mentioned earlier, the value of farm equipment per acre in 1909 was $2.64, an increase of 75 percent over the previous 40 years (61, p. 416). The total inventory of implements on farms in 1914 was $1.7 billion, 3.5 times that in 1890 (176, p. 457). The retail margin of farm implement stores remained in the 18 to 19 percent range during the period from 1889 to 1919, slightly below the average margin for all retail stores of about 27 percent (176, p. 848).

The mechanization of the dairy farm made advances as well. The invention of the cream separator, silo, and Babcock test (which determined the amount of butterfat in milk) made production and marketing of dairy products more profitable. During the Civil War, the widely respected agricultural editor Orange Judd remarked that he knew of no milking machine "except the human hand." By 1910, about 12,000 farms had mechanical milking machines. Still, the general use of mechanical milkers had to wait until electricity reached the farm in the 1930's and 40's. (97, pp. 457-59; 132, pp. 398-400; 176, p. 469).

Farm Prices, Output, and Income: As Figure 2 shows, the index of real farm prices stood at 87 in 1888 (1910-1914 = 100). Prices rose to a peak of 96 in 1891, only to fall to 82 in 1896, the low point of the 1890's agricultural depression. Prices rebounded to 89 by 1897, then averaged 91.2 from 1900 to 1904. They continued this rising trend,

averaging 93 from 1905 to 1909 and (by construction) averaged 100 from 1910 to 1914. Moreover, prices were a bit more stable during this period. At no time between 1896 and 1914 did farm prices decline for two consecutive years, and the largest drop was only 6 percent (1899 and 1903) as compared to a 9 percent drop from 1882 to 1886 and a 12 percent drop from 1891 to 1896.

The growth in productivity in this period was rather slow. The USDA's index of farm productivity (Table 1) stood at 94 in 1890 (1929 = 100). The index of productivity rose to 105 in 1900, but tapered off and averaged 95 from 1910 to 1914. Kendrick's index shows a similar pattern; standing at 83 in 1889, the index averaged 83.9 during the 1890's, 92.2 in the 1900-1909 period, and 91.6 from 1910 to 1914. Lu, Cline, and Quance confirm the conclusion that productivity grew slowly during this period (103, pp. 8-10).

Real gross farm output (see Figure 3) rose 25 percent during the 1890's to $4.1 billion in 1899. By 1914, real gross farm output was $6.2 billion, an increase of about 50 percent. Kendrick's work (Table 2) shows real net farm output to be $6.8 billion in 1889 and $9.6 billion in 1919 (1929 dollars) (93, p. 347). Again, if real land values are used as a proxy for farm income, the pattern remains the same. The average real price of land declined 7 percent in the 1890's to $24 per acre in 1899. By 1909, real land prices had increased to $38 per acre; by 1915, the price was $42, about 77 percent higher than in 1900.[2]

Farmer Unrest, Political Activity, and Prosperity: Following the decline of the Greenbackers, the attention of the "soft money" advocates shifted to silver in the 1890's as a source of expanding the money

supply. The issue was still the lagging farm economy, and the vehicle was the Populist party.

The Populist party's roots trace to the Northern and Southern Farmers' Alliances. Started in the mid-1870's, the Southern Alliance began as an anti-horse-thief and anti-land-grab organization in Texas; in Lousiana, it started as an organization dedicated to cleaning local cemeteries. In both cases, the talk soon turned to farm politics. In other states, Agricultural Wheels were formed, dedicated to the proposition that "agriculture is the great wheel or power that controls the entire machinery of the nation's industries" (153, p. 204). In the North, the National Farmers' Alliance and the Farmers' Mutual Benefit Association were founded and aided by the support of the farm publications of the day (153, pp. 194-219).

An 1889 meeting led to a loose coalition of the alliances under the banner of the Populist or People's party. The planks of the platform included the expansion of fiat money; the outlawing of futures markets for agricultural commodities; the free coinage of silver; the outlawing of land ownership by aliens; limits on taxation; economy in government spending; and ownership and operation of the communications and transportation industries by the people "as is the United States postal system" (153, pp. 229-30).

Following some success in the elections of 1890 (particularly in Kansas), James B. Weaver was nominated as the presidential candidate of the Populist party in 1892 (Weaver had been the Greenbackers' candidate twelve years earlier). The party platform contained the same points as in 1889, plus added demands for tariff reductions, popular election of senators, and the eight-hour workday. Weaver received just over

1 million votes out of nearly 12 million cast. Nearly 90 percent of his support came from the twenty-five states with strong Farmers' Alliances. Five senators, ten congressmen, fifty state officials, and 1,500 local officials won on the Populist ticket (153, pp. 294-304).

Following some gains in the South in the elections of 1894, the stage was set for the dramatic election of 1896. The Populists and the Democrats both nominated silver's leading advocate, William Jennings Bryan. This displeased some Populists that preferred nonredeemable paper currency over the silver-backed money desired by the Democrats. Still, having nominated Bryan first, the Democrats had deprived the Populists of the candidate they desired.

Bryan was a colorful orator whose Democratic party acceptance address rejected the gold standard in no uncertain terms: "You shall not press down upon the brow of labor this crown of thorns, you shall not crucify mankind on a cross of gold" (153, pp. 304-311). However, the Republican strategy to continue support of the gold standard succeeded. William McKinley defeated Bryan by 700,000 votes out of 13 million cast, drawing most of his strength in the Northeast and Midwest. The Populist party also lost a number of seats won in the previous six years. Their issue defeated, and farm prosperity on the horizon, the Populists were never again a force in national politics. A number of candidates ran as Silver Republicans in the West and Populist Democrats in the South, but they remained close to the major parties. The Populists did run third party candidates for president until 1908, but none gathered more than 118,000 votes.

In concluding, it is worth noting some of the deeper reasons for farm discontent and prosperity during the period from 1870 to 1914. Some

revisionists of economic history have concluded that the economic position of farmers during this period was not as serious as earlier claimed. Higgs dismisses claims of railroad or bank exploitation, citing nearly constant railroad rates (relative to agricultural prices) until 1900 and declining interest rates during the 1800's that reflected the reduced risk that accompanied the settlement of the West (76, pp. 86-99).

North cites three complaints of farmers: (1) declining terms of trade between the agricultural and nonagricultural sectors, (2) the use of monopoly power by railroads, grain buyers, et al., to absorb all profits that accrued from improved transportation costs, and (3) usurious interest rates by the bankers. He dismisses these claims (1) because the long run terms of trade were nearly constant before 1890, and improvements in manufactured goods meant farmers were actually getting more for their money; (2) citing Higgs, he notes that railroad rates declined and that the divergence between U.S. farm prices and market prices at Liverpool narrowed throughout the period; and (3) he observes that few farms were mortgaged (Kansas was the highest with 60 percent of the farms mortgaged), mortgages were short term (the average life of farm mortgages was 3½ to 4½ years), and competition in the mortgage market did exist in many areas. In concluding, he admits individual grievances did exist, "<u>but had these specific situations been changed or modified anywhere along the line, the basic distress felt by the farmer would not have been alleviated</u>" (emphasis in original) (113, pp. 130-134).

What then was the cause? Both authors agree that the instability of prices, combined with the desolation of nineteenth century farm life

led to the short-lived farm revolts. According to Higgs, "The American farmer generally lived on his farm a half mile or more from the closest neighbor and several miles from the nearest town. The loneliness of such life must have cut deeper as the number of urban alternatives grew and became more accessible . . . . One hundred and sixty acres was a small world, and many had less" (76, p. 101). On this point, the more traditional historian agree. Fite notes the comments of nineteenth century farmers and observers:

> . . . farm life "was drudge, drudge, from daylight to dark, day after day, month after month, year after year";
>
> . . . to a farmer, "Mother Earth is an exacting parent, calling for constant and regular toil, and whipping him day by day with weeds to be hoed, dry gardens to be watered, . . . and an almost endless round of embarrassments to be overcome" (62, p. 11).

Perhaps it was this reality that led an 1896 observer to believe "there was something at the back of all this turmoil [the Populist revolt] more than the failure of crops or the scarcity of ready cash" (75, p. 232).

As for the prosperity that followed, it can be credited to several factors: the closing of the American frontier; the increase in domestic demand through immigration and urbanization; the continued strength of foreign markets; a trade surplus and expansion of Alaskan gold output, both of which increased the money supply; and relaxation of banking regulations which also allowed the money supply to increase after 1900 (26, pp. 115-21; 64, p. 123). These factors led one economic historian to proclaim, "For a decade or so American agriculture knew the bliss of equilibrium" (35, p. 112). More accurately, having known the bitterness of an equilibrium where supply shifted to the right faster than demand, farmers came to know the bliss of the opposite condition.

The Land-Grant System: 1888-1914

At the beginning of this period, the president of the University of Tennessee's Board of Trustees complained about the condition of the colleges:

> If there was no effort to kill the child [the agricultural college] outright, there was to make and keep it sickly and puny by giving it insufficient air and food. It was put off in a cold corner, and, like Oliver Twist, was fed on a limited quantity of the thinnest possible gruel. And though, like Oliver, it piteously begged for more, like Oliver it got no more (3, p. 170).

Change, however, was on the way. Bolstered by the Hatch Act, progress in teaching and researching agriculture began slowly, then accelerated into the twentieth century.

Internal Organization of the Colleges: Early in this period, the problems of the past continued to plague the land-grant system. In addition, there was the problem of defining the responsibilities of the colleges and the experiment stations.

As agricultural science developed, the curriculum became more advanced and course offerings quickly became more diverse. In 1890, Cornell offered 3 courses in agriculture; by 1900, the number reached 37, and by 1914 it reached 169. Similarly, Kansas offered 112 courses by 1910; Michigan, 80; Illinois, 142; Oregon, 123; and Iowa, 170. Indeed, the pendulum had swung so far that the colleges soon became concerned about their lack of humanities and economics (56, pp. 119-20). Also indicative of this growth, 100 books on agricultural science were published by agricultural college faculty up to 1895; 300 were issued during the next decade (157, p. 126).

As course offerings became more attractive, the number of students rose and the number of faculty being produced by and employed by the colleges increased. As shown in Table 3, the financial support of the colleges increased tenfold between 1890 and 1909. Of the $18 million of college income in 1909, state governments provided $10 million, four times that provided by the federal government. While a large number of students were enrolled in nonagricultural majors, Kellogg and Knapp estimate that 20 percent of the student population was enrolled in agriculture in 1900 (91, p. 6). The development of Michigan State College is illustrative of the growth of the times: enrollment in 1915 was four times that in 1896; the teaching staff had increased five-fold; the entrance requirement was raised from an eighth grade certificate to a high school diploma; the value of the physical plant tripled; annual appropriations from the state legislature grew from $16,000 to $560,000 (98, pp. 197-98).

Table 3

Development of the Land-Grant Colleges, 1890-1909

Year	Number of Students	Number of Faculty	College Income	Value of Property
1890	9,433	735	$1,846,000	$23,000,000
1895	--	--	3,415,000	--
1900	39,603	3,171	7,112,000	--
1905	--	--	11,650,000	--
1909	72,865	5,623	18,596,000	113,292,000

Source: 16, p. 37.

The most immediate problems for the newly founded experiment stations were to find station directors and department heads and to establish libraries and laboratories (5, p. 38). Furthermore, these had to be in place in order to receive the first Hatch funds in 1888.

In addition, a line of authority had to be established. In only three cases--Ohio, New York, and Connecticut--were independent stations founded. In many cases, the president of the university or the dean of the agriculture college was named the first director of the experiment station. Sometimes, this was done for reasons of economy; in other cases, it was done to protect the authority of the chief offices. As the responsibilities grew, most schools transferred the job to the dean; in a few, the job went to another officer. In some cases, the station director reported directly to the president, an arrangement that sometimes prevented cooperation between the dean and the director (157, pp. 221-22).

Two organizational forms were used. In the first, the director was the chief authority, with all station workers answering to him. In the second, the director was simply a presiding chairman over a democratic committee of all department chairmen. Most schools eventually drifted toward the first system. The second system resulted in the different department heads refusing to be subordinate to others. As a result, too many decisions were appealed to the president, often to the dissatisfaction of all involved (15, pp. 100-110; 185, pp. 68-69). By 1914, three stations--Ohio, New York, and Connecticut--remained independent of the college. Ohio and New York joined their stations to their colleges in the 1920's, leaving Connecticut as the only free-standing station.

The Development of Agricultural Research: By establishing the principles that experimental work need not be a profitable venture and that the institution was an experiment station and not a model farm, the Hatch Act freed researchers from some of the constraints placed on agricultural research in the previous period. Scientists quickly learned, however, that the time was not right for extensive original research. As bulletins were distributed to farmers, the demand for answers to practical problems increased. The emphasis, according to Eddy, "was on today's best action, not tomorrow's lasting solution" (56, p. 95).

This short run emphasis was the result of several factors. Farmers became anxious for answers, and researchers were expected to provide them. Many researchers were also required to teach classes. Most stations were assigned regulatory duties by the state legislatures. Finally, many stations suffered from political interference and diversion of Hatch funds to other purposes (123, pp. 214-16; 130, pp. 4-6).

Much of the work at the stations involved repetition or adaptation of work done at other stations. Such work served two purposes. First, it helped verify the results of others' work. Second, it helped convince farmers that the results of other stations also applied in their localities. Many stations were also involved in studies of agricultural conditions (meteorological observations, geologic formations, and agricultural surveys), particularly in western states and territories. Regulatory work at the stations increased; feed, seed, and fertilizer regulation were assigned to most stations, even though most states did not provide funds for such work (187, p. 4). Still, important work was done. Common work at many stations included work on plant growth patterns, the causes and prevention of plant diseases, collection and identification of plants

and insects, fertilization and irrigation rates, and testing the adaptibility of plant types to various regions. In 1904, for example, there were nearly 1,300 tests of 490 corn varieties in seven states (158, pp. 141-64).

Perhaps no other discovery during this period was as important as the development of the Babcock test at the Wisconsin experiment station. Designed to determine the butterfat content of milk (and thus, the size of the farmer's paycheck) the Babcock test made dairying a more profitable venture by helping farmers cull their herds and by allowing the standardization of milk prices. One observer noted that "the Babcock test was to associated dairying [cooperative dairy marketing] what the Morse electric telegraph was to railroad operation" (112, pp. 87-88).[3]

Relations With the Farm Community: The relations of the colleges with farmers improved only in the later years of this period. During the 1890's, several colleges were caught in the political uprisings of the day. In some cases, the Grangers continued to lobby for the creation of agricultural colleges independent of the state universities. In a few cases, the Grangers hoped to use the Hatch funds as a springboard for establishing an independent station, and then an independent college (28, pp. 100-01; 58, pp. 17-43; 151, pp. 55-77; 177, pp. 303-25). In Kansas, the center of the Populist storm, the agriculture college had three presidents between 1896 and 1900. All college employees were fired following the elections of 1896 in which the Populists gained control of the statehouse. The Republicans returned the favor upon regaining power in 1898 (41, pp. 67-83).

A sampling of an 1898 survey of experiment stations shows the mixed attitude of farmers toward the stations:

Georgia--"The more intelligent [farmers] are more friendly; the more ignorant, the more prejudiced;"

Idaho--"Merely apathetic;"

Iowa--"Friendliness and confidence of all who are familiar with our work;"

Louisiana--"Utmost friendliness and confidence, except on the part of a very few;"

Michigan--"Majority friendly, but a minority of considerable size and aggressiveness are hostile;"

Vermont--"The uninformed are indifferent;"

Wyoming--"Indifferent; they do not care to know much about us; of course, there are notable exceptions;"

Mississippi--"As is usually the case in this world, we get approximately what we deserve" (12, pp. 27-28).

The same survey showed that the stations believed their results were widely used by farmers. However, a 1913 poll found that 44 percent of the farmers surveyed believed farming could only be learned by experience; only 6 percent said they found station literature to be useful (63, pp. 202-14; 142, pp. 215-20).

Relations With the USDA: The USDA maintained its dedication to research during this period. As a result, the USDA remained supportive of the stations. Founded in 1888, the Office of Experiment Stations operated mainly as a clearinghouse for research results, compiling these results and printing them in the Experiment Station Record. The office maintained the official position that the stations were for research purposes, not model farms, and that the work of the stations should be

free of political interference (184, pp. 249-50). The office also sent a nonvoting representative to the annual meetings of the newly formed Association of American Agricultural Colleges and Experiment Stations.

Two issues did arise with the potential for conflict between the USDA and the stations. The first was the idea of a USDA controlled central station to do basic research. Although such efforts were strongly resisted by the stations, the office gradually acquired more power for coordinating some research that was performed by state stations and supported by non-Hatch appropriations (158, pp. 132-34).

Another issue that arose was the diversion of Hatch funds to non-research uses. In more than a few cases, Hatch funds were diverted to pay teachers' and administrators' salaries, excessive rents, and inflated maintenance charges. In 1894, Congress granted the director of the Office of Experiment Stations the authority to determine the appropriateness of Hatch fund expenses and to withhold payments when irregularities occurred (48, pp. 57-58). This action was supported by an 1895 resolution of the land-grant college association (9, pp. 58-59). Relations still remained cooperative, however, with only one temporary case of payment withholding, and that not until 1912 (Oklahoma State has this dubious honor, the result of having purchased library books with Hatch funds)(134, pp. 136-37).

The policy of the office was one of influence rather than coercion. The annual on-site examinations required by the 1894 law were referred to as "visits" rather than the more ominous sounding "inspections." A good deal of the credit for this attitude must go to the office's director, Alfred C. True (who served from 1893 to 1915) and Agriculture Secretary James "Tama Jim" Wilson (1897-1913, the longest serving cabinet

officer in U.S. history) whose long tenures were dedicated to applying science to agriculture.

The Development of Agricultural Extension: The delivery of the information developed at the stations was an early concern of researchers and administrators. Initially, it was believed that researchers should come in close contact with farmers in order to solve problems and gain farmers' confidence. By the end of the period, however, the work load had become so great that the need for "middlemen" to serve as intermediaries between researchers and farmers was clear (3, pp. 29-45; 13, pp. 95-97).

Early efforts at extension included short courses in agriculture (actually held on campus), agricultural trains which toured the countryside with demonstrations and literature, and farmers' institutes or public lectures on agricultural topics, sometimes given by representatives of the college. In 1902, the colleges spent $163,000 on 2,700 institutes that reached 800,000 farmers, mostly in northern states. By 1914, funding had tripled, the number of institutes had tripled, and attendance had nearly quadrupled (156, pp. 32-41).

In the South, another form of extension arose out of the cotton boll weevil infestation. Striking Texas with full force in 1903, the weevil reduced cotton yields 50 percent in that state. Hundreds of families moved as fear of the weevil spread. That same year, Dr. Seaman A. Knapp had tried an experimental form of extension. A pragmatic man, Knapp understood the psychology of the farmer: "What a man hears he may doubt, what he sees he may possibly doubt, but what he does himself he cannot possibly doubt" (20, p. 155).

With this philosophy, Knapp's agents would visit a farm community, select a leading farmer, and instruct him in the best farming methods to overcome the weevil. Moreover, they would get local farmers and businessmen to pledge enough money to cover any losses the farmer might sustain. The project was a success the first year; Knapp's demonstration farms showed a profit during the worst cotton year in a quarter century.

The word spread quickly and, although the indemnification feature had to be dropped, farmers joined immediately. Led by the charismatic Knapp (who referred to his agents as "missionaries," developed the "Ten Commandments" for fighting the boll weevil, and told an audience to "get agricultural religion [science] or you will go to agricultural hell"), the cooperative demonstration project had 450 agents in 12 states in 1912. By 1913, over 100,000 farmers took part in the demonstration program (104, p. 264). Cotton yields of participating farmers were nearly double the national average (20, pp. 147-214; 156, pp. 63-64).[4]

Still, the extension movement had problems. Much of the work was funded by large companies--the railroads, John Deere, International Harvester, J. I. Case, and John D. Rockefeller's philanthropic General Education Board--leading one farmer to compare their interest to "that the shepherd has in his sheep; he takes care of them in order that he may secure more wool at shearing time" (141, p. 205). Academics feared conflicts of interest would arise between businesses and the experiment stations. Both the USDA and the colleges were opposed to an extension service independent of the department and the colleges.

Provisions of the Smith-Lever Act of 1914: The writing of the Smith-Lever Act is discussed at length in Chapter V. However, the provisions of this legislation, which established the cooperative extension

service, need a brief summary here. The overall objective of the Smith-Lever Act was to "aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same." To accomplish this objective, the act provided:

(1) Agricultural extension work would be inaugurated in connection with the land-grant colleges and would be carried out in cooperation with the USDA;

(2) That the work would be directed at persons not in attendance at the colleges in a manner agreed to by the USDA (Section 2);

(3) That each state would receive $10,000 plus additional funds based on the rural population of the state; these additional funds would be made available only if matching funds were provided by the state, county, college, local authority, or individual contributors (Section 3);

(4) That funds which were misapplied by any state must be replaced by that state; no money was to be used for the purchase or improvement of land or buildings, and no more than 5 percent could be used for the printing and distribution of literature (Section 5);

(5) That the Secretary of Agriculture would certify the eligibility of each state for funds and must report to Congress on the expenditure of funds (Sections 6 and 7).

A complete version of the original Smith-Lever Act appears in Appendix C.

Notes to Chapter III

1. These figures were estimated using nominal land prices (176, p. 457) and the index of wholesale prices for all goods (182, p. 26).

2. See note 1 of this chapter for an explanation of the calculation of these figures.

3. Prior to the Babcock test, there was no accurate way to determine butterfat content and thus, milk value. Milk was purchased on a volume basis, leading some farmers to "water down" their milk. The emminent dairyman W. H. Hoard later observed, "The Babcock test had more influence than the Bible in making dairymen honest" (43, p. 201; 67, pp. 39-40).

4. Knapp was wise enough to know that any effort to improve rural life also had to reach farm wives and children. To reach the former, he developed a system of Home Demonstration Work that taught improved homemaking methods. To reach the latter, he organized Boys' Farm Clubs and Girls' Home Clubs (which eventually became 4-H clubs) to teach farming and homemaking skills (104, pp. 44-107).

CHAPTER IV

NONMONETARY VALUES INFLUENCING THE CREATION OF THE AGRICULTURAL EXPERIMENT STATIONS

Innovations in the institutional structure of society are the product of the political decision process. The decision process produces a prescription--a statement of what ought to be done based on the positive and normative knowldge available to decision makers.

Normative knowledge deals with the goodness and badness of conditions, situations, and things. Nonmonetary (i.e., non-price) values are a subset of the normative knowledge that influences decision makers. To understand why one prescription is chosen over others, we must have an accounting not only of the monetary, but also of the nonmonetary values that affect the decision process.

The Hatch Act of 1887 and the Smith-Lever Act of 1914, which created the state agricultural experiment stations and cooperative extension service, produced institutional innovations. Different prescriptions for accomplishing an objective--the advancement of agricultural science--were offered. Contained in these different prescriptions were different sets of nonmonetary values that led decision makers to different conclusions about the proper prescription to follow. In resolving this conflict of prescriptions, some nonmonetary values were chosen over others as being more appropriate. That is, they were judged to be more

compatible with the objectives of the new institution and, therefore, the new institution was designed in such a way as to fulfill these values (i.e., promote the conditions providing goodness and avoid the conditions providing badness).

Chapter V discusses the writing of the Hatch and Smith-Lever Acts and the conflicts among prescriptions that had to be resolved in the process. In this chapter, the stage is set for that discussion by presenting an accounting of the nonmonetary values that affected the decisions that produced the state agricultural experiment stations.

A Word on the Research Method

When dealing with monetary values economists often must aggregate data. For instance, an economist wishing to find the price of corn for a given crop year will likely construct some weighted average that accounts for location of the market, date of sale, quality of corn, etc. Because of this process of averaging, it is very possible that no farmer sold his corn at "the" price of corn that year.

Similarly, this chapter seeks some "average" nonmonetary values that decision makers used in creating the experiment stations. In this aggregation process, historical materials are surveyed, similar values are aggregated, and an "average" value statement is determined. While it is unlikely any of the decision makers would agree with the exact wording used here, they would likely agree with the general content of the statement (just as a farmer might agree that the average price of corn was "about right" even though he sold his for a different price). The procedure in this chapter will be to give an average statement of each value followed by a sampling of quotes to support that statement.

The testing of knowledge, either positive or normative, involves subjecting concepts to the tests of clarity (lack of ambiguity), coherence (logical consistency with other concepts), and correspondence (a comparison of the concept to perceived reality) (87, p. 12). Each value in this chapter was subjected to these tests. Clarity was tested by stating each value in terms that define only one condition, situation, or thing as possessing goodness or badness. Coherence was tested by comparing each value to similar values (for instance, by comparing one scientific value to another to insure that the values defined as scientific values are logically related). Correspondence was tested by citing expressions of the same value by different persons, thereby comparing the concepts to reality based on the experiences of different individuals.

The values in this chapter are also catalogued into classes (such as the class of values defined as the values of science or the class defined as the values of agrarian fundamentalism). This classification is based on Knight's notion that items (in this case, values) should be classified so that items within the same class are similar with respect to important characteristics and dissimilar with respect to unimportant ones. Across classes, items should differ with respect to important characteristics (94, pp. 205-8).

For instance, the important characteristic of the values of science is that they define a good environment in which to do research; the values of agrarian fundamentalism, on the other hand, define the good aspects of farm life and prosperity. Thus, the values within each class are similar with respect to the important characteristic of that class, but different across classes. Similarly, within each class there are subclasses of values that are differentiated in a like manner. Within

each subclass, the quotations cited are similar in that they define the particular condition that provides goodness (such as honesty). Across subclasses, however, the characteristics that provide goodness are different (honesty, for example, is different from freedom).

The values discussed in this chapter were identified by identifying the prescriptions offered by different decision-making institutions, then identifying the important nonmonetary values that led to the offering of those prescriptions. It should be recognized that these values have been reconstructed from historical materials. Most were expressed in a political context. Given this, the cynic may doubt the validity or sincerity of such values. In defense of this work, Hathaway's thoughts on this problem are relevant:

> Some may argue that in modern governments speeches and messages by [a politician] are not a reflection of his personal values and beliefs, but are merely designed to project a desirable 'image' in an advertising sense. Even if it were true, it would not remove the point. The fact that the drafters of the message felt an expression of such [values] was the desirable image suggests they thought that others shared the same beliefs (emphasis in original) (72, p. 7).

Thus, this work assumes that political speeches and political decision making do reflect values that are important to some groups in society. Five major sets of values are identified here as important to the creation of the experiment stations: the values of science, vocationalism, federalism, strict constructionism, and agrarian fundamentalism.

The Values of Science

The responsibility of the scientist, according to Einstein, is to search for relations "which are thought to be independent of the searching individual" (57, p. 799). There are certain values, shared mostly

by scientists, regarding a good environment in which to seek such relations. These values deal with the goodness of scientific progress, honesty, patience, and scientific freedom.

The Utility of Science

The first value of science is that the advancement of science is good since it provides the basis of progress for society. According to this view, science, by improving the material well-being of man, was the driving force in the betterment of society.

Harvey W. Wiley believed this to be true when, as USDA chemist, he told the 1897 convention of the Association of American Agricultural Colleges and Experiment Stations (hereafter referred to as the association), "Rigid scientific investigation is the basis of all progress and that every truth, every discovery has in it a germ of usefulness to mankind" (11, p. 70).

President W. L. Broun of the Agricultural and Mechanical College of Alabama voiced a similar value in an 1892 address to the association. In it, he left no doubt as to the contribution of science to the welfare of mankind in the past and the important role agricultural scientists would play in improving society:

> No one knew a century ago that steam would revolutionize the world and change the methods of human industry. No one knew that it would enable England with its limited area and population to do the work that represents the equivalent of the manual labor of all the able-bodied men of the world, entered every department of human industry, and largely modify our education systems. It is then no longer a question whether science shall be taught or not. The spirit of the age demands it . . . .
>
> I beg you to consider the relation you hold to the present and future well-being of our country. You are scientific investigators working for the improvement and promotion of that

> industrial art which directly concerns the well-being of the largest portion of the human family . . . . You are working to ameliorate the condition of human life, and by showing how better to subdue the earth, to bring increased prosperity and happiness to the home of the people, you are not working for self, but for the good of humanity (7, pp. 63-66).

Scientists, however, were not alone in their confidence in science. As early as 1834, Jesse Buel, editor of the agricultural periodical The Cultivator, told his readers, "The study of these laws [of science] and their application to the wants and comforts of life, have for ages, constituted one of the highest and most useful employments of man and have contributed, more than any other human effort, to refine and elevate us above the grosser and degraded condition of savage life" (42, p. 55). He was equally optimistic of the contribution science would make in improving the life of the farmer: "All young men who wish to become respectable, or excel in agriculture should be impressed with the necessity of obtaining knowledge in the science of agriculture . . . [and] should resolve to obtain this knowledge; and these two things being premised, there is little doubt of success" (42, pp. 158-59).

The Goodness of Honesty

Another value of science is that it is good for scientists to be honest and to determine the truth objectively. To be effective as a seeker of truth, the scientist must be believed. His credibility must be earned by his work and respected by the public. The key to this public respect, in the opinion of scientists, was honest, accurate investigation.

At the organizational meeting of the association in 1887, President B. L. Arnold of Oregon Agricultural College warned his colleagues,

"Nothing should go [to the farmer] from the colleges but well-established principles" (2, p. 11). At the same meeting, the report to the convention by the Committee on Station Work (composed of Samuel Johnson and Wilbur Atwater of the Connecticut station and George Cook of the New Jersey station) concurred, concluding that honesty and the confidence of the public were indispensible: "The American farmer, although not a scientific specialist, has a keen sense of what is sound and good, and even if he does not understand the details or the exact drift of the research, if he has faith in the man who is carrying it on, he has faith enough in the thing itself to be glad to have it done" (2, p. 29).

In 1909, Cornell's Dean of Agriculture, Liberty Hyde Bailey, addressed the association on the "Better Preparation of Men for College and Station Work" and concluded that nothing short of an unwavering dedication to truth would suffice:

> Our conclusions should follow naturally as a result of a line of work, and it matters not whether anybody is pleased with them or not. An honest man can withhold nothing in the search for truth, nor color his opinions for any person or for any benefit to himself, or detract anything except on new evidence or a new consideration of the subject. When he arrives at a conclusion, he speaks; and when he speaks, he stands . . . . It is the obligation of the investigator to know no other criterion than truth. If fame attracts him to modify his opinions, he is not a scientific man. If he modifies or understates or overstates his scientific conclusions because he is afraid of them, he does not have a scientific mind and does not have integrity of thought, and he is not honest. He does not go where the truth leads him . . . . [The scientific man] starts out to find what is true. He divests himself of all preconceived notions as to what the result is to be. He merely wants to know what is the fact, and if the fact that he discovers today contradicts the fact he discovered yesterday, or even contradicts his own public statement of yesterday, he is the first man to acknowledge and publish the contradiction; and he finds as much satisfaction in the discovery as if he had not made an imperfect conclusion the day before (15, pp. 27-28).

Two years later, President H. J. Waters of Kansas State discussed the ethics of station work and declared persons with less than unquestioned honesty unfit for station work:

> The moment the slightest question arises regarding the honesty or fairness of the man who has conducted an experiment, or regarding the fairness of the institution issuing the report, the work is without force or effect. The results of an experiment depend for their value upon the honesty with which it has been conducted . . . .
>
> Any man, therefore, who cannot be trusted to be absolutely fair and honest with his superiors, his associates, and his subordinates, who cannot be trusted absolutely in his private as well as his public life, cannot safely be entrusted with matters of such importance as original research, and should be put to work where he may conveniently be watched and where the opportunity for doing serious harm is not so large (17, pp. 143-44).

In that same discussion, Professor C. E. Marshall of the Michigan Agricultural College added that, "From the very nature of the work, no more honest or conscientious men can be found in the world" (17, p. 154). Clearly, the goodness of honesty as a necessary condition for successful research was a strongly held value among scientists.

The Goodness of Freedom

An essential value of science is that it is good for scientists to be free to pursue truth, unconstrained by economic and political interests. According to the scientific view, researchers must be free to follow any lead in the pursuit of truth if they are to make their maximum contribution to society's welfare; political, professional, or economic considerations must never distract scientists from their mission of acquiring knowledge. This value was widely held among scientists, and their dedication to it became stronger as other pressures, particularly

extension work, threatened to distract them in the early twentieth century.

As early as 1887, the association's Committee on Station Work (again, composed of scientists Samuel Johnson, Wilbur Atwater, and George Cook) reported, "The success of research always depends upon the exercise of the individuality, as well as the ability of the men involved in it. Freedom of action is one of its first conditions" (2, p. 30).

Discussing the organization of college work in 1909, President A. B. Storms of Iowa State told the association, "Insofar as academic or administrative freedom is interfered with by political influence, dry rot is certain to result and corresponding inefficiency and demoralization" (15, p. 56). In the discussion of President Storms' paper, the Director of the New York station, W. H. Jordan, cautioned that researchers should not by subject to frequent distractions: "An investigator to be efficient must remain mostly within the atmosphere of inquiry and should not have his continuity of thought and effort interrupted by duties foreign to his general trend of effort" (14, p. 115).

Two years later, Jordan reiterated this value, telling his colleagues that substantial contributions to science could be made without leaving the laboratory:

> I am not wholly in sympathy with the sentiment . . . that the investigator must smell of the soil. It is a good healthy smell, but if you will recall what you already know, and will examine into the environment and relations of the men who have brought out some of the most valuable contributions to agriculture, you will find that they did not always know much about the soil. It is not necessary that you take a man out on the soil in order that he may work out a truth tremendously important to agriculture (16, p. 159).

Vermont Director J. L. Hills agreed, claiming the station director must protect his scientists from outside demands on their time:

> The Marathon race of ancient and modern times is a long continued, grueling contest in which men run about twenty-five miles straight-away. The Marathon racer does not turn aside every mile or two, first to try pole vaulting, then to put shot, then to take a broad jump, and then to leap hurdles . . . . He does not permit himself to be diverted from the one thing he is doing--running. Similarly, if the station worker has to do several things at once, or to serve two or more masters, to teach, to administrate, . . . to engage in extension work, his research work will suffer . . . .
>
> The station director . . . should be the Cerberus who guards the inmates of his domain against the insistent demands of those who would withdraw them from their tasks for work in the outer world (16, p. 164).

In many cases, scientists were joined by administrators in advocating freedom as a prerequisite for research. For instance, in 1894, the Board of Regents of the University of Wisconsin took the official position,"In all lines of academic investigation it is of the utmost importance that the investigator should be absolutely free to follow the indications of truth wherever they may lead" (56, p. 99).

Being primarily a scientific institution itself, the USDA also agreed on the importance of freedom to research. As early as 1888, Agriculture Commisioner Norman Colman warned that political influence had no place in the scientific environment:

> The greatest danger [to the stations], that of political interference and manipulation, needs to be carefully guarded against. Whenever it is understood that anything but special fitness constitutes qualification for positions in the management or work of these institutions, deterioration in the workers and the work is for sure (184, p. 249).

Later, the Office of Experiment Stations often expressed support for scientific freedom. A 1908 editorial in the Experiment Station Record (the official publication of the office) warned against professional and financial intrusions into scientific freedom:

> The researcher must be free of all coercion whatever. In reaching his conclusions he should be equally free from the prescription of received opinion and the temptation to exploit his results for the purpose of obtaining future support (175, p. 303).

In the eyes of the scientific community, there was no doubt about the goodness of scientific freedom and its necessity for successful research.

The Goodness of Patience

According to the agricultural scientists, it is good for both the public and the scientist to be patient with research work. This value was related to the growing belief that the discovery of truth was inevitable if society was persistent in its search. There was, during the nineteenth century, a growing confidence that science could solve the problems of practical men. This confidence was shared by the scientific community, which was also confident of the inevitability of truth. This inevitability was expressed by Pennsylvania State College President George Atherton in his address as president of the association in 1888:

> [The discovery of new truths] is self-propagating, and leads on and on, once discovered, into new fields, widening as we go, as the circles from the stone dropped into the lake widen, and thus the bounds of human knowledge are continually increased (3, p. 79).

Three years later, the presidential address of Director H. H. Goodell of Massachusetts maintained this confidence, but tempered it with the knowledge that research work was time consuming and uncertain:

> It takes ten years at least to establish one agricultural fact, but it is on the aggregation of facts the stable law depends, and although we cannot always see the immediate practical value of the addition of a new fact to this fund of knowledge, still no one can ever tell how much vital importance is hidden in it (6, p. 54).

In 1912, Georgia Director H. C. White again spoke to the association about the inevitability of truth and, again, he cautioned that such work must be done by the persistent researcher:

> All the mighty processes of Nature are ours to control when we shall have mastered the manner of them. But we may not master until we understand. All these things we ought to know; all these things we can know; they are not beyond our knowledge and comprehension. There is no bar to fullest knowledge in all these things that will not fall before earnest, persistent intellectual attack. But the attack must be directed by the thinker in his closet rather than by the workers in the field (18, p. 86).

These four values, shared primarily by the scientific community, defined a good environment in which to conduct research. As such, they played a major role in the prescriptions offered during the writing of the Hatch and Smith-Lever Acts.

The Values of Vocationalism

Vocationalism stresses the practical importance of science in improving the lives of workers. Truth for its own sake holds no credence here. Instead, truth for the sake of raising the productivity of workers is the sole source of utility that derives from a scientific discovery.[1] This is not to imply that a conflict of scientific versus vocationalist values should be considered inevitable. Indeed, as this section will show, agricultural scientists were also very vocal in expressing their vocationalist values.

The Utility of Science

According to the vocationalist, scientific research which helps the working class improve its lot in life is good. The objective of all

research, according to the vocationalist, is to improve the material well-being of the working class and, in the case of the experiment stations, farmers in particular. Farmers, of course, expressed this value. As one farmer complained at the 1882 meeting of the Wisconsin Agricultural Society, "We do not want science floating in the skies; we want to bring it down and hitch it to our plows" (43, p. 18).

Farmers were joined by agricultural scientists in voicing this value, possibly as a defense against the classically educated elitists who cared little for applied science. This value was expressed many times during the meetings of the association:

> President George Atherton, Pennsylvania State College, 1889, said that science should "train all the power of the brain, eye, and hand to work in unison to increase the productive capacity of the earth to cheapen the means of subsistence and thus to give man more leisure" (3, p. 33);
>
> President W. L. Broun of the Agricultural and Mechanical College of Alabama declared in 1892, "The test of exact knowledge of the principles of science is the ability to put them in practice" (7, p. 62);
>
> Director Issac Roberts of the New York station, 1897, reminded his colleagues, "So long as teachers study science for science' sake the farmer will swear at the bugs for the bugs' sake" (11, p. 70).

New York Director W. H. Jordan provided the most eloquest expression of this value when he rejected truth for its own sake in his 1903 address as president of the Society for the Promotion of Agricultural Science:

> If we measure the worth and dignity of knowledge by its utility in material things, that is, by its importance to industrial life and its relation to man's physical welfare in giving him increased control over his environment, then it is clear that applied science is the all important and triumphant factor of . . . civilization . . . . Physical well-being and material prosperity are conditions essential to the nourishment of the best fruits of civilization, and that in contributing to industrial achievements and to

> the comfort and independence of the individual, science is indirectly a powerful aid in cultivating man's intellectual and moral attributes . . . . Abstract truths are cold, inanimate, and devoid of human relation. They may delight the intellectual recluse through the mere pleasure of their mastery, but they are not joined to human need and effort . . . . The assertion that to know is greater than to act, that abstract truth is a larger service, is intolerable in this humanitarian age (173, pp. 625-28).

Four years later, at the semicentennial celebration of the Michigan Agricultural College, Jordan repeated that the sole utility of science resulted from its usefulness:

> Again, an investigator in science should be judged by his controlling motives or point of view. It has been said, with what accuracy I do not know and shall not inquire, that an English university once wrote over its portals: 'No useful knowledge taught here.' One of our own scientists is absurdly reported to have expressed a regret that chemistry was ever put to money-making uses. Those of us who are devotees of applied science repel such sentiments and, having right on our side, declare with great fervor that we will have nothing to do with knowledge that cannot be brought into the service of humanity. We are glad that learning has escaped from the monastery into a throbbing, busy world. We have no sympathy, either, with the modern monastic spirit sometimes manifested by those who claim to be working in the field of what is designated as pure science and affect contempt for the utilitarian (30, p. 134).

The Goodness of Productivity

In simple terms, the second value of vocationalism is that it is good for an individual to contribute to his own and society's welfare by being productive. This value is an expression of the work ethic, that an individual should contribute to the welfare of society by working and providing for himself and others.

The goodness of productivity was expressed by Purdue University President J. H. Smart, claiming in his 1890 presidential address to the association, "The most valuable man is he who takes rude material and

produces something of high value out of it, and who takes pride in what he has wrought" (5, p. 40).

Congressman Gilbert Haugan expressed the badness associated with inactivity during the debate on the Smith-Lever Act in 1912:

> Work is what God intended us to do . . . . Let no young man or woman delay, . . . let him work and forget his trials, troubles, and tribulations of life . . . . If you suffer the mind or body to be unoccupied, temptation and evil thoughts will overtake you; toil terminates in enjoyment . . . . Of all the contemptible things idleness is the worst; it leads to sin, device and destruction (160, pp. 11614-16).

Congressman Cyrus Cline of Indiana agreed, adding that there was another benefit to society, namely, "The man or woman who is constantly employed not only is taken out of the conditions that foster crime, but becomes interested in the success of business and the prosperity of the country" (160, p. 11620).

The Conduct of Research

An extreme form of vocationalism holds that it is good for science to be researched and taught by persons familiar with the practical problems of farmers. Voiced exclusively by farmers, this value took an extremely practical, nearly anti-intellectual view of science and how it should be conducted.

This value was expressed by "W. A." in a letter to the editor of the New England Farmer as early as 1852:

> The art [of agriculture] cannot be taught to any advantage, except by practice. He who teaches it ought to have acquired his qualifications by absolute practice . . . . He ought to have a familiar acquaintance with most kinds of tools and appertaining to the business, and also of the various kinds of farm work (54, p. 251).

By 1880, this view had softened somewhat, and some farmers were at least willing to allow research to be done by specialists. It still required that the work done at the stations be purely practical, as expressed by an editorial in a rural New York newspaper:

> The farmers of the state will be satisfied with nothing short of an experimental farm managed by men with ears to hear their questions and capability and willingness to answer them in a practical way before the questioner's eyes on the farm; not a mere station with a chemical laboratory where a few scientists with fat salaries can pursue their studies and amuse themselves with their visionary schemes and pet theories of farming, as valuable to the average farmer as to the man in the moon (164, p. 23).

To conclude, the values of vocationalism define good science as that which contributes to the material well-being of farmers. These values, like the values of science, were important to the creation of the agricultural experiment stations.

The Values of Federalism

Federalists support aggressive action by a central government in order to create a more perfect union.[2] Such a position is based historically on Alexander Hamilton's liberal interpretation of the Constitution: that the central government has, in addition to the specific powers enumerated in the Constitution, "implied powers" that result from the "necessary and proper" clause of the Constitution.[3] Hamilton's test for determing the constitutionality of a legislative measure was

> the end to which the measure relates as a means. If the end be clearly comprehended within any of the specific powers, and if the measure have any obvious relation to that end, . . . it may safely be deemed to come within the compass of the national authority (emphasis in original) (92, pp. 179-80).

The values of federalism, dealing with the interpretation of the Constitution, define a good government as one which acts aggressively to promote the general welfare of the nation.

Interpretation of the General Welfare Clause

The most important value of federalism is that it is good for the Constitution to be liberally interpreted so as to provide for the general welfare of the people. According to the federalists, the general welfare clause included in the preamble of the Constitution provides the federal government with the authority to act aggressively on behalf of the citizens. During the period from 1870 to 1914, there was a growing belief that much good would result from aggressive action on the part of the central government. President W. O. Thompson of Ohio State told the association in 1912 that such actions resulted not only in an increase in the welfare of the people, but an improvement in the government itself:

> Everyone recognizes that we have had a progressive interpretation of the Constitution under which we live and that the interpretation has tended steadily toward enlargement of the powers of government. This enlargement has chiefly been in the interest of farmers . . . .
>
> The public welfare clause of our Constitution and other portions have been generously interpreted in order to justify the government's participation in many activities looking to the development of the people . . . . The fact that government has become more humane, more beneficent, and almost philanthropic in many of its activities, it is probably due to the humanizing influences of the educational activities supported and stimulated by the government . . . [which] softens and ameliorates the harshness of strong government.
>
> The growth and strength, therefore, of our government is not a thing to be feared but rather to be welcomed. This will always be true so long as the institutions fostered and supported by the government may react, through their representatives, upon the sources of authority (18, pp. 93-94).

The Necessity of Government Action

In many cases, according to the federalists, it is good for the federal government to act to procure those benefits which the states could not achieve by acting alone. Federalism, according to Dean Eugene Davenport of the University of Illinois, holds that "to the nation in the operation of its legitimate affairs [i.e., promoting the public welfare] no state boundaries exist" (19, p. 123). Following this reasoning, Davenport told his colleagues in 1912 that five reasons existed for aggressive federal action, in this case the Smith-Lever Act (all of which can be presumed to be good in the eyes of a federalist):

> It nationalizes the movement at once;
>
> It gains time in starting the movement in reluctant states and initiating activities that might long remain dormant in the best of states;
>
> It tends to equalize conditions by taking money from prosperous sections to help build up the poorer sections;
>
> It takes from all the people for the development of agriculture;
>
> Indirect Federal taxation is less noticeable (156, pp. 90-91).

The Federal Government as Catalyst

A closely related value is that the aggressive use of the power of the federal government is good since such action encourages increased activity by state governments. This value was expressed as the second of Eugene Davenport's five points above; it was reaffirmed by Georgia Senator Hoke Smith during the Smith-Lever debate in 1914:

> The National Government 50 years ago made the first appropriation toward the agricultural colleges. At that time the States were doing nothing in that direction. Instead of taking from the States a feeling of responsibility, the States have more and more, following the lead of the National Government, increased their local appropriations to support their agricultural colleges, and now more than five times as much is spent by the States to support their agricultural colleges as the amount appropriated by the National Government (162, p. 2579).

These three values of federalism, which define the good aspects of aggressive federal action, were essential to the writing of the Hatch and Smith-Lever Acts. Since many persons still believed in a strict interpretation of the Constitution, federalist values became an important justification for federal action on behalf of agricultural research and extension work.

The Values of Strict Constructionism

Strict constructionism insists that the Constitution is to be interpreted literally rather than liberally. This position traces its American intellectual lineage to James Madison and Thomas Jefferson. To Madison, the general welfare clause of the Constitution was nothing more than an introductory phrase that conferred no other powers on Congress than those specifically enumerated. Interpreting the Constitution, therefore, was nothing more than a recognition that federal authority was limited by "the plain sense and implication" of the document (92, pp. 210, 748). Similarly, Jefferson believed a liberal interpretation of the general welfare clause would have the effect of

> giving [Congress] a distinct and independent power to do any act they please which might be for the good of the union [and] would render all the preceding and subsequent enumerations of power completely useless. It would reduce the whole instrument to a single phrase--that of instituting a Congress with power to do whatever would be for the good of the United

> States; and as they would be the judges of good or evil it would also be a power to do whatever evil they pleased. It was intended to lace Congress up strictly within the enumerated powers, and those without which, as means, those powers could not be carried into effect (159, Appendix, pp. 124-25).

Thus, the values of strict constructionism define a good government as one in which the central government's powers are strictly bound by the Constitution and as one that avoids any breach of the Constitution since such actions are likely to damage the people's welfare in the future.

Interpretation of the General Welfare Clause

At the heart of the strict constructionist view is the value that it is bad for the general welfare clause to be abused; abuse inevitably leads to an increase in the power of the central government. According to the strict constructionists, the general welfare clause should not be used for the benefit of one group, lest it lead other groups to demand similar preferences and an eventual diminution of personal freedom for all.

This was the view taken by Senator John Ingalls of Kansas when he claimed the Hatch bill was

> not in any sense whatever, responsive to any great demand. It is one of that great category of measures which have been presented to us in times past in obedience rather to the clamor of a certain select class of self-constituted reformers of all the institutions of the earth and it is based on an entirely mistaken apprehension of the theory of this Government. It illustrates the tendency of this class of agitators to demand the continual interposition of the National Government in State and local affairs, with the result, as I believe, of absolutely destroying the independence and freedom of individual conduct, and subverting the theory on which the Government is based (159, pp. 723-24).

Senator George Vest of Missouri agreed, claiming the legislation had the undesirable effect of "striking down all distinction between Federal and

State powers until the people of this country are now being educated from day to day that the states are mere forms without power; that for everything they seek they must come to Washington" (159, p. 727).

This value was not lost on scientists seeking support from the federal government; while they were willing to ask the government to support research, they were fearful that centralized control would diminish the usefulness of such work. For instance, Rutgers College President Merrill Gates warned his association colleagues in 1889 that centralized control of the stations would frustrate the intentions of the Hatch Act:

> Let a bureau be organized to foster . . . the whole interests of this country and you will have an immense amount of machinery. The moment you have the machine then comes the awful dead weight of the machine itself . . . . Let us beware how we put out of our own hands and into the hands of any central department in Washington the power which by law is conferred upon us and which is vital to our existence. Let us beware how we do that, directly or indirectly. The moment that is done and the machine is set running, the very life which that machine was set up to foster, that machine in the end will crush out (3, p. 63).

Beyond the question of control, however, was the basic question of constitutionality of federal money appropriated for agricultural research, which was considered educational in intent. Since education was not a power granted Congress by the Constitution and, therefore, was reserved for the states, Senator Vest of Missouri again questioned its constitutionality:

> I still think Congress [does not] have the power to thrust its hand into the Treasury of the people and take out the money of the people and appropriate it for the purpose of education in the State . . . . I believe now, that the subject of education is under the control of the States and the States alone (159, p. 726).

Similarly, when debate turned to the original provisions of the Hatch bill, which required the experiment stations to regulate fertilizer

content based on standards set by the Commisioner of Agriculture, Senator Joseph Hawley declared it was "extremely undesirable that any officer of the Federal Government . . . should be establishing standards for work of private individuals or private corporations established under State laws" (159, p. 726). Such standards, in his opinion, were an undue constraint on personal freedom, as were any abuses of the general welfare clause.

The Decentralization of Power

According to the strict constructionists it is good for power to be decentralized as much as possible to prevent potential abuses and mistakes. This value was widely held by scientists. Although they were comfortable asking for federal support for research and extension, they feared that centralized authority would create the potential for mistakes and minimize the creativity that is fostered by local institutions.

A. W. Harris, president of the University of Maine, rejected any control of the experiment stations by a central office when he told the association in 1901:

> I believe in an efficient central office, but I fear any material increase in the authority of a central agency, lest it end in making the governing board of the experiment station--the mere executive agent of the central governing power--a worse evil than no central government at all. Even a Washington control would involve mistakes, and a strong centralization of authority would multiply every error by an alarming factor. Moreover, it is a great advantage . . . that each experiment station has the opportunity to work out its own individuality (48, p. 107).

In 1913, Dean Eugene Davenport of Illinois addressed the same question, again calling for minimized central control of research and extension:

> Let us remember that all the great advancements in science are the result not of cooperation, but of freedom . . . . Fifty centers of initiative are vastly better than one, both in devising and in executing detail [sic] plans for the advancement of agriculture. What though some of the states come short, others are bound to succeed, and as a whole the chances of success under such a scheme are vastly increased over those under a plan that recognizes in fact but one center and that administrative rather than operative (19, p. 132).

This value was also expressed by political figures. For instance, Kansas Senator Joseph Ingalls rejected all USDA control over the experiment stations during the debate on the Hatch bill:

> It is not desirable that uniformity of methods or results should be obtained. That is exactly what we wish to prevent. We do not want any bed of Procrustes erected on which all of these institutions shall be laid, and if they are too long have them abbreviated, and if they are too short, so far as the view of the Commissioner [of Agriculture] is concerned, have them stretched out or lengthened to meet his views of the results and methods which ought to obtain. Sir, it is the contrariety of opinions on these subjects that results in the greatest good for the greatest number. It is the collision and contest between opposing ideas or views of contending localities that enable us to reach the highest results in the departments of activity and government (159, p. 724).

Similar thinking led Senator Thomas Sterling of South Dakota to insist on local control of extension work during the debate on the Smith-Lever bill by quoting Thomas Jefferson:

> Communities develop not by external but by internal forces. Else they do not live at all. Our Commonwealths have not come into existence by invitation, like plants in a tended garden; they have sprung up by themselves, irrepressible, a sturdy, spontaneous product of the nature of men nurtured in a free air . . . .
>
> It is this spontaneity and variety . . . that has given our system its extraordinary elasticity, which has preserved it from the paralysis which has sooner or later fallen upon every people who have looked to their central government to patronize and nurture them (162, p. 2579).

The conclusion, in the view of the college administrators and some legislators, was that when federal action was judged necessary, the power

of the government should be dispersed as much as possible to promote the welfare of the people.

The values of strict constructionism can now be summarized: it is good for the activity of the federal government to be restricted to the specific powers granted by the Constitution since an expansion of such activity will likely lead to diminished freedom and increased dependence on the federal government. Furthermore, when aggressive action is judged necessary, it is good for power to be dispersed as widely as possible in order to minimize abuses and maximize the improvement in the general welfare. As will be shown in Chapter V, the values of strict constructionism played a major role in minimizing federal control of the experiment stations.

The Values of Agrarian Fundamentalism

Agrarian fundamentalism holds to the conviction that "agriculture is par excellence the fundamental industry, and that farmers are, in a peculiar sense and degree, of basic importance in society" (52, p. 5). Such values arise from a combination of (1) the Jeffersonian notion that "those who labor in the earth are the chosen people of God, if ever he had a chosen people--whose breasts he has made his peculiar deposit for substantial and genuine virtue" (96, p. 29), and (2) the physiocratic doctrine that all wealth is ultimately derived from the land. The inevitable conclusion of such values is that a large, prosperous farming sector is necessary for the welfare of the nation.[4]

Agriculture as the Basis of Prosperity

Following the physiocratic tradition, the first value of fundamentalism is that it is good for the farm economy to be prosperous. This value traces to Francois Quesnay's eighteenth century physiocratic argument that only the land could create new wealth; manufacturing and commerce only changed its form and location. Or, as Anne Robert Jacques Turgot wrote in 1766:

> He [the husbandman] is, therefore, the sole source of the riches, which, by their circulation, animate all the labors of society; because he is the only one whose labor produces over and above the wages of the labor . . . . It is the earth which is always the first and only source of all wealth; it is that which as a result of cultivation produces all the revenue (115, p. 36).

This value was expressed by some agricultural scientists, in particular, University of Illinois Professor G. E. Morrow in his 1894 presidential address to the association:

> We recognize the fact that the interest we represent is, by far, the chief material interest of this nation; the one which millions of our citizens directly depend for their livelihood, and the one that prosperity or adversity of which most quickly and most directly affects the welfare of all classes. Not more honorable than other needed industries, agriculture is the great basal industry of the world and on which others particularly depend (8, p. 26).

This value was most frequently expressed by politicians from rural states (all during the debate on the Smith-Lever Act):

> Congressman Gilbert Haugen, Iowa--It is the farmer, the workingman and their wives who are going to make this country prosperous (160, p. 11615);

> Congressman William Collop, Indiana--Upon agriculture our industrial fabric is build; all depend upon it and must look to it for their continuance. The factory may shut down, and other business operations will move on; the mine may be closed, and still business will thrive; stores may be closed, and supplies will be found elsewhere, but stop the production of the farm for a single year and the grass

> will grow in the streets of every city in the land. Without it the wheels of industry will cease to turn and the fires in the furnaces no longer burn. Upon its success all others depend (163, Appendix, p. 786);
>
> Congressman Gilbert Haugen, Iowa--All are agreed that with prosperity on the farm we have prosperity in the city, in the shops, and the mills, and with close times on the farms we have close times in the cities, crumbling banks and factories (163, p. 1939);
>
> Congressman John Adair, Indiana--Agriculture is the foundation of all prosperity. It has built up and maintained our great manufacturing industries. It has made possible our beautiful and opulent cities, bound together with bands of steel. It has furnished the wealth that has opened up and beautified, no matter how obscure, every hole and corner of the vast universe. You may burn down and destroy our splendid cities, and the wealth of the farm will rebuild them more beautiful than before; but destroy our farms, and our cities will decay and our people will starve (163, p. 1942).

Farmers as Citizens

There are, according to agrarian fundamentalists, certain characteristics of rural life that lead one to conclude that farmers are good citizens and it is good for a large portion of the population to be on farms. Thomas Jefferson had earlier claimed the superiority of farmers: "Corruption of the morals in the mass of cultivators is a phenomenon of which no age nor nation has furnished an example" (96, p. 29).

Once again, college officials voiced this value. Michigan Agricultural College President J. L. Snyder told the association in his 1908 presidential address:

> Agriculture fosters a true spirit of democracy and develops character and provides conditions which are the true measure of the greatness of the nation . . . . Provisions for the maintenance of agencies for promoting agricultural production are therefore contributions to democracy, and this does not concern the farmer alone but every citizen of the Commonwealth (14, p. 28).

As might be expected, political figures from rural states were vocal in expressing this value (again, all were expressed during the debate on the Smith-Lever Act):

> Congressman Asbury Lever, South Carolina--The surest defense this Nation has as against foreign invasion is the prosperity and contentedness of its great agricultural classes. And more than that, . . . I am willing to venture the prediction that if representative government in this country is to be preserved unimpaired to the future, it will be through the conservatism and patriotism of the American farmer (160, p. 10861);
>
> Senator Asle Gronna, North Dakota--The great city is the place where vice feeds upon itself, like a festering sore thriving upon its own rottenness. The best interests of our republic demand the widest possible extension of our population outside of the cities. So that, without reference to its direct benefit to the farmer, any legislative policy which will tend to check the tendency of our people to herd in the cities and which tend to keep upon the farms those who are there and encourage others to go upon the farm has the widest possible foundation for its justification (163, p. 3033);.
>
> Congressman Dick Morgan, Oklahoma--During the last decade our urban population increased 34 percent; our rural population increased but 11 percent. Where is this thing to end? If this ever increasing drift of population to our cities cannot be turned back, at no far-distant day we will see 300,000,000 people in the United States, three-fourths of whom will be in our towns and cities. Such a condition would weaken the fabric of our Government, endanger our free institutions, and cause thoughtful men to shudder for the safety of the Republic (160, Appendix, p. 312).

Ownership of Land

The final value of fundamentalism is that it is good for farmers to own the land they till. This value is based on the ideas that (1) land-owning farmers care more for the condition of their land, (2) the prosperity of the tiller is related to his ownership of the land, and (3) American's desired to avoid the creation of an unlanded peasantry.

This value was shared by many different groups in society. For instance, in 1896, U.S. Commissioner of Education W. T. Harris told the association's members:

> Either our soil will be tilled by tenants for the benefit of the landowner who resides in the city, giving thereby encouragement to the growth of two distinct classes--one the poor, dependent peasantry; the other an intelligent but selfish and unpatriotic class of absentee landlords--or we . . . shall build up an intelligent, prosperous and independent class of farmers and artisans, each of whom owns his home, tills his fields, markets his own products, helps to regulate the affairs of his own township, sits in the councils of his own state or of the nation, in character, in intellectual and social qualities the peer of the lawyer, capitalist, or priest (10, p. 17).

Director Eugene Davenport of the University of Illinois agreed:

> No subject is of more importance here than the growth of the tenant system. It is at first a consequence, but once established it becomes a prolific cause of evil that is insidious and far-reaching. It robs the land of that careful oversight that is its due; it tends to impoverishment of the soil, lessened productiveness, and a failing revenue. It discourages improvement and removes the impulse and the occasion for rural adornment and landscape beauty. It is incompatible with the home instinct which is the chief excellence of rural surroundings. Renting divides with another the results of effort (10, p. 84).

As before, this value was expressed by farm state legislators during the debate on the Smith-Lever Act:

> Senator Lawrence Sherman, Illinois--The better plan is always to encourage by every possible means the holding in severalty of small tracts, so that the man who works the soil and the owner of the freehold may be identical. Anything that will tend to increase this holding of smaller tracts of land, so that the tiller of the soil and the owner of the soil may be the same should be encouraged (163, p. 3116);
>
> Senator James Vardaman, Mississippi--The Roman Republic, to a certain extent our great prototype, was strong, clean, virtuous, and true as long as she was governed by the free cultivators of the soil, . . . but when the rich dwellers in the city became the owners of the land

> and the old agricultural population was reduced to industrial vassalage, free institutions died and Rome became a despotism under the name of republic (163, p. 3036).

The values of agrarian fundamentalism, by defining the goodness of farm life and prosperity, became a justification for passing legislation beneficial to agriculture and, in particular, the Smith-Lever Act.

Summary

Nonmonetary values are a subset of the normative knowledge that affects the decision process. This chapter has reconstructed, from historical materials, the nonmonetary values that affected the Hatch Act of 1887 and the Smith-Lever Act of 1914. Chapter V looks at the prescriptions offered during the writing of this legislation and, more specifically, the role of nonmonetary values in the prescriptions offered and the final prescription chosen. As will be shown, the policy decision process involved choosing among conflicting prescriptions based on different sets of values. That is, the institutional form chosen favored the fulfillment of some values and left the fulfillment of others frustrated.

Notes to Chapter IV

1. Richard Shryock has discussed the sources of indifference toward basic science in nineteenth century America. The explanations he considers include: the ability of the U.S. to borrow basic science from Europe; the preoccupation of the U.S. with settlement of the continent and the suspicion of anything cultural or elitist by frontier people; the suppression of scientific freedom in many church-affiliated colleges; the exploitive nature of capitalism when abundant natural resources are available; and the lack of an aristocratic elite, such as existed in Europe, to subsidize and perform basic research (147, pp. 98-110). Although he does not present them as such, these sources of indifference could be considered possible origins of vocationalism.

2. The word "federalist" has had several different definitions throughout history. At the Constitutional Convention of 1787, the "Federalists" preferred a weaker central government than the "Nationalists" and some Federalists left the Convention in protest of the final form of the Constitution. Following the Convention, the "Federalists" were all those who supported ratification; those that opposed ratification were "Anti-Federalists." Following ratification, "Federalists" came to mean those that supported a liberal interpretation of the Constitution. "Strict constructionists" were those that supported a literal interpretation of the Constitution and opposed a strong central government. Some "Federalists" (in the second sense of the term) that supported ratification, such as James Madison, later became strict constructionists (85, pp. 12-13).

3. This clause, in the final paragraph of Section 8 of Article I of the Constitution, permits Congress to "make all laws which shall be necessary and proper for carrying into executive" all powers granted to the federal government.

4. Paarlberg has identified five other values of agrarian fundamentalism not included here. These included:

   farming is not only a business but a way of life;
   farming should be a family enterprise;
   anyone who wants to farm should be free to do so;
   a farmer should be his own boss;
   it is good to make "two blades of grass grow where only one grew before" (117, p. 7).

   The last value is related to the goodness of productivity, a value included in vocationalism. No evidence that the other four values affected the establishment of the experiment stations could be found.

CHAPTER V

THE WRITING OF THE HATCH AND SMITH-LEVER ACTS

> "There is something between the gross specialized values of the mere practical man, and the thin specialized values of the mere scholar. Both types have missed something; and if you add together the two sets of values, you do not obtain the missing elements."
>
> Alfred North Whitehead (155, p. 672)

Institutional innovations involve a policy choice between alternative prescriptions that reflect values, including nonmonetary values. Some nonmonetary values are accepted as appropriate in the sense that their fulfillment is expected to contribute to the accomplishment of the new institution's intended objectives; others are judged as inappropriate in that their fulfillment is judged incompatible with the success of the new institution.

This chapter treats the history of the establishment of the state agricultural experiment stations in the United States. More specifically, the movements leading to the writing of the Hatch Act of 1887 and Smith-Lever Act of 1914 will be examined.[1] The second act requires examination in order to understand the jurisdictional boundaries between the information-creation (experiment stations) and information-delivery (extension services) branches of the land-grant system. This boundary remained undefined until extension was formalized as an institution

within the system. In both cases, special emphasis will be placed on the nonmonetary values associated with the prescriptions offered in the decision process.

Following this historical treatment, the conceptual framework developed in Chapter II will be applied to help analyze the outcome of the decision process. To conclude, the values underlying the experiment stations (those accepted as appropriate during the decision process) will be identified and the significance of the choice discussed.

The Hatch Act of 1887

Issues to be Resolved

Four issues dominated the debate about the creation of the experiment stations. These four issues involved:

> What should be the relationship between the stations and the federal government, i.e., the USDA?
>
> Was a system of independent, free-standing stations preferable to a system of college-controlled stations?
>
> What should be the relation of professional researchers and professional educators, especially in a system of college-controlled stations?
>
> Was the main objective of the stations to be original investigation or practical problem solving and demonstration? (1, pp. 7-9).

Of these four, only the first two were significant to the writing of the Hatch Act. The third was debated among scientists and administrators of the colleges; they were, however, willing to settle this

issue among themselves another day, choosing instead to concentrate on the first two questions.

Similarly, scientists and administrators did not want to address the fourth issue in the policy arena, because, as historian Charles Rosenberg concluded, "They had found it both difficult and impolitic to be quite candid in their predictions of what an experiment station might be and do" (30, p. 2). This reluctance resulted from the divergent opinions on what an experiment station should do. To farmers, common sense and the day's best farming methods demonstrated on a model farm would be enough to solve their problems. To scientists, a truly experimental institution--one that sought to advance science beyond the present-day methods and that could not be judged on the basis of profitability--was needed. Knowing that popular opinion was not on their side on this issue, scientists allowed this question to lie dormant during the debate on the Hatch Act.

The Movement Establishing Experiment Stations

The Movement Among Scientists: During the twenty-five years following the writing of the Morrill Act of 1862, the primary responsibility of the land-grant colleges was "to teach such branches of learning as are related to agriculture and mechanic arts." Justin Morrill had envisioned the colleges performing "careful, exact, and systematized registration of experiments" that would result in "a rational induction of principles upon which we may expect to establish a proper science [of agriculture]" (95, p. 32). However, the Morrill Act made only a vague reference to experimentation, providing that 10 percent of the

land grant could be used to purchase a model farm and that each college was to supply an annual report "recording any . . . experiments made and their costs and results" (a complete version of the original Morrill Act appears in Appendix A).

This vagueness left many administrators undecided about the propriety of research work at the colleges. These provisions, according to President Joseph Denison of the Kansas Agricultural College, "seem to imply . . . that the colleges are to do experiments" (71, p. 27). However, President James Gregory of the Illinois Industrial University differed:

> The agricultural colleges were organized, not for the purpose of experimenting first and foremost, but for the purpose of teaching agriculture, or the branches of learning related to agriculture, and it has not been uniformly accepted that the agricultural colleges are to be experiment stations. They are not necessarily experiment stations. One of the questions for us to settle is, how far they can be made experiment stations, how far their funds can be diverted for this purpose and used for this purpose (71, p. 40).

Furthermore, much work in the laboratory and on the experimental farms amounted to little more than regulatory work or manual labor for instructing students.

By 1871, however, a movement to establish agricultural research institutions was beginning. In that year, Illinois President James Gregory called a convention of Friends of Agricultural Education, consisting mostly of professors of agriculture, to discuss methods of performing and standardizing research. Two significant developments came out of that convention.

First, the delegates adopted a resolution declaring, "The establishment of not less than one station in each of the several States of the

Union would be eminently beneficial to the agricultural interests of the country" (71, p. 137).

Second, the delegates began to discuss the political importance of the stations to the colleges. Professor Willard Flagg of Illinois told the delegates, "Our agricultural colleges are dependent upon the money of our people for their support, and we must recognize the wants of the people in such a way as to secure their confidence and their aid; and looking at that, it has been my own feeling, to a great extent, to endeavor to popularize agricultural science" (71, p. 43). C. W. Murtfeldt of the Missouri Board of Agriculture agreed: "In the end our Agricultural Colleges will amount to nothing but that they will be experiment stations" (71, p. 77). Clearly, representatives of the colleges were becoming aware of the political as well as scientific importance of the stations. Experiment stations, they began to realize, could attract the political support of farmers disenchanted with the failure of the colleges to become purely vocational institutions teaching students only practical agriculture.

The following year, 1872, Commissioner of Agriculture Frederick Watts called a meeting of college representatives, state boards of agriculture, and other agricultural scientists. At this meeting, the Committee on Experiment Stations (dominated by Connecticut's Samuel Johnson, who had advocated an independent station in that state since 1855, and his student, Wilbur Atwater) issued a report favoring the establishment of independent stations. Showing a clear Johnsonian influence, the report defined a station as a specialized institution "for the exclusive purpose of carrying on experimental investigations for the benefit of the farmer" (95, p. 35). Furthermore, the report established the

principle that the station had to be staffed by professional, full-time researchers and funded on a permanent, regular, and adequate income from state, federal, and private funds.

However, neither the committee nor the convention could reach a specific legislative plan. Most delegates recognized that the states would be unable or unwilling to provide additional support for the stations. The Congress, which had become infected with farmers' skepticism regarding the usefulness of the colleges, would not be easily convinced to support such stations. More importantly, Johnson and Atwater, fearing that any money appropriated to stations attached to the colleges would be diverted to other uses, continued to insist on independent stations. Discouraged with the deadlock, Commissioner Watts called no more meetings (95, pp. 35-38; 133, pp. 160-62).

Having both trained at the independent stations that already existed in Europe, Johnson and Atwater pressed for a state-supported station in Connecticut and, in 1875, struck a compromise between the state legislature and Wesleyan University to support an experiment station for two years. At the end of that period, the state legislature, at the urging of Atwater, severed the station's ties with the university and established the station as an independent entity.

Atwater continued his lobbying for independent stations in the 1880's. Influenced by his visits to successful independent stations in Europe, Atwater maintained that researchers must be able to pursue knowledge without the constant educational and academic interruptions that would inevitably arise at a university. Distracted by such annoyances, the scientist could not perform his primary duty, which was, in Atwater's view, the advancement of knowledge.

Furthermore, Atwater cursed the houses of both the classical and agricultural colleges as uninterested in or unable to perform effective agricultural research. The former, unfamiliar with the needs of agriculture, would provide only "gratuitous and accidental drippings to agriculture" (95, p. 24). The latter, surviving on small incomes, suffering from political interference, and plagued by the vocational demands of farmers, could not provide the environment needed for successful research. There was, in his opinion, no alternative to permanently subsidized, self-governed, free-standing stations (95, pp. 19-24; 133, p. 161).

Despite his success at establishing what was to become the most successful station of the period, Atwater's scientific arguments in favor of independent stations lost ground to the political arguments for establishing stations under the control of the colleges. At an 1881 convention of Teachers of Agriculture, a Committee on Conjoint Experimentation, dominated by professors from midwestern land-grant colleges, issued a report in favor of college-controlled stations. The report defined research as "the discovery and verification of new truths in agricultural science" and argued that the entire population would benefit from public expenditures on such work (95, p. 39). Furthermore, the report presented a strong case for attaching the stations to the colleges.

First, since the colleges owned farmland and some laboratories, and employed the best scientists then available, attaching the stations to the colleges would reduce the cost of the system. The availability of scientific personnel was cited as "the great reason for attaching experiment stations in the United States to the agricultural colleges (95, p. 39).

Second, and perhaps in response to the vocational demands being placed on the colleges, the committee predicted that research would have "great value to students as a means of practical education" (95, p. 39). Finally, the committee reemphasized the political implications of college stations: college stations would likely improve the strained relations between the colleges and farmers, whereas independent stations would compete with the colleges for the loyalty of farmers and, ultimately, for state and federal funding (95, pp. 38-40).

In 1882, Professor Seaman Knapp of Iowa State wrote the first official bill intended to establish experiment stations in the U.S. Striking a compromise between the independent and college station advocates, Knapp's plan had the following parts:

(1) As a means of diffusing knowledge of agricultural topics, "national experiment stations" were to be established in connection with each of the land-grant colleges;

(2) Such stations were responsible for conducting "researches or experiments bearing directly on the agricultural industry of the United States";

(3) Such stations were to be under the control of the board of trustees and supervised by a professor of agriculture;

(4) The character of the work to be performed at each station was to be determined by the Commissioner of Agriculture, the president of the college, and the professor of agriculture;

(5) Each state would receive fifteen thousand dollars annually to support such work (157, p. 204).

Knapp stressed the compromising nature of his plan. By declaring the intent of the bill to be the diffusion of knowledge of the science of agriculture, the bill overcame any constitutional objections by bringing it in line with the organic act establishing the USDA. And, by placing the stations under joint USDA-college control, Knapp hoped to provide the colleges with the political benefits of association with the stations, yet still provide the stations with an independent environment in which to do research.

This compromise still did not satisfy those administrators preferring stations completely under the control of the colleges. President Theophilus Abbot of the Michigan Agricultural College led the opposition to Knapp on the grounds that his plan did not give the colleges the control needed to require the stations to serve the colleges' needs. Such separate but equal status for research was unacceptable to Abbot, who favored the Michigan system of part-time research done by educators. Citing reasons of cost savings and the need to improve the political popularity of the colleges, Abbot rejected the Knapp plan:

> I do not think it well for the college, however it might be for the science of agriculture, to plant here an experimental station to be conducted independently of the various departments of the college and of their separate heads . . . . We have ordinarily done at this college, I believe, more experimenting than any [independent] experiment station in the United States. It is rather an extension of our work than a superseding of it by a foreign set of workers with new laboratories that seems to be needed (emphasis in original) (95, p. 46).

Gathering the support of other presidents, Abbot convinced Illinois Congressman William Cullen to rewrite the Knapp bill for submission in 1884. The Cullen bill had the following provisions:

(1) The work was still justified as part of the USDA's information diffusion mission;

(2) The stations were to be organized as departments of the land-grant colleges and placed under the direction of the college trustees;

(3) The Commissioner of Agriculture was forbidden from controlling or directing the work of any station, and it was explicitly declared that "nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the states in which they are respectively located" (95, p. 48).

A final meeting of land-grant college officials was called by Agriculture Commissioner Norman Colman in 1885. Heeding his request to develop "a bond of union and sympathy between the department and the colleges," the convention (including Seaman Knapp) endorsed the provisions of the Cullen bill and appointed a committee to lobby for its passage (95, pp. 49-50). Despite a delay of two years, the Cullen bill would eventually become the basis of the Hatch Act of 1887.

Some conclusions can be drawn here on the decisions of college officials during this movement. The original advocates of independent stations--Samuel Johnson and Wilbur Atwater--were scientists with the sole objective of advancing agricultural science. They were suspicious that research funds for college-controlled stations would be diverted to other uses. To them, any legislative action should create institutions that fostered an environment of freedom in which to conduct research. The political ramifications for the colleges of such action were

irrelevant; the advancement of science was expected to be the sole concern of the experiment stations.

The administrators of the colleges, men like Theophilus Abbot who were still struggling to build their colleges in the face of widespread farmer skepticism, could not ignore the political effects of creating independent stations. To them, an independent institution that challenged the colleges for popularity and public funds was simply intolerable. Such an arrangement, they felt, would threaten the educational mission of the colleges in the long run. If, on the other hand, a college-controlled station improved the standing of the college in the farm community, both the college and the station would likely prosper in the future. Knapp, it appears, was less dedicated to independent stations than searching for agreement between the differing factions.

This is not to imply that the presidents were unsympathetic to the Johnson-Atwater intention of creating an environment of freedom and honesty in which to perform research. Indeed, as indicated by the Cullen bill, the colleges' proposal placed constraints on the USDA that greatly limited USDA control over the stations and reserved the right to plan and perform research for the colleges. Administrators were not opposed to scientific freedom; they simply wanted an institutional structure allowing them to exercise that freedom.

The Movement Among Farmers: Although the Grange, Greenbackers, and Populists were active during the years of the experiment station movement, only the Grange had any identifiable impact on the writing of the Hatch Act. Indeed, an examination of the platforms of the Greenbackers (1876 and 1880) and the Populists (1892 and 1896) reveal concern for two primary issues: increasing inflation and reducing the power of the

railroads and other businesses. Nowhere in their platforms did they display any interest in the issues of education or research. The Populists did press for "reforms" at some of the colleges during the 1890's (especially in Kansas), but they did not affect the writing of the Hatch Act (153, pp. 186-89, 229, 298).

The Grange was founded to improve the social and economic conditions of farm life. During the 1870's, the Grange attempted to improve farmers' economic conditions through cooperative marketing, and their membership peaked at 850,000 in 1875. The failure of these cooperative enterprises left many members disenchanted, and membership fell to 115,000 by 1885, but the Grange remained active in agitating for legislation favorable to farmers. The concentration of their membership in a small number of agricultural states created a form of political leverage that increased their political influence.

The Grange members had a strong vocationalist outlook. This led the state Granges to take differing attitudes toward the colleges based on the success they believed their college was having at providing vocational skills for farmers and their sons. For instance, in some states--Michigan, Ohio, Wisconsin, and New York--the Grange helped secure state funds to support research. In others, the Grange lobbied to separate the agricultural colleges from the classical state universities, and in four states--Mississippi, North Carolina, Rhode Island, and Connecticut--they were successful in establishing independent agricultural colleges.

Some of the sources of this criticism from Grangers were discussed in Chapter III: student numbers were low, few students were returning to the farm, the curriculum at most schools was dominated by classical subjects, and model or experimental farms were ridiculed for their lack of

profitability and organization. Another reason for this dissatisfaction, however, was a lack of understanding by farmers of the slowness of the research process. After the University of Wisconsin received state funds for research in 1880, the Grange blamed the lack of results in the following years on the attachment of the college to the classical state university and demanded an independent agriculture college in 1882 (130, pp. 1-20). In New York, farmers showed outright hostility toward the experiment station established in 1885, as indicated by an editorial in a New York farm newspaper:

> It is enough to make an earnest American despair for the future of democracy in America to see the ease with which a few men, hating to work for their own living and determined to live on the government, succeeded in putting a law through our legislature to set them up, with $22,000 a year income, in the fraudulent business of conducting agricultural experiments to improve farming. From top to bottom, the bill, the station, and its operations have been a fraud on our farmers and taxpayers . . . . In the name of New York's insulted farmers and in the name of good government, we demand the legislature to abolish the Geneva Agricultural Experiment Station. It is a humbug (74, p. 416).

Such an attitude shows outright disdain for anything except practical instruction, a common vocationalist attitude among many farmers who had no use for the "book farming" offered by the agricultural colleges.

Despite such opposition by some in the farm community, the Grange supported the Hatch bill provided certain amendments were attached to the bill. These amendments, as might be expected, were intended to provide experiment stations that would be more practical in their outlook.

The first amendment provided that, in those states already having established independent stations, the state legislature should have the right to designate which of the two institutions--the agriculture college or the independent station--should receive the federal appropriation. This amendment was a direct result of the efforts of the Ohio

Grange, which was dissatisfied with the lack of vocational education at the state agricultural college. They succeeded in establishing an independent station in that state, then passed the idea of the amendment on to the National Grange (158, p. 128).

The second amendment offered by the National Grange provided that, in those states where (1) no independent experiment station existed and (2) in which the agriculture college established had "departed from the purposes of that [Morrill] act by neglecting agricultural education," the money was to be appropriated to the state board of agriculture. Furthermore, any independent station established thereafter was to be protected by insuring that "the appropriation shall go thereto without the intervention by any college board or faculty" (48, pp. 43-44).

The objectives of farmers should be evident by now. Having had their vocationalist objectives frustrated for a quarter century in some states, farmers were determined to make available the option of independent stations in those states where the colleges were considered failures. By providing the option of independent stations, the Grangers clearly hoped to accomplish three things, namely, to establish institutions that would provide practical information on the problems of farmers; to pressure the failed colleges into providing a more practical education or, in some extreme cases, to establish independent colleges; and to shift the battle for such institutions from the Congress, where the politically organized colleges would likely have the upper hand, to the state legislatures, where the vocationalist appeals of farmers might be received more sympathetically.[2]

The Role of the USDA: The general objective of the Department of Agriculture, as clearly stated in the department's organic act of 1862, was "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture." More specifically, the first Commissioner, Issac Newton, outlined seven objectives for the new department:

(1) Collecting, arranging, and publishing statistical and other useful agricultural information;
(2) Introducing valuable plants and animals;
(3) Answering inquiries of farmers regarding agriculture;
(4) Testing agricultural implements;
(5) Conducting chemical analyses of soils, plants, and manures;
(6) Establishing a professorship of botany and entomology;
(7) Establishing an agricultural library and museum.

Of these, the collection of statistics, publishing of new information, and distribution of seeds dominated the first twenty-five years of the department's history (22, pp. 13-25).

Although the department had no formal authority over the land-grant colleges, the USDA did sponsor meetings of college representatives in 1872, 1881, 1883, and 1885. As mentioned before, these meetings, dominated by college representatives, led to the writing of the Cullen bill and, ultimately, to the Hatch Act.

The USDA supported the general provisions of the Hatch bill, but Commissioner Norman Colman presented four amendments to Congress in 1887. First, since he believed there to be considerable economies in establishing research institutions (such as the construction of buildings

and equipping of laboratories), he proposed that only one institution in each state was to receive federal funds. Second, perhaps as a means of reaching a compromise between the colleges and the Grange, he proposed that the state legislature determine which institution should receive the funds. Third, to prevent diversion of the funds to the construction of non-research facilities, he proposed that only $5,000 of each state's appropriation could be spent on buildings and repairs the first year and $1,000 annually thereafter. Fourth, as a means of improving communication among stations and between stations and farmers, he proposed that a central office be established in the USDA, not to dictate or control the stations, but to act as a clearinghouse to catalogue, consolidate, and publish the work of the stations (158, p. 127).

As a scientific institution itself, the USDA was clearly sympathetic to the establishment of experiment stations, even if those stations were not attached to the colleges; as a client-oriented entity since its creation, the department also understood the necessity of meeting the needs of farmers in order to maintain political popularity. The amendments offered by the USDA reflected these concerns.

Passage of the Hatch Act: Congressional Debate and Decision

By the time the Hatch bill was introduced in Congress in 1886, two questions remained to be answered: (1) should states be provided the option of establishing independent stations? and (2) what degree of control should the USDA have over the stations? On the first question, the prescription offered by the college officials (only college-controlled stations should be established) differed from that of the Grange and

the USDA (the option of independent stations should be provided). On the second, the Hatch bill supported by the colleges only allowed the Commissioner of Agriculture to establish standards of value for use in fertilizer analysis by the stations. The USDA supported this prescription, adding only that a central office in the USDA should be established to collect and publish research results.

Introduced in the Senate by James George of Mississippi, debate on the Hatch bill began in July of 1886. Reported favorably by the Senate Agriculture Committee, the provisions of the legislation included:

(1) The objective of the bill was to "aid the Department of Agriculture in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture";

(2) That experiment stations were to be established as departments in connection with the land-grant college in each state;

(3) That such stations were to "conduct original researches and verify experiments";

(4) That such stations were to be under the control of the trustees of the colleges who would have the power to appoint a director of the station;

(5) That the Commissioner of Agriculture would determine "a standard of valuation of the ingredients of commercial fertilizers, upon which the analysis of fertilizers, as far as made by said stations, shall be based," however, "nothing [in the act] shall be construed to authorize said Commissioner to control or direct the work or management of any such station";

(6) That the results of experiments at the stations must be distributed to newspapers each three months;

(7) That each state would receive $15,000 annually to operate such stations;

(8) That "nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States" (159, Appendix, pp. 120-21).

The first and third provisions defined the objectives of the bill. The second, fourth, and fifth established that all stations were to be controlled by the colleges. The sixth intended to assure maximum publicity of station results and the eighth was a strict constructionist provision intended to assure the states that, despite their federal funding, the colleges and stations were to remain under state supervision.

The Hatch bill would not escape the Senate unchanged. Senator Preston Plumb of Kansas offered the first amendment, an attempt to eliminate the Commissioner's power to set standards of valuation for fertilizer.

Plumb's objection was that such powers would give the Commissioner "the power to determine the commercial value of all the fertilizers in the markets of the United States." Rhode Island's Jonathon Chace stressed that the section was harmless, simply wanting to establish, "not a standard of value in money, but to establish a standard of quality--chemical quality if I may use that phrase--so that there may be one universal standard all over the country that shall be accepted by buyers and sellers, . . . and so judge more readily and more perfectly of the value as a fertilizer" (150, p. 722). M. C. Butler of South

Carolina agreed, pointing out that many states had already assigned such regulatory duties to the colleges.

Joseph Hawley of Connecticut rejected the arguments of Butler and Chace, claiming the federal government had no constitutional authority to establish such standards for any articles:

> Why not establish a standard hoe, a standard pill, or a standard anything else? We have all a right to make these articles exactly as we please in spite of your law and in spite of your Commissioner of Agriculture" (159, p. 723).

Finally, even proponents such as Chace expressed reservations about "clothing the Commissioner of Agriculture with too much power over this matter," the amendment was accepted, and all references to establishing standard fertilizer values were removed (159, pp. 721-28).

This amendment marked the first victory of the strict constructionists over the federalists. By adhering to the belief that the involvement of the federal government in areas where it had no constitutional authority was bad, the strict constructionists had eliminated all federal control over fertilizer standards and, in the process, had eliminated one potential form of control the USDA had over the stations.

Senator George Edmunds of Vermont next offered an amendment requiring that 15 percent of the funds in each state be reserved to be used as the Commissioner of Agriculture directed. His stated purpose was to achieve "uniformity of methods and results," but the Massachusetts Grange also supported the amendment as a means of assuring that not all of the money could be diverted to nonagricultural uses by college administrators.

This amendment also ran into opposition from the strict constructionists. Senator John Ingalls of Kansas led the opposition, claiming no "bed of Procrustes" should be erected to fit the stations to the

Commissioner's desires and that local institutions providing a "collision and contest between opposing views" would ensure "the greatest good for the greatest number." Again, the strict constructionist view dominated and federal control of the stations was avoided (159, pp. 721-24).

The final amendment offered by the strict constructionists again limited the role of the federal government by striking out all references to the USDA in the bill's first section, leaving its purpose to be only the acquisition and diffusion of knowledge (but not necessarily to aid the USDA in doing so). Furthermore, the wording of this section was changed from that which indicated the stations would be "connected to" the colleges (which some thought referred to the actual physical location of the stations) to "under the direction" of the colleges (which referred more to administrative control). Again, the colleges' control over the stations was strengthened, not because such college-controlled stations were thought to be more efficient at improving agricultural science, but solely because the strict constructionist faction of the Senate wanted stringent constraints on federal control of these state institutions.

The final amendment offered was the Granger proposal permitting independent stations. Proposed by Senator John Spooner of Wisconsin and supported by M. C. Butler of South Carolina (two sites of intense Granger agitation), the amendment provided that Hatch funds could be used at previously established independent stations, and at "distinctly agricultural colleges" that might be established in the future (i.e., agricultural colleges that were separated from the classical state universities). Explaining that "the farmers of Wisconsin may become extremely anxious that there should be a separate agricultural college"

because it was "impossible to secure the attendance of any large number of students of agriculture" when the college was in connection with a classical institution, Spooner pressed the case of the Grangers (159, p. 1043).

Missouri Senator George Vest joined Spooner in this criticism, claiming the low proportion of land-grant students enrolled in agriculture in 1885 (2,022 out of 7,803 according to the Commissioner of Education) indicated "the most lamentable indifference on the part of these people [college administrators] as to agriculture" (159, p. 1042).

Senator Justin Morrill of Vermont (author of the original land-grant college act) disputed these arguments on two counts. First, he claimed, "All these stations should be more or less connected with the agricultural colleges, where they have a staff ready to do the work" (159, p. 1043). Second, Morrill rejected the vocationalists' contention that the colleges had only the goal of providing a vocational education for farm students:

> It never was intended to force boys of farmers going into these institutions so to study that they should all come out farmers. It was merely intended to give them an opportunity to do so, and to do so with advantage if they saw fit (159, p. 1043).

Even the arguments of Morrill did not convince the legislators. The amendment allowing independent experiment stations was approved, not out of respect for the goodness of scientific freedom or admiration for the European tradition of independent stations, but as a response to the unhappiness of farmers over the lack of vocational education being provided by the existing colleges.[3]

In the House of Representatives, Congressman William Hatch of Missouri guided the senate version to passage by a 152 to 12 vote with

no amendments and with minimal debate (less than three pages in the Congressional Record). The sole complaint came from Representative John O'Neill of Missouri, claiming that the interests of labor were being neglected while, "Under the head of 'agriculture,' every bill that has been presented to this House with the 'cow' brand upon it has been promptly considered and passed" (159, p. 2283). However, even O'Neill voted for the Hatch bill.

Having passed the Senate on January 27 and the House on February 25, 1887, President Grover Cleveland signed the bill on March 2. Cleveland had already declared himself in sympathy with the movement, indicating in a federalist tone the importance of the legislation:

> The aim of government is the improvement of the people in every station and the amelioration of their condition [including] acquiring and diffusing among the people useful information respecting the subjects it has in charge, and aiding in the cause of intelligent and progressive farming, by the collection of statistics, by testing the value and usefulness of new seeds and plants, and distributing such as are found desirable among agriculturalists (48, p. 45).

Thus, in its final form, the Hatch Act had three major provisions:

(1) The agricultural experiment stations were to be established under the direction of the land-grant colleges;

(2) Where independent stations existed or were established in the future, or where independent agricultural colleges were established, the state legislature could designate which institution would receive the Hatch funds;

(3) That the USDA had no control over the stations except to provide forms for recording and tabulating experiment results.

The Role of Nonmonetary Values in the Hatch Decision

Institutional innovations are the product of prescriptive policy decisions, usually involving conflicting values. In the decision process, some values are accepted as appropriate since their fulfillment (the acquisition of the goodness or avoidance of the badness expressed) is judged to contribute to the accomplishment of the new institution's objectives. Others are rejected as inappropriate since their fulfillment is judged to frustrate the objectives of the institution.

The Hatch Act involved four major sets of values--those of science, vocationalism, federalism, and strict constructionism. Some of these values were competing since the fulfillment of one came only at the frustration of another. Others are complementary since the fulfillment of one also fulfilled another. This section discusses which values were accepted and which were rejected during the writing of the Hatch Act and the implications of these value choices.

The primary objective of the agricultural scientists was the creation of new knowledge to advance the science of agriculture. The creation of experiment stations accepted the scientific value that scientific progress is good. However, the values of vocationalism placed a constraint on research work; science was not intended to search for truth for its own sake. Instead, the goodness of knowledge was judged to arise from its application to the practical problems of farmers.

Again, it must be emphasized that scientists were responsible for the union of the values of science and vocationalism. Scientists were the most vocal in emphasizing the usefulness of science to the problems of farmers; herein lies a critical change in the values of science.

During the earlier part of the nineteenth century, most scientists felt the goodness of scientific knowledge could only be appreciated by a scientific elite. For instance, in 1853, Canadian agronomist T. Sterry Hunt wrote an American colleague, "Science for the millions is humbug! True science, like true nobility, is essentially aristocratic" (133, p. 123). Thirty-four years later, most agricultural scientists had abandoned such elitist values. Indeed, no scientist involved in the Hatch decision advocated truth for its own sake. This conversion was critical for the success of the movement, for it was the scientific elite--the representatives of the land-grant colleges--that led the experiment station movement to its successful conclusion. Had this conversion not occurred, the movement would likely have been delayed years in gaining sufficient strength to be successful or would have pitted scientific elitism against the more popular vocationalism, probably resulting in the establishment of experiment stations that were dedicated to demonstration rather than experimentation, thereby delaying the development of agricultural science.

In the conflict between federalist and strict constructionist values, strict constructionism appears to have dominated the decision. Since the legislation was considered to be educational in nature, and education was considered a state responsibility, the passage of such a bill required a liberal interpretation of the general welfare clause. The elimination of all federal control, however, was a clear choice of strict constructionist over federalist values. The elimination of all USDA control over the stations, clearly making the stations state institutions, provided a decentralization of power considered good by the strict constructionists.

Thus, an important conclusion can be drawn here about the complementarity of the values of science regarding the goodness of scientific freedom and the values of strict constructionism regarding the decentralization of power. The decentralization of research decision making in the U.S. is due primarily to the selection of strict constructionist over federalist values. This complementarity of strict constructionist and scientific values--the former stressing limited federal control and the latter stressing scientific freedom--provided scientists with the freedom to perform research as they saw fit for their local constituents (farmers) well into the twentieth century. It is, in part, the breakdown of this complementarity that is forcing the stations to face changes in the late twentieth century, a topic discussed in Chapter VI.

The Role of Monetary Values in the Hatch Decision

This section examines the role of monetary values in the Hatch decision. According to the induced innovation theory, changes in the relative price of two factors of production will induce both technological and institutional change. For instance, according to Ruttan, "A rise in the price of labor relative to the price of land induces technical changes designed to permit the substitution of capital for labor and, at the same time, induces institutional changes designed to enhance the productive capacity of the human agent and to increase the worker's control of the conditions of his own employment" (29, p. 341).

This is, apparently, what occurred during the last half of the nineteenth century. Table 4 shows two measures of the price of labor

Table 4

Measures of Relative Factor Prices, 1850-1914

Year	Index of Wage Rates ÷ Index of Land Prices, 1910-1914 = 100[1]	Nominal Annual Wage ÷ Nominal Land Price[2]
1850	138	--
1860	103	7.32
1870	160	6.60
1880	138	7.92
1890	139	7.56
1900	160	8.52
1910	100	6.36
1914	101	--

[1]Calculated using an index of wage rates (183, p. 317) and an index of land prices constructed from nominal land prices (176, p. 457).

[2]Calculated using nominal annual wages (constructed by multiplying 12 x the monthly wage rate) and nominal land prices (176, pp. 457, 468).

relative to the price of land. The first is a composite labor-land price index; the second is the ratio of the nominal annual farm wage to the average nominal farmland price. Both indicate that the price of labor was rising relative to the price of land on the second half of the nineteenth century.

On the technical side, this may explain some of the early work done at the experiment stations. Much of the early work was done on soil fertility and fertilizer analysis. This research may have been, as the induced innovation theory suggests, an attempt to substitute the cheaper

input (land) for increasingly expensive labor. On the institutional side, the establishment of the experiment station was, apparently, an attempt to improve the human agent by providing a long term investment in the production of knowledge.

Another source of the demand for institutional innovation is the relative price of products. Chapter III discussed in detail the specialization and regionalization of agricultural production in the nineteenth century. As the entire continent was opened for settlement, the country went through a process of sorting out the comparative advantage of each region. The regionalization of production was a major source of the demand for institutional innovation, as explained by historian Margaret Rossiter:

> Connecticut with its relatively poor land for grain and corn was rapidly losing its remaining markets to western competition. Economic pressures forced Connecticut agriculture back upon its comparative geographical advantage in supplying eastern cities. After 1860 those farms that were not abandoned turned increasingly to such perishable food products as fruits, eggs, and dairy products and to other crops, such as hay, which would not pay the long cost of transportation. The rise of such a specialized commercial agriculture required a more precise knowledge of crops, costs, and methods of cultivation and was a great spur to agricultural reform in Connecticut in the late 1860's (133, p. 157).

This source of demand for institutional change was not lost on Congress, as shown by the report of the House Committee on Agriculture on the Hatch bill:

> Experiments in the Agricultural Department at Washington are reliable only for such portions of the country as present the same conditions of temperature, moisture, soil, etc. . . . . Agriculture is so variable in the different States that it is impracticable for one station to cover the field of needed investigation. The cotton and rice States have their climate, their peculiar crops, their insect enemies, and their special problems. The great prairie States have their peculiar wants and difficulties, and so of the several sections. Experiments that are at all reliable can only be

> performed in the several localities and under their varying conditions . . . . When we consider the vast area of our country it will not be seriously contended that one station in each state would be too many (159, Appendix, p. 121).

The regionalization of an increasingly commercial agriculture, caused partially by changes in relative product prices, was clearly a major reason for the institutional form chosen in the Hatch decision.

This section, combined with the previous section on nonmonetary values, should reinforce the contention made in the first chapter: while changing relative market values may drive an economy to the point where an institutional innovation is needed, nonmonetary values help determine the form of the new institution and contribute to the performance of the institution at creating and distributing new income streams.

Application of the Conceptual Framework to the Hatch Decision

Structure: Besides the Congress, three interacting institutions were involved in the Hatch decision--the land-grant colleges, the Grange, and the USDA. Figure 4 shows the institutional characteristics of these three--their objectives, jurisdictional boundaries, sources of power, and means of preference articulation.

The need for legislative action arose, in part, because the conduct of agricultural research was not the clear responsibility of any institution. As discussed earlier, college administrators were uncertain they had the legal capacity to do research and were certain they did not have the funding to perform such work. Thus, legislation was needed to draw new jurisdictional boundaries that assigned agricultural research to the colleges or another independent institution.

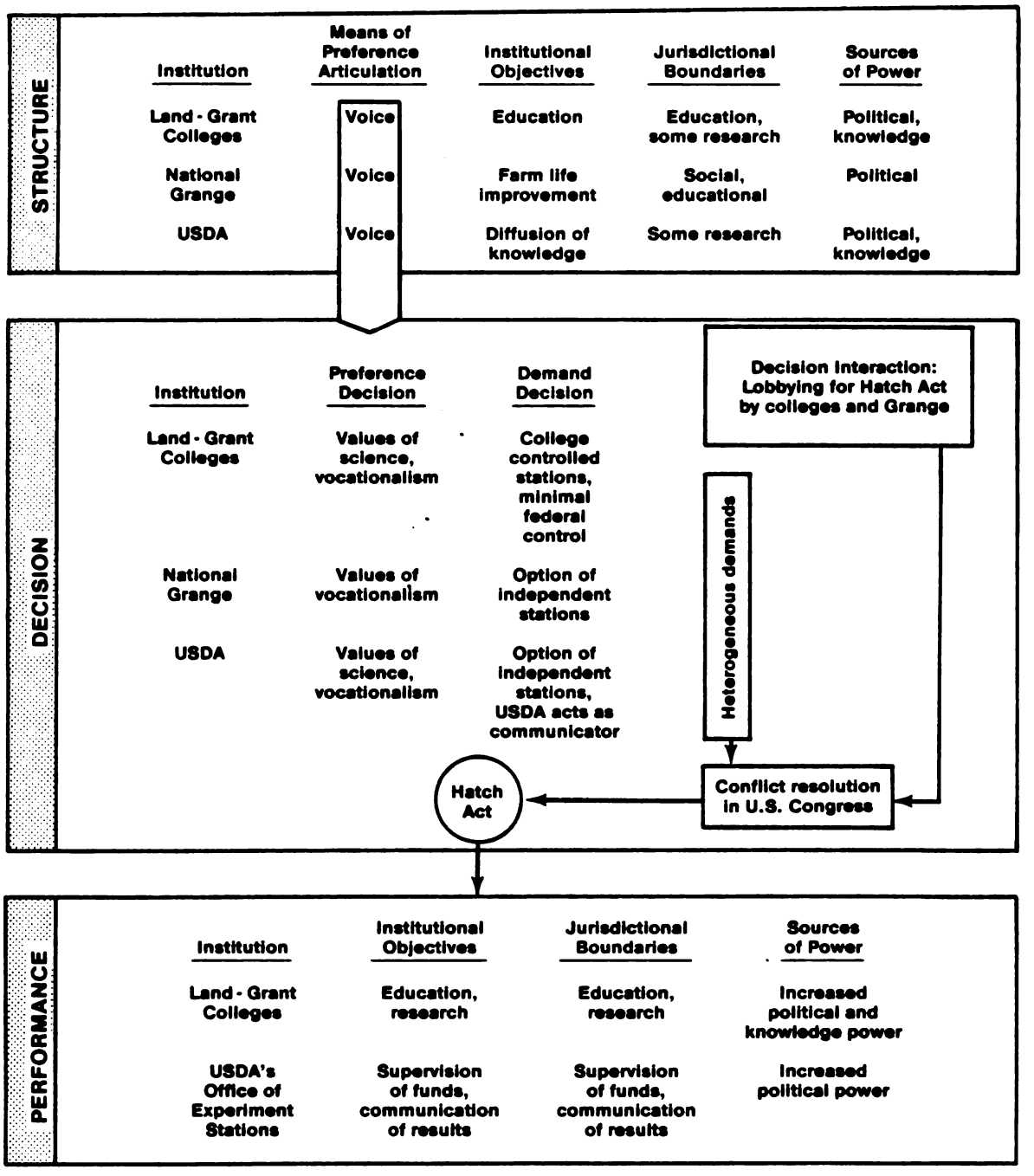

Figure 4

Schematic Presentation of Conceptual Framework
Applied to the Hatch Act of 1887

The colleges seemed to hold relatively more power to influence the decision than either the Grange or the USDA. With many farmers indifferent to the establishment of experiment stations and the Grange having a relatively small membership, the power of the Grange to affect the decisions of others was somewhat limited. The USDA had no formal control over the colleges and, with limited funding and legal powers, could act only to facilitate discussion among college officials and provide support in the Congress.

The colleges, on the other hand, had several meetings to discuss the establishments of stations and, as agreements evolved, slowly become an effective political group. The colleges also had, in the form of the faculty, the best sources of agricultural science knowledge in the U.S. Since the establishment of independent stations would have required hiring some of these faculty away from the colleges, these human resources became an important political asset in pressuring for the establishment of college-controlled stations.

Decision: The decision process is the narrowing down of potential prescriptions to one that is carried out. Such a process involves the processing of positive and normative information, including nonmonetary values, through a decision rule to produce a prescription of what ought to be done. When prescriptions, offered in the form of demands, conflict, or are heterogeneous, a conflict resolution process must be pursued. During the decision process, institutions attempt to assure a favorable outcome by using power to influence other decision makers.

The preference decision assesses the goodness or badness of situations, conditions, or things. The preference decision of the land-grant

college representatives expressed scientific values--that scientific progress, patience, honesty, and freedom were good. These values were tempered, however, by a vocationalist attitude that implied science which solved the problems of farmers was good. The Grange had a vocationalist outlook. Composed of farmers, the Grange insisted that the sole utility of science was derived from its usefulness. Being a scientific institution, the USDA was sympathetic to the values of science; however, it also understood the vocationalist values of farmers, and that experiment stations would have to fulfill these values to be successful.

The demand decision produces a prescription--a statement of what ought to be done. In the case of the Hatch Act, prescriptions had to be offered on two problems: (1) should stations be independent of or attached to the colleges? and (2) what degree of control should the USDA have over station work?

The land-grant colleges offered the prescription that the stations should be connected to the colleges with minimal federal control. This prescription resulted from a recognition that stations would be an important asset, and the minimization of federal interference in station operations was the colleges' means of providing a good scientific environment. Disappointed with the lack of vocational education in the land-grant colleges, the Grange demanded the option of independent stations so that, in those states where the colleges were "failures," independent stations that would be helpful to farmers could be established.

The USDA prescribed no more federal control than the establishment of a central office to collect and publish station work. However, as an institution that had learned the lesson that a public institution must

provide a useful service to its constituents (in this case, farmers), the USDA prescribed the option of independent stations as a means of assuring a useful product (science) for farmers. This reflected the USDA's understanding of the importance of vocationalist values.

Since demands were heterogeneous, a conflict resolution process had to occur. This process was initiated by the setting of the agenda when the Hatch bill was presented to Congress. Before the bill could be passed, however, amendments were enacted to (1) allow independent stations to be established and (2) eliminate all USDA control of the stations. This built a ruling coalition by satisfying the Grangers, who wanted practical results from the stations, and the strict constructionists in Congress, who wanted limitations placed on the power of the federal government. In this form, the Hatch bill achieved a ruling majority in the voting stage and the bill was enacted into law.

Figure 4 recognizes that institutions sought to use power to influence the decisions of others. The Grange was successful in achieving some of its amendments by delivering a "deluge" of petitions to Congress "praying" for the option of independent stations (48, pp. 48-49). However, no other institution used power as skillfully as did the representatives of the colleges. Indeed, even as Mississippi Senator James George (the Hatch bill's most devoted advocate in the Senate) confessed:

> I have relied exclusively upon the judgement, upon the information, and upon the technical skill of the presidents of the agricultural colleges. In fact, I have merely introduced the bill which they approved and sent to me (159, p. 721).

By using their political power to place their demands on the agenda of Congress, the colleges were able to assure a favorable outcome to the decision process; that is, the establishment of attached experiment stations with minimal federal control.

Performance: Performance is defined as the aggregate changes in the institutional structure that result from the prescription selected in the decision process. This section looks at the changes in the institutional structure that resulted from the Hatch decision and the values accepted by the decision, and thus, underlying the state agricultural experiment stations.

The Hatch Act changed the institutional characteristics of the land-grant colleges and the USDA. For the colleges, the Hatch Act meant major changes in objectives and jurisdictional boundaries. The objectives of the colleges formally expanded to include the creation of new knowledge. Concurrently, the jurisdictional boundaries of the colleges now included the financial and intellectual resources needed to generate new knowledge. By increasing their financial resources, their stock of scientific knowledge, and potential popularity with farmers, the colleges increased their political power, an asset that would be useful in acquiring funds in future years (including the Smith-Lever Act). Having realized success in passing the Hatch Act, the colleges formalized their capability for collective action by creating the Association of American Agricultural Colleges and Experiment Stations, an organization that would be politically powerful in future years.

The USDA added the objective of collecting and distributing the results of experiment station work through the Office of Experiment Stations. However, the control of the USDA over the stations was very limited. Having no legal right to control the work of the stations, the department's sources of power were limited to those of suggesting lines of work, encouraging cooperation among stations, and fostering communication among scientists.

Public policy decisions involve the choice of some nonmonetary values as more appropriate than others. In the case of the Hatch Act, a compromise between the values of science, vocationalism, strict constructionism, and federalism occurred.

The original Hatch bill, drafted by land-grant officials, accepted the goodness of scientific freedom. However, this value was tempered by the vocationalist value (among both scientists and farmers) that good science was that which solved the practical problems of farmers. The value that truth for its own sake was good, or that science was good only for a small scientific elite, was rejected outright. Farmers, dissatisfied with the already "too classical" agricultural colleges, would support only a practical institution. College scientists and administrators, having been the object of such farmer dissatisfaction and realizing that the development of science was essential for the development of both agriculture and the agricultural colleges, tempered their scientific values with a respect for vocationalism.

The mere passage of the Hatch Act required the acceptance of the value that federal action to provide for the general welfare of the nation was good. Again, however, this value was tempered by the strict constructionist value that decentralization of power was good. The strict constructionists' amendments to the Hatch bill, while still allowing federal funding, were clearly intended to place control of the stations in the hands of the states.

This, of course, indicates the complementarity of the values of science and strict constructionism in this instance. Both wished to minimize federal control of the stations and, as a result, were simultaneously accepted in the writing of the Hatch Act.

The Smith-Lever Act of 1914

Issues to be Resolved

Four major issues had to be resolved before passage of the Smith-Lever Act was possible. These were:

Should an extension service be independent of or attached to the colleges of agriculture?

What degree of control should the USDA have over extension work?

Should an extension bill be passed separately or as part of a comprehensive vocational education program?

What should be the relation between professional researchers and extension workers?

The remainder of this chapter examines how these issues were resolved during the writing of the Smith-Lever Act.

Of these four, only the first three were of significance during the debate on the establishment of the extension service. The question of research-extension relations, like the question of education-research relations during the writing of the Hatch Act, was avoided by the college administrators in hopes of being able to settle this question themselves after the establishment of the extension service.

The Movement Establishing Extension Services

The Movement Among the Land-Grant Colleges: Immediately after the passage of the Hatch Act, the land-grant colleges formed the Association of American Agricultural Colleges and Experiment Stations. Controlled

by the presidents and deans of the colleges, the association facilitated communication between members on educational and research problems and provided a strong lobbying voice for the colleges in Washington, D.C. It was perhaps the earliest public sector interest group to be formally organized.

As early as 1887, the members of the association discussed the need to develop farmers' institutes to teach the farming principles discovered at the experiment stations (2, p. 12). The increasing demands on researchers' time by farmers grew until, shortly after the turn of the century, the association's members began to discuss the need for a full-time extension staff.

By 1906, the demands on the time of researchers were such that Wisconsin experiment station Director W. A. Henry complained, "Our station workers are now overwhelmed with an ever-increasing flood of farmers' letters on every possible topic." The solution, he told the association, was the organization "in every college and station a separate corps of workers whose sole duty shall be to serve as intermediaries between the college and station . . . and our great farm clientage" (13, p. 95). According to Director Henry, only a corps of such workers could simultaneously satisfy farmers' demands and allow researchers the freedom to pursue new knowledge, which, as a scientist, he felt was essential.

For the next five years, the college representatives continued to discuss the need for an extension staff, particularly to relieve the work load being placed on researchers. The consensus of the colleges was summarized in 1908 by New York Director W. H. Jordan: "An investigator to be efficient must remain mostly within the atmosphere of inquiry and should not have his continuity of thought and effort frequently

interrupted by duties foreign to his general trend of effort" (14, p. 115). Kansas State Agriculture College President H. J. Waters was more succinct when, during a 1913 address on "The Organization of an Extension Service," he told the association:

> The research man must have isolation and approximate control of his time and a freedom of movement that is not possible for the [extension worker]. The investigator's dominant impulse must be to discover the truth . . . . The scientist cannot brook argument from a layman (19, p. 148).

Among scientists, a major driving force behind the establishment of an extension service was the need to relieve their extension work load and provide a greater degree of scientific freedom.

In 1909, the association passed a resolution emphasizing three key components of an effective extension service--that a federal appropriation be used to support extension work; that each agricultural college establish a separate department to perform extension duties; and that funding be given only to the land-grant colleges (15, pp. 37-38). Using this plan, the executive committee of the association worked with Michigan Congressman J. C. McLaughlin to submit a bill to Congress in 1909. The McLaughlin plan also included a provision that the money was to be used for the instruction of persons "not resident in these colleges" to prevent the diversion of extension funds to other uses (156, p. 103). Although the McLaughlin bill was never voted upon, it became, with the support of the association, the basis for the work of Representative Asbury Lever of South Carolina and Georgia Senator Hoke Smith in establishing an extension service.

The Demonstration Work of the USDA and the Movement Among Farmers: Started in 1903 by Dr. Seaman Knapp (the author of the original experiment station bill) the Farmers' Cooperative Demonstration Work in

several southern states played a key role in the extension service movement by establishing the county agent model. Using a system of county agents, progressive farmers were recruited in each community to demonstrate methods for reducing the damage being done by the cotton boll weevil. Other farmers, seeing the successful results, would then join as cooperators and, by 1912, the movement had 100,000 cooperators in 12 states. Funded by the USDA's Bureau of Plant Industry, the demonstration work had 450 agents and a budget of $750,000, compared to only 182 full-time extension workers at the agricultural colleges. Most of the work done by the colleges took the form of lectures at farmers' institutes or agricultural trains (156, pp. 63-64; 157, p. 279).

Despite his earlier professional affiliation with the agricultural colleges, Knapp had become very impatient with their performance, particularly their lack of successful work in changing the production methods of farmers. Telling an assistant, "These idiots [the faculties of the agricultural colleges] still think that A. and M. College means 'Academic and Military' rather than Agricultural and Mechanical," he criticized their information as not extending "beyond the three-mile limit" surrounding the campus (26, p. 153). Having no other alternative, Knapp developed a successful extension project independent of the colleges.

Knapp's success was evident in the response of farmers to his work compared to that of the colleges. A survey of southern farmers indicated that 15 percent of them had received advice from Knapp's demonstration agents and 90 percent of those had followed the agents' suggestions. In contrast, only 2 percent had attended the college-sponsored farmers' institutes and only 25 percent had used the information provided (50, p. 71).

Knapp's popularity with the colleges' farm constituency worried many college presidents and deans. Knapp attempted to allay these fears by reminding them that, as the author of the original experiment station bill, he still wanted all research work done at the stations. He also assured them that his role was temporary and all demonstration work would pass to the colleges when the boll weevil emergency had passed (20, p. 195).

The presidents were, in a word, unconvinced. The conflict reached a peak in 1906 when the president of Clemson College and the governor of South Carolina conspired to prevent Knapp from speaking at the college's farmers' institute because they did not want "outsiders to come into the State, do a little work, and claim all the credit" (20, pp. 195, 224). This fear that the popularity of the demonstration work would hurt the colleges politically and financially prevented cooperation between Knapp and the colleges (except in a few cases: Texas, Alabama, Mississippi and, at the demand of the farm community, South Carolina).

Despite his declared sympathies with the colleges, Knapp insisted that any extension bill passed should include provisions to allow his demonstration work to continue. Knapp remained skeptical that the work would develop rapidly under the direction of the colleges and, as one aide later recalled, "The idea of demonstration work [had to be sold] not only to farmers and the public generally, but to the colleges as well. The colleges [had to] realize that county agent work was good"(20, p. 232). In Knapp's opinion, only an independent (at least temporarily) extension service would allow him to continue his emergency work and convince the colleges of its importance.

Knapp's vocationalist attitudes and actions had endeared him to southern farmers. Indeed, following his death in 1911, Congressman Benjamin Humphreys of Mississippi informed his colleagues that grateful southern farmers were raising funds to build a monument to Knapp.[4] It is not surprising, therefore, that farmers agreed with Knapp on the need for independent extension work.

Moreover, farmers saw vocational education at the secondary level as a means of providing farm boys with the vocational education they were not receiving from the agriculture colleges. The colleges, the farmers felt, were educating their children away from the farm into other professions. The Grange, therefore, supported a comprehensive vocational education plan as embodied in the bill proposed by Vermont Senator Carroll Page (full details of the Page proposal are discussed later in this chapter).

The Role of the Office of Experiment Stations: Under the leadership of Alfred C. True (who directed the office from 1893 to 1915), the Office of Experiment Stations within the USDA became a great asset to the colleges and stations. The office maintained its position as a clearinghouse for station research results and as a communications medium for researchers. Although the office did have the power to withhold funds from stations if money was misspent, it could do so only on the grounds that funds intended for experimentation were being directed toward other uses. The office had no formal role in determining or executing the research agenda of the stations.

The office did have another informal but important role: that of advocate and defender of scientific values and scientists. On the subject of extension work, the office frequently editorialized in its

official publication, the Experiment Station Record, about the need to limit the demands for extension work being placed on researchers:

> (1898) "The dull grind of voluminous correspondence or popular composition will surely sap his alertness in the pursuit of truth" (170, p. 302);
>
> (1900) "It is those stations which have most closely adhered to the fundamental conception that they are institutions for research which have attained the greatest measure of success in the eyes of practical men" (171, p. 404);
>
> (1903) "An itching for popular applause . . . seduces many investigators to neglect their laboratories for the office and the lecture platform" (172, p. 413);
>
> (1903) The stations "should not be expected to bear the brunt of the [extension] work. It is a distinct and independent line of work from that of the experiment station" (174, p. 1).

In 1909, office Director Alfred True took the official position that Hatch funds could not be used for extension work. However, he did indicate, "This Office will always be glad to do anything in its power to aid the agricultural colleges in securing funds with which to thoroughly organize and develop extension work" (95, p. 113). As a nonvoting member of the land-grant college association, the office shared the colleges' position that an extension service should be established as a part of the agricultural colleges. In 1911, True told the association only a trinity of teaching, research, and extension would adequately serve the agricultural community:

> I am unable to see how such a plan can be operated successfully without bringing those three divisions together to form a college of agriculture . . . . It seems to me that in our land-grant institutions all the agricultural work should be brought together into one great group (17, p. 72).

The Role of the Commission on Country Life: Although the Commission on Country Life had no active role in the writing of the Smith-Lever Act,

its report provided additional momentum to the extension movement. Appointed by President Theodore Roosevelt in 1908, the commission had the responsibility of reporting on the conditions and potential solutions to the problems of rural life. Roosevelt spelled out his directions quite clearly:

> Your purpose is neither to investigate the farmer, nor to inquire into technical methods of farming. You are simply trying to ascertain what are the general economic, social, educational and sanitary conditions of the open country, and what, if anything, the farmers themselves can do to help themselves, and how the Government can help them (47, p. 53).

To accomplish their objective, the commission surveyed 550,000 farmers, held 30 regional meetings, and encouraged the school superintendent of each county to hold and report meetings of farmers.

Reporting their results in 1909, the commission took the position that extension work should be established under the direction of the colleges of agriculture for reasons of cost and communication efficiency. The commission may have been influenced by college officials on this issue. Professor Liberty Hyde Bailey of Cornell was the commission's chairman and President Kenyon L. Butterfield of the Massachusetts Agricultural College was a member of the commission.

Furthermore, the commission concluded that only a comprehensive program intended to promote vocational education at all levels would improve rural life. The commission also stressed that an aggressive program of cooperation between state and federal governments was needed to improve rural conditions (47, pp. 10, 28-31). Despite its lack of power beyond that of suggestion, the wide scope of the commission's investigation added substantial weight to extension movement by confirming that the rural population was in favor of extension work and vocational education.

Passage of the Smith-Lever Act: Congressional Debate and Decision

By 1912, two proposals to create an agricultural extension service were on the legislative agenda of Congress. The first, proposed in the House by South Carolina's Asbury Lever and in the Senate by Georgia's Hoke Smith, was a plan only to establish an extension service. The bill's provisions included:

(1) The objective of the bill was "to aid in diffusing among the people of the United States useful and practical information on subjects related to agriculture and home economics";

(2) That an extension department be inaugurated at each of the land-grant colleges;

(3) That extension work be defined as the instruction of persons not attending the colleges;

(4) That extension work be carried on in a manner agreed upon by the Secretary of Agriculture and the agricultural college in each state;

(5) That $10,000 plus an additional amount based on rural population be appropriated to each state to support such work;

(6) That no part of the fund be used to erect buildings or teach lectures in the colleges (163, p. 1760).

The second bill, proposed by Senator Carroll Page of Vermont, was a broad plan for all forms of vocational education. His plan appropriated $12 million among several educational projects. Provisions of the bill included:

(1) The objectives of the bill were "the promotion of instruction in agriculture, the trades and industries, and home economics in secondary schools," the preparation of

teachers for these vocational subjects, and the maintenance of extension departments and branch experiment stations;

(2) Money appropriated for the teaching of agriculture in high schools and for the creation of separate high schools to teach industrial arts and home economics;

(3) The creation of district high schools (1 per each 15 counties) to teach agriculture;

(4) The establishment of "branch experiment stations" at each district high school to perform experiments and demonstrations;

(5) Money appropriated for teacher training in vocational subjects at the agricultural colleges and the state normal schools;.

(6) The establishment of an agricultural extension department at each agricultural college;

(7) That work of the extension department and the branch experiment stations would be controlled in cooperation by the USDA and the agricultural colleges (160, pp. 7663-71).

Representatives of the colleges lost no time in expressing dissatisfaction with the Page bill. Opposition to the plan arose on three issues: the attachment of secondary vocational educational legislation to the extension bill; the creation of branch experiment stations at high schools; and the degree of control over extension work held by the USDA.

Opposition on the first point was expressed by New York's station Director W. H. Jordan. He lamented that the extension bill had been

"left to the parental care of Congress," only to have it "not only married [to vocational education in the Page bill] but without the consent of its parents" [the association]. Declaring it a "polygamous marriage," he demanded "a divorcement, not only on the grounds of illegality, but of incompatibility" (16, p. 99). The association maintained throughout the Smith-Lever debate that it was not opposed to support for vocational education at the secondary level, simply that federally funded secondary education was a more controversial idea that should be dealt with separately.

On the issue of branch experiment stations, the association's members insisted the establishment and control of such stations must always be in the hands of the state's central station. Otherwise, they felt, such decisions would be made for reasons less worthy than those of efficient scientific investigation. Illinois Dean Eugene Davenport asserted that legislative creation of branch stations "speedily takes on a political aspect" solely for "local financial gain or advantage" (17, p. 79). Iowa State Director C. F. Curtis agreed, arguing that scientific decisions were more objective than politicians' and, "The central station may be assumed to extend its activities in a systematic, logical, and effective manner, whereas legislators are apt to be moved by less worthy motives" (18, p. 183). College administrators probably came to this conclusion because of their sincere respect for the necessity of scientific freedom in administrative decision making and from political lessons learned following the writing of the Morrill Act when legislative location of the colleges left some of the institutions politically and financially scarred.

On the third issue, that of USDA control of college extension, the college representatives insisted that federal control be minimized. University of Missouri President F. B. Mumford warned the association in 1912 that excessive control by the USDA would lead to a political distribution of agents similar to the USDA's much abused (by congressmen with distribution privileges) seed distribution program. The seed program, according to Mumford, had become "a waste of public funds" known to "everyone but Congress" (18, p. 137). Only a plan that established a politically and scientifically independent extension service would avoid such problems. To provide such a service, the association demanded that USDA control of extension work be avoided.

Endorsed by the land-grant college association, Smith and Lever pressed their case when Congress convened in 1912. In the House, Lever guided the bill through with only one major amendment. That amendment, proposed by Fred Blackmon of Alabama, provided that nothing in the Lever bill could be construed to interfere in any way with the Farmers' Cooperative Demonstration Work of the USDA.

Lever opposed the amendment, simply suggesting that the demonstration work be brought under the control of the colleges in ten to twenty years. Lever's idea was rejected by Benjamin Humphreys of Mississippi, claiming the farmers of the South would trust only the work done by the agents of Seaman Knapp. Backed by other southerners, the Blackmon amendment to continue an independent corps of demonstration agents in the South was approved (160, pp. 11621, 11635-36, 11720).

Lever was successful, however, in defeating an amendment by Samuel Tribble of Georgia requiring all extension agents have not less than five years of "practical and successful experience in farming." Fearful that

extension jobs would be filled by academic theorists or inexperienced graduates, Tribble insisted that such work required practical men with sufficient experience to communicate with farmers. Opponents rejected Tribble's vocationalism on two grounds; first, that few such men could be found, and second, that "practical and successful" was impossible to define. The amendment was eventually judged unworkable and defeated (160, pp. 11708-09).

Smith was having less success in the Senate. Although the Senate Agriculture Committee report supported the Smith bill, Senator Page quickly moved to substitute his bill for Smith's.

Smith spoke against the Page bill, objecting to the establishment of branch experiment stations at high schools: "Experimentation is not the proper thing for a high school. Experimentation in agriculture is the work of the trained student, of the scientist in testing truth" (161, p. 1955). Smith also argued for separating the two bills because he did not want the issue of extension to be intertwined with the more controversial issue of federally supported vocational education in the Page bill. Following the suggestion of President Kenyon L. Butterfield of the Massachusetts Agricultural College, Smith urged the Senate to pass his bill immediately and appoint a congressional committee to study the issue of vocational education (161, p. 913).

Page rejected Smith's proposal, then offered to accept the Smith bill, but to amend it by adding all of his own non-extension provisions. Smith again objected, claiming the funding for high school vocational education in the Page bill was insufficient (about $500 per high school) and that the Page bill raised serious constitutional questions by retaining "too much power in the National Government with reference to the

secondary schools" (161, p. 2109). Page supporters dismissed Smith's constitutional objection, claiming the improvement of American life was at stake and "here we face a question of humanity" (161, p. 2105). In the end, Page prevailed and the Smith bill, with all of Page's other provisions added, was passed by the Senate.

The Senate and House were now at odds, the former supporting the amended Smith bill and the latter favoring the simpler Lever bill. The dispute was sent to a House-Senate conference committee which was unable to reach a compromise. Thus, the Sixty-second Congress adjourned in 1913 without passing any form of extension legislation.

In the meantime, Illinois Dean Eugene Davenport and Kansas State President H. J. Waters reasserted the colleges' opposition to USDA control of extension work. They indicted both the Smith-Lever and Page plans on two counts. First, that if extension agents were classified as USDA employees, the extension system would inevitably fall into the hands of "unscrupulous politicians" who would construct "the most gigantic political machine every devised." Second, unless the extension department was clearly under the control of the colleges, the popularity of the extension service would soon have the extension tail wagging the collegiate dog. Eventually, they believed, the popularity and funding of the colleges and experiment stations would suffer at the hands of the more practical and popular extension work (19, pp. 131, 150).

In a 1913 address to the association, newly appointed Agriculture Secretary David Houston moved to alleviate these fears. First, he reassured the college representatives that the department had "no selfish institutional ambition" and was not seeking to control the work of the colleges. Second, he guaranteed the colleges would have control of both

the extension methods and agents. Third, he told them the USDA sought only to guarantee "the funds are efficiently expended for the purpose for which they are appropriated," that is, to prevent the diversion of extension funds to research or on-campus education (19, pp. 20-21). Calmed by his message, the association again endorsed the Smith-Lever plan.

When the Sixty-third Congress convened in 1913, Smith, Lever, and Page resubmitted their bills. Once again, Lever's bill moved quickly through the House. This time, Lever proposed an amendment to continue the demonstration work already being done (163, p. 1932). Trying to balance the concerns of both colleges and farmers, he stated that the colleges would control the work, but the demonstration method would continue (157, p. 288). At his urging, the amendment was passed.

In a last minute attempt to defeat the bill, Congressman John Fitzgerald of New York expressed the strict constructionist view that extension work was a form of education and, therefore, a responsibility of the states. The Lever bill, he concluded, was "obnoxious" and "contrary" to the theory of American government (163, p. 1944). The House was unmoved and the Lever bill was passed on January 19, 1914.

Buoyed by the success of Lever, Smith immediately substituted the final version of the Lever bill for his own. Furthermore, both houses of Congress had passed resolutions creating a commission to study the viability of federally funded vocational education, effectively killing the Page bill and opening the way for passage of the Smith bill (163, p. 1944).[5]

Smith fought off four final amendments, the first by Senator Thomas Sterling of South Dakota to eliminate all USDA control over the extension

funds. Claiming the USDA had no constitutional right to control such spending, Sterling declared that an extension service built on the model of minimal federal control provided in the Morrill and Hatch Acts was preferable. Smith counseled against the amendment, warning that he had struggled to strike the compromise in his bill which allowed the USDA to supervise the spending of funds, but allowed the colleges to select and supervise the agents. At Smith's strong urging, the Sterling amendment was defeated (163, p. 2522).

The next amendment, which allowed the state legislature to determine whether the funds should go to the college or to the state board of agriculture, was proposed by John Weeks of Massachusetts (where the state board performed extension work). Smith opposed the motion, claiming such a "double agency of control" was inadvisable. Again, his advice was followed and the motion was defeated (163, pp. 3128-29).

The final two amendments in the Senate concerned the distribution of extension funds. The first, offered by Albert Cummins of Iowa, would have distributed funds on the basis of land in farms rather than rural population. Arguing that midwestern states were being discriminated against by a distribution based on rural population, several midwestern and western senators advocated a distribution based on land in farms or value of production. Smith responded by arguing that the intent of the bill was to educate people and, therefore, funds should be based on rural population.

Senator F. M. Simmons of North Carolina added the weight of the land-grant colleges to Smith's argument by reading a letter from the association in favor of a population-based distribution. In the end, Smith prevailed and a coalition of senators from the South and East

(which would have lost money to the West and Midwest had a land-based distribution been used) defeated the Cummins amendment (163, pp. 2579-83, 2655-58, 2736-44).

The final amendment, offered by Wesley Jones of Washington and supported by the National Association for the Advancement of Colored People, would have required southern states to divide extension funds equally between the white land-grant colleges and the black land-grant colleges established by the Morrill Act of 1890 (163, pp. 2929, 3035). Claiming the bulk of the Hatch funds were going to experiment stations at the white colleges, Jones asserted that an equal distribution of extension money was needed to improve the farming methods of blacks.

Southern senators objected vigorously. Smith, a Georgian, claimed that black farmers were already being served by, and had more respect for, white demonstration agents (163, p. 2520). James Vardaman of Mississippi claimed blacks were incapable of improvement unless taught and directed by whites (163, p. 2652). Finally, Smith told his colleagues that his state did not want extension funds if they were to be shared with the black colleges (163, p. 2946). Combining the votes of southerners with some western support, Smith defeated the Jones amendment and the original wording of the bill, which allowed the state legislature to determine the distribution of funds, was preserved (163, p. 3124).

As in the House, the bill received last minute opposition from strict constructionists. Thomas Sterling of South Dakota accused the bill of "extreme paternalism." John Works of Oregon called the bill "class legislation" and predicted it would create a "spineless citizenship, taking away their initiative and enterprise and industry." Frank

Brandagee of Connecticut lamented that the bill was "utterly outside the province of national activity" and that the general welfare clause was being abused to evade "any of the [Constitution's] limitations" (163, pp. 2571-77, 3126). Their efforts were in vain, however, and the Smith bill was passed by the Senate on February 7, 1914.

Following a conference committee agreement on some minor differences in the two bills, President Woodrow Wilson signed the Smith-Lever Act on May 8, 1914. Two years earlier, Wilson had declared his support for extension work:

> [It is] the duty of the Government to share in promoting agricultural, industrial, and vocational education in every way possible within its constitutional power . . . . The Nation cannot enjoy its deserved supremacy in the markets and enterprises of the world unless its people are given the ease and effectiveness that come only with knowledge and training (160, p. 10860).

Thus, in its final form, the Smith-Lever Act had the following major provisions:

(1) The agricultural extension services were to be established under the direction of the land-grant colleges;

(2) The extension methods used and agents employed were to be chosen by the colleges;

(3) The USDA was to supervise the expenditure of extension funds, insuring that such funds were not diverted to other uses.[6]

The Role of Nonmonetary Values in the Smith-Lever Decision

Five major sets of values influenced the writing of the Smith-Lever Act: agrarian fundamentalism, vocationalism, science, federalism, and strict constructionism.

The values of agrarian fundamentalism, which held farm life to be superior to all others, became a major justification for passage of the Smith-Lever Act. Many legislators saw the act as a means to reverse the migration from farms to urban areas and to increase the welfare of the nation by increasing the prosperity of the farm sector. Ohio Congressman Frank Willis clearly had this in mind when he called statistics showing 46 percent of the population living in urban areas "startling and alarming" and implored his colleagues to pass the Lever bill as a means to reverse the trend:

> To the end that the life of the American farmer may be more attractive and profitable and that more of our people may be encouraged to live in the country, where the good Lord intended them to live, and thereby aid in the solution of this mighty national problem, let us pass this bill (163, pp. 11619-20).

South Carolina Representative Wyatt Aiken agreed: "Profitable farming spells back to the farm. Back to the farm spells relief for the congestion of the unemployed in our cities, and a consequently healthy public sentiment" (163, p. 11622). Furthermore, several legislators (quoted extensively in Chapter IV) asserted that a prosperous farm economy was the basis of a prosperous national economy and supported extension work as a means of promoting farm prosperity. Thus, although agrarian fundamentalism did not affect the institutional form chosen, these values provided a justification for passing such legislation and added legitimacy to the movement.

As in the case of the Hatch Act, the Smith-Lever Act involved a conflict between federalist and strict constructionist values. By 1914, however, the acceptance of strict constructionism among legislators had declined substantially. Thus, federalist values (a liberal interpretation of the general welfare clause in particular) were chosen over those

of the strict constructionists. The institutional form chosen, however, still showed respect for strict constructionism: the power of the USDA was limited to supervising expenditures--not hiring or directing agents. This limit, as admitted even by the bill's proponents, was out of respect for the strict constructionist value that local control, even of federally funded institutions, was good. In this regard, the Hatch bill had provided evidence that federally funded institutions could operate at the state level without leading inevitably to centralized federal control.

The values of science were again instrumental. The insistence of the members of the land-grant association that researchers should have their work load lightened to provide the freedom needed for efficient research and that extension workers had to be protected from political manipulation were major factors in the writing of the Smith-Lever Act. These two prescriptions set the legislative agenda by establishing the association's position that extension should be attached to and controlled by the land-grant colleges. Indeed, the support for these demands won important commitments from Secretary of Agriculture Houston to protect the extension service from USDA and congressional manipulation.

Just as with the Hatch Act, the values of science were complementary to the values of strict constructionism. The values of science, like the values of strict constructionism, favored the establishment of politically independent, locally controlled institutions as the best means of achieving a good condition. For science, the condition was scientific freedom; for strict constructionism, the condition was decentralization of power.

The values of vocationalism were important in that they firmly established the idea that good science was that which addressed the problems of farmers. This was the idea behind Seaman Knapp's work, the model upon which the county agent system was based and which developed popular support for the extension movement.

The Role of Monetary Values in the Smith-Lever Decision

There is some evidence that monetary values, as predicted by the induced innovation theory, contributed to the movement establishing the extension service in the United States. During the debate on the Smith-Lever Act, some legislators expressed concern that the prices of farm products were rising faster than those in the rest of the economy.

In the House, Edgar Crumpacker of Indiana warned his colleagues, "The world may be feeling the influence of the Malthusian law at this time," and that beef animals were being marketed at "the highest price ever in this country." The situation, he concluded, "impresses upon the Government the imperative necessity of encouraging in every legitimate way the increase in food production," including the passage of an extension service bill (160, pp. 11610-11). Similar concerns were expressed by Congressman Irvin Pepper of Iowa, who predicted the trend would continue and, therefore, "It is not going to be a question in the future of securing a fair price for farm products, but the problem is going to be to raise enough farm products to supply the demand" (160, p. 11623).

The index of real farm prices shown earlier in Figure 2 supports these claims that farm prices were rising relative to other prices. This index rose from 82 in 1896 to 102 in 1914 (1910-1914 = 100). If changes in relative product prices do induce institutional innovations intended

to alter relative prices and redistribute income, one would predict that somewhere amidst this upward trend an institutional innovation would occur. In the extension service case, at least, the induced innovation theory gains support.

When looking at relative factor prices, a curious example of the complementarity of monetary and nonmonetary values appears. The index of wages relative to land prices (Table 4) stood at 160 in 1900; affected by the closing of the western frontier and rising land prices, it fell to 100 for the period 1910-1914. If the induced innovation theory is correct, this trend should have resulted in institutional innovations intended to substitute cheaper labor for more expensive land.

An innovation, in the form of the extension service, did, of course, occur. And, ironically, several legislators supported the legislation as a means of transferring labor into the agricultural sector. However, many did not do so because of the rising price of labor. They did so, instead, because of their devotion to agrarian fundamentalism; that farm life was the good life and that farmers were good citizens essential to a republican form of government and, therefore, the government ought to encourage a back-to-the-farm movement by establishing an extension service to improve the profitability of farming. In this case, nonmonetary values appear to be complementary to monetary values; both implied that labor should have been transferred into the farm sector.

Finally, it appears that investments in human capital were leading to an increased demand for scientific knowledge. Improvements in the human agent, like changes in technology, are likely to lead institutional innovations. There was substantial investment in human capital

during this period, as indicated by the decline in the national illiteracy rate from 20 percent in 1870 to 6 percent in 1920 (176, p. 382). This improvement, which might have made farmers more receptive to scientific advice, may have contributed to increasing demands on the time of researchers and resulted in the need for an institutional innovation--the extension service.

Application of the Conceptual Framework to the Smith-Lever Decision

Structure: Figure 5 shows the five interacting institutions involved in the Smith-Lever decision--the land-grant colleges, the Grange, the Commission of Country Life, and the USDA's Office of Experiment Stations and Bureau of Plant Industry (which was performing the Farmers' Cooperative Demonstration Work).

By 1910, the Association of American Agricultural Colleges and Experiment Stations was a well-organized political force. Through its annual meetings, the colleges were able to discuss and lobby for legislation considered favorable to the colleges. Furthermore, as a result of growing state appropriations and the Hatch funds, the colleges had built more facilities, larger faculties and a larger stock of scientific knowledge. These financial and intellectual resources provided the colleges with (1) active political leadership to write and lobby for legislation and (2) the steady flow of information that would be necessary to sustain the operation of a successful extension service.

The Commission of Country Life was somewhat limited in its sources of power. Appointed to recommend solutions to the problems of rural life, the commission had some power to lobby for the legislation it

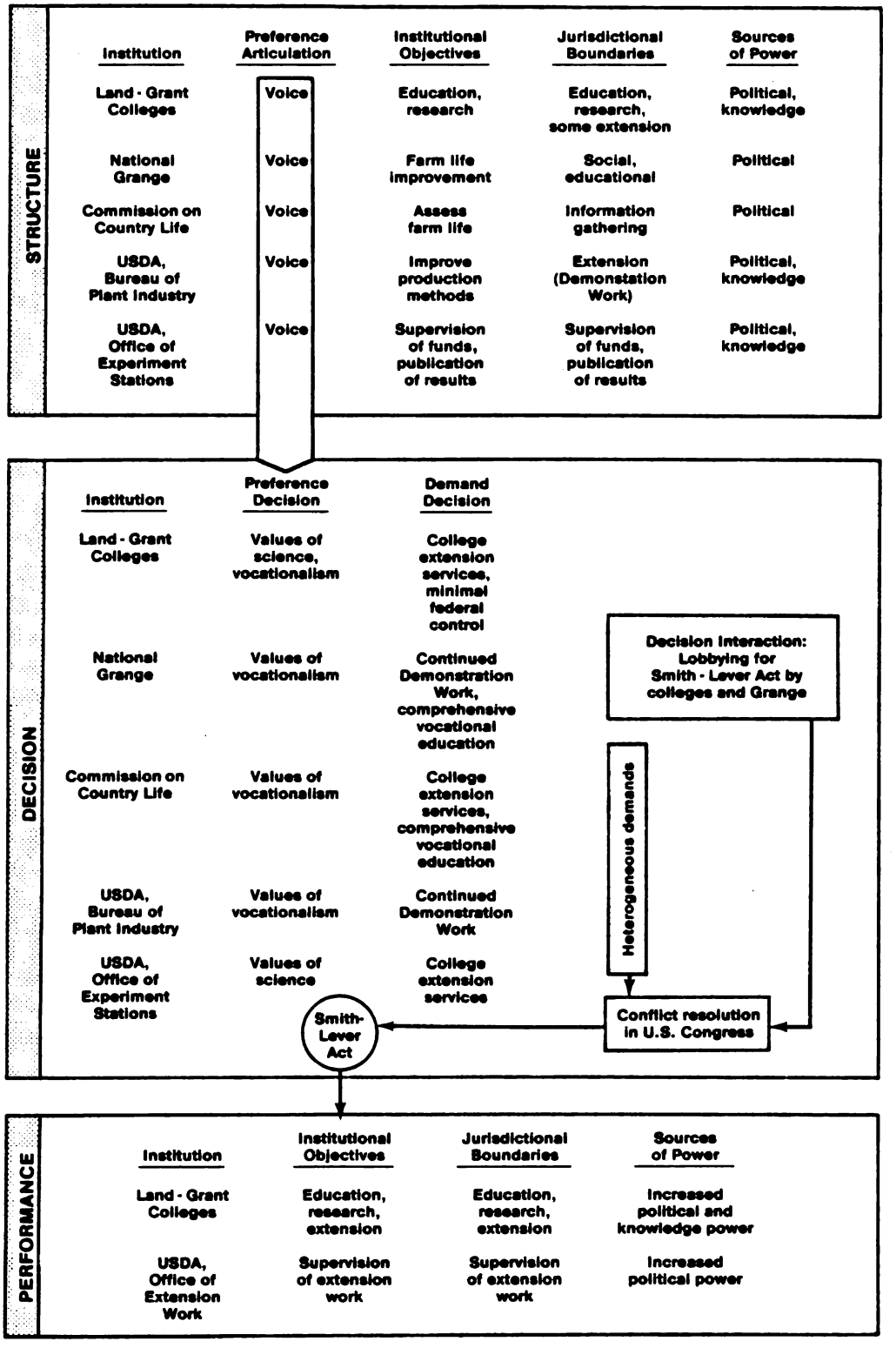

Figure 5

Schematic Presentation of Conceptual Framework Applied to the Smith-Lever Act of 1914

recommended, but its major role was in lending legitimacy and support to the extension movement.

Two agencies of the USDA were involved in the Smith-Lever decision. The Office of Experiment Stations acted primarily as a communicator among the colleges and between the colleges and the public. The office had little power over the stations (except, as when it ruled that Hatch funds could not be used for extension work, it prevented the misuse of funds). However, by working with the college officials through the land-grant association, the office was able to exert some political power.

By funding Seaman Knapp's demonstration work, the Bureau of Plant Industry had the objective of improving the production methods of southern farmers. Through Knapp's personal popularity and the size of the program (450 agents, 100,000 farmers and a budget of $750,000 in 1912), the bureau had developed considerable political power.

Decision: The colleges' preference decision showed a continuing belief in the values of science. The colleges (particularly experiment station scientists) saw the extension service as a means of providing greater scientific freedom. The colleges did recognize, however, that the practical nature of extension work required an acceptance of vocationalist values. Reflecting farmers' sentiments, the Grange and the Commission on Country Life were both vocationalist in outlook. A close partner to the colleges, the Office of Experiment Stations, expressed scientific values. Although the Bureau of Plant Industry was a scientific institution that probably supported scientific values on other issues, its control of demonstration work made it an advocate of vocationalist values in this case.

Still wishing to defend both scientific freedom (from too much extension work) and their political support (from an independent

extension service) the colleges' demand decision was for an extension service that was attached to the colleges and free from excessive federal control. Having seen the popularity of Knapp's demonstration work, the colleges did not want to risk the creation of a more practical institution that would challenge for the support of the farm constituency. Having experienced the demands placed on the time of researchers, the colleges felt a need for a corps of extension specialists. Although the colleges were not opposed to federal support of secondary vocational education, they avoided this controversial idea in order to obtain passage of a bill establishing only the extension service.

Noting the success of the demonstration work in the South and what some farmers perceived to be a continuing failure of the colleges to provide a vocational education, the Grange demanded continued demonstration work, even if independent of the colleges, and a comprehensive program of vocational education as proposed in the Page bill. Similarly, as a conduit of farm opinion, the Commission on Country Life demanded comprehensive vocational education. However, to reduce the cost of an extension system, the commission recommended an attached extension service.

The Bureau of Plant Industry and, in particular, the father of demonstration work, Seaman Knapp, demanded the option of continued independent demonstration work. Although he respected the need for research, Knapp's decision was the result of his vocationalist values and his perception that the colleges were doing a poor job of fulfilling these values.

Since demands were conflicting, a conflict resolution process had to be pursued. By 1912, the conflict resolution process had begun with

the introduction of the Smith-Lever bill (supported by the colleges and the Office of Experiment Stations) and the Page bill (supported by the Grange and, by implication, the Commission on Country Life). However, since neither bill could muster a majority in Congress, a coalition had to be built.

In 1913, Smith and Lever built a ruling coalition by (1) convincing Congress to form a committee to study the issue of federal aid for secondary vocational education; (2) amending their legislation to allow for the continuance of the demonstration method under the direction of the colleges; and (3) using an agreement offered by Secretary of Agriculture Houston to the colleges (that guaranteed limited federal control of extension work) to convince the colleges and Congress that the USDA would not control extension work. This coalition was strong enough to overcome last minute strict constructionist objections and, with the support of President Wilson, enacted the Smith-Lever Act. Figure 5 also indicates the use of power by the colleges to influence the Smith-Lever decision. The following two examples are evidence of this influence.

The first is evident by the fact that the mechanical (or engineering) side of the A. and M. colleges was ignored by the Smith-Lever (and Hatch) Act. This was due, in part, to the lack of organization on the part of the engineers. They were not represented in the land-grant association, and not until 1913 did they organize into a separate Land-Grant College Engineering Association. Ignored by the Smith-Lever Act, the Dean of Engineering at the University of Kentucky, F. Paul Anderson, told his colleagues, "Make friends with your agricultural brethren, for

they will hold the purse strings of our land-grant colleges for some years to come" (99, p. 21).[7]

The second example comes from a confrontation between New Jersey's Dean and Director, Jacob G. Lipman, and President-elect Woodrow Wilson. Over Lipman's objections, then-Governor Wilson had submitted a bill establishing an independent state extension service to the New Jersey legislature just days before his departure for Washington in 1912.

Lipman responded by convincing the chairman of the New Jersey Senate Agriculture Committee to stall the bill in committee. When the senator complained that Wilson (by then in the White House) was "making it pretty hot for me" by insisting the bill be reported out of the committee, Lipman reassured his friend: "Senator, why do you worry? Woodrow Wilson is no longer Governor of New Jersey. He is only President of the United States!" (180, pp. 49-51). The bill was then rewritten to satisfy Lipman and passed by the legislature. The lesson is quite clear: on both the state and national level, the agricultural colleges' political ability to place items on the legislative agenda and influence the decision process affected the outcome of the Smith-Lever decision.

Performance: The changes in the institutional structure that followed the Smith-Lever decision were very similar to those that followed the Hatch Act. By adding the extension service to the agricultural colleges, the colleges had (1) added the objective of providing information directly to farmers and (2) redrawn their jurisdictional boundaries to include the resources and personnel to do this work. And, by delivering a useful product to farmers, the extension service would, in future years, increase the popularity of the colleges with farmers and provide increased political power for the entire land-grant system.

While the values of agrarian fundamentalism did provide a justification for passing the Smith-Lever Act, they did not influence the form of the new institution. The passage of the legislation was clearly intended to satisfy the vocationalist values of farmers wanting practical information, but it also intended to fulfill the scientific value that freedom of inquiry was good.

Although strict constructionism was on the decline by 1914, and the mere passage of the act reflects federalist values, the strict constuctionists still managed to limit the control of the USDA over extension work to that of insuring that extension funds were not diverted to other uses. This was, of course, complementary with the scientific value of freedom, which led college administrators to lobby for limited USDA power to reduce the potential for political interference.

Summary

The institutional forms chosen in the Hatch and Smith-Lever decisions were influenced by nonmonetary values. However, neither the vocationalist values of farmers nor the scientific values of researchers can fully explain the choice made. A full understanding of these policy decisions must recognize that the values of federalism and strict constructionism also influenced the prescriptions chosen. These two decisions produced an agricultural research system that was geographically and administratively decentralized and that would be capable of close cooperation with the teaching and extension functions of the land-grant colleges.

Notes to Chapter V

1. Two other pieces of legislation were passed during this period that affected the land-grant colleges. The Morrill Act of 1890 authorized the appropriation of $25,000 annually per state to support the educational functions of the colleges and established separate A. and M. colleges for blacks in the south. The Adams Act of 1906 authorized the appropriation of $30,000 annually per state for support of basic research at the experiment stations (129, p. 3-12). These acts are not discussed at length in this thesis since they provided additional support for existing institutions rather than significant institutional innovations.

2. It is testamony to the political skills of the land-grant college administrators that, despite the dissatisfaction of farmers with the colleges, only three independent stations were established--Ohio, New York, and Connecticut--and all of these were established before the Hatch Act was passed. While it would be interesting to examine the records of state legislatures to determine why so few independent stations were established, such work is beyond the scope of this thesis.

3. There is another possible explanation why some southern senators objected to USDA control of the experiment stations. According to Paul Gates, there was no Department of Agriculture in the Confederate Government because southerners felt the bureau which preceded the USDA was an expensive, bureaucratic failure. At one point, the Atlanta Southern Confederacy editorialized that the bureau was a "stench in the nostrils of all good men in the South." While no evidence was found this attitude still existed during the writing of the Hatch Act, the possibility should be recognized (66, p. 305).

4. Seaman Knapp died April 1, 1911. While it would be reasonable to speculate that he would have worked for an independent extension service had he lived, no evidence was found that his death affected the outcome of the Smith-Lever decision.

5. Federal support for vocational education at the secondary level was established in 1917 by the passage of the Smith-Hughes Act.

6. The relations of the colleges with the department were clarified by a 1914 memorandum of agreement between the USDA and the colleges. This agreement provided:

> all extension work done by the department would be done through the colleges;
> all extension agents would be joint employees of the department and the colleges, but the colleges would control the hiring and supervision of agents;
> the Secretary of Agriculture would establish an Office of Extension Work to work with the colleges on extension matters;
> each college would establish a separate extension division and appoint a leader to administer all extension work within the state (21, pp. 38-39).

7. It is interesting to note the lack of development of the research and extension capacity on the mechanical side of the A. and M. colleges. The first engineering experiment station was organized at the University of Illinois in 1903. In the next twelve years, eight others were organized. Most, however, were poorly funded. Edward Eddy notes five reasons for the lack of government support for engineering research and extension:

   (1) Industry was prospering sufficiently so that no demand arose for such work;
   (2) Conflicts arose between the land-grant college engineers and engineers at other universities over who should do such work;
   (3) There was no organization such as the Association of American Agricultural Colleges and Experiment Stations to lobby for engineering legislation;
   (4) Unlike farmers and their land, engineers were not confronted with obviously exhausted supplies of resources;
   (5) Indifference on the part of industry which considered vocational education or on-the-job training sufficient (56, pp. 100, 127-29, 144-45, 172).

At the second meeting of the Land-Grant College Engineering Association in 1913, President E. E. Sparks of the Pennsylvania State College blamed the lack of legislative success on the absence of political unity among engineers and between engineers and their constituents:

> Agriculture will naturally have a great advantage over engineering. The agriculturalist is an individualist who has no affiliation other than the agricultural college, but the engineer may be a graduate from any one of a dozen engineering schools in any state and he is likely to be part of a corporation which embraces graduates of other schools. Consequently when you mention agricultural support for the college, you include the entire class of people, but you cannot name a united engineering support for any 'land-grant' college. It is to be further noted that the agricultural support comes from the country where interests are simple and where devotion to the cause is easily secured. The engineering interests lie largely in the city where life is complex and devotion to any one interest is difficult to secure (99, p. 24).

The lesson for the engineers, as has been discussed in this thesis, was that the use of political power by the agricultural colleges and farm organizations was crucial in promoting the movements for research and extension to their successful completion.

CHAPTER VI

SUMMARY AND CONCLUSIONS

> "The only thing wrong with scientists is that they don't understand science. They don't know where their own institutions came from, what forces shaped them and are still shaping them, and they are wedded to an anti-historical way of thinking which threatens to deter them from ever finding out."
>
> Eric Larrabee (100, p. 48)

This research is based on the premise that scientists, especially social scientists, should and do want to know the origins of their institutions. This concluding chapter first reviews the objectives, methods, and results of the research. Next, the contribution of this research to the theory of induced innovation will be discussed. In the third section, the implications of the research for the future of the land-grant system are discussed. In the final section, suggestions for future research will be made.

Summary

Research Objectives

The objective of this research was to answer the question, Do non-monetary values matter in the process of induced institutional innovation? The induced innovation theory hypothesizes that changes in relative

factor prices induce changes in technology. New technology, combined with relative factor prices, induce changes in institutions intended to redistribute the new income streams generated by the new technology. These new institutional arrangements, therefore, determine the development of another round of technological development. Thus, an iterative and interactive process of technical, monetary, and institutional changes drives the system of technological and institutional development (29, pp. 334-42).

This thesis recognizes the important contribution made by the development and verification of the induced innovation theory and does not quarrel with the essence of the theory. Instead, it attempts to add to the theory by establishing the importance of nonmonetary values embedded in a significant institutional innovation in American agriculture, the state agricultural experiment stations.

Research Methods

To examine this question, a conceptual framework was developed using components of the theories of industrial organization, political science, and institutional economics. In the framework developed, structure was defined as an interacting set of decision-making institutions. Each institution makes a preference decision (regarding the goodness or badness of situations, conditions, or things) and a demand decision (prescriptions regarding what ought to be done). When demands conflict, or cannot be fulfilled simultaneously, a conflict resolution process must be pursued to determine which demands will be fulfilled. Performance can then be discussed in terms of the institutional changes that result from the decision and the nonmonetary values that are accepted or rejected by the decision.

To assess the importance of nonmonetary values in the process of induced institutional innovation, this framework was used to examine the writing of the Hatch Act of 1887 and the Smith-Lever Act of 1914. By defining the responsibilities of the land-grant colleges with respect to the creation and delivery of new knowledge, these two decisions were responsible for the institutional innovation known as the state agricultural experiment stations.

Research Results

The conclusion, simply stated, is that nonmonetary values clearly did matter in the creation of the agricultural experiment stations and that this can be shown in an objective, systematic manner. The values of science--that scientific progress, patience, freedom, and honesty were good--were accepted by legislators who viewed them as valid arguments for the creation and autonomy of the stations. The goodness of scientific freedom was reaffirmed by the Smith-Lever Act; it allowed the colleges to determine the appropriate amount of extension work done by each researcher, but clearly intended to relieve researchers of their growing extension work load.

This acceptance of the values of science was tempered, however, by the intended use of the scientific developments produced by the stations. The advancement of truth was not sought for its own sake. Indicative of the influence of vocationalist values, truth was to be sought for the utility it would provide for farmers and, therefore, for society. While farmers were vocationalist in their outlook, they did not have a monopoly on vocationalist values. Agricultural scientists in the late nineteenth century were equally convinced that the practical usefulness of

science was its primary source of utility, a view that differed from that of the scientific aristocrats of a generation earlier.

Scientists had come to this conclusion for two reasons. First, having been the target of farmers' vocationalist dissatisfaction in the prior quarter century, the scientists knew that development of agricultural science was necessary for the intellectual and political development of the colleges. Realizing that the colleges needed the research capacity of the stations to satisfy their farming constituency, college scientists and administrators supported stations attached to the colleges. Second, recognizing that science could contribute to the improvement of farm life, scientists were anxious to apply science to agricultural production processes. The acceptance of the values of vocationalism by the scientific elite was an essential catalyst in the movement toward the creation of experiment stations; this elite provided the political leadership necessary for the success of the movement.

This conclusion stands in contrast to that of Davis and North. Using a model of institutional innovation similar to Ruttan's, they conclude, "The development of new knowledge and the underwriting of its diffusion were not profitable endeavors for voluntary organizations when farm size was small, and therefore farmers pressed at both the state and federal level for public agricultural colleges [and] experiment stations." The reason for this pressure, according to Davis and North, was that relative market values had changed and farmers were convinced "they were entitled to a larger share of the pie" (53, pp. 104, 252). Such a conclusion ignores the fact that farmers were rather indifferent, even hostile, toward the colleges and stations. Furthermore, it underestimates the role of nonmonetary values in the process of induced innovation and,

in particular, the leadership role assumed by the educational elite in the innovation process.

To understand the autonomy of these federally funded, state controlled institutions, one must recognize the role of nonmonetary values regarding good and bad forms of government. The Hatch and Smith-Lever Acts both required a liberal interpretation of the general welfare clause of the Constitution, which federalists considered good. However, strict constructionist values placed a constraint on the fulfillment of such federalist values. By limiting the control of the USDA over research and extension work, the strict constructionists fulfilled their values that limited central government and decentralization of power were good forms of government.[1]

Recognition of the complementarity of scientific with constructionist values is essential. The former, believing freedom of scientists to be necessary for the advancement of science, and the latter, favoring decentralized, local control of institutions as a means of perpetuating a republican form of government, are highly complementary. That is, the fulfillment of one also fulfills the other. The selection of these values as appropriate during both the Hatch and Smith-Lever Acts go far in providing an explanation for the creation of a decentralized system of agricultural research in the United States. The importance of this complementarity to today's agricultural scientists is discussed in the third section of this chapter.

The role of the values of agrarian fundamentalism is also worth mentioning. Fundamentalism provided a persuasive justification for passing legislation advantageous to agriculture. By upholding the worth of farmers, and by defining a large, prosperous, landowning farm population

as necessary for the welfare of the nation, fundamentalism provided a justification for legislation that favored agriculture over other classes.[2]

Contribution to the Theory of Induced Innovation

This thesis has attempted to contribute to the theory of induced innovation by emphasizing the role of nonmonetary values in the innovation process. This section summarizes the theory of induced innovation, including the role of nonmonetary values and the complementarity of institutional innovations, technological innovations, and improvements in the human agent.

Institutions, technology, and human capital interact to release the resource constraints faced by an economy. Changes in any one of these three can provide an improvement in the productivity of scarce resources and, therefore, produce new income streams. Furthermore, a strong complementarity exists between institutional change, technical change, and improvements in the human agent. A change in technology, for instance, may produce new income streams. Technological change combined with institutional innovations or improvements in the human agent, however, may produce larger income streams than improvements in technology alone.

Improvements in any of these three are the product of prescriptive decisions describing what ought to be done. As such, they involve the processing of positive and normative knowledge, including monetary and nonmonetary values, through a decision rule. The infinite cost of perfect information implies that the decision rule must include a distribution of power which can impose a decision on some unwilling parties.

Changes in institutions, technology, and the human agent will produce changes in knowledge, including monetary and nonmonetary values. These changes in knowledge will result in a new round of innovations.[3]

Thus, induced innovation, in all its dimensions, is an interactive and iterative process aimed at releasing the resource constraints on an economy through improvements in institutions, technology, and the human agent. These three complementary factors are changed through prescriptive decisions produced by the use of positive and normative knowledge and a decision rule which includes a distribution of power. Changes in these three factors result in changes in knowledge which, ultimately, force another round of innovations.

Research on induced innovation which includes only factor endowments and technological change is, therefore, inadequate. A complete understanding of induced innovation requires a more comprehensive approach; relative product prices, nonmonetary values, decision rules, distributions of power, and the complementarity of innovations must also be explored.

Implications of the Research for the Land-Grant College System

What is the importance of this research for the land-grant system today? First, one must recognize a certain degree of serendipity in the values and decentralized institutional form chosen. Evenson, Waggoner, and Ruttan, for instance, have shown that a significant portion of the improvement in U.S. agricultural productivity is associated with the decentralization of research from the state station to the substation level (59, pp. 1101-07). Commenting on these results, Bonnen has

observed, "The economic logic of diminishing returns would suggest that the national to state segment of decentralization, if one were able to measure it, should generate an even stronger impact on productivity" (33, p. 43). While the large land base and regionalized nature of U.S. agriculture would suggest the need for a physically decentralized system, nonmonetary values--in particular, the values of science and strict constructionism--produced a decentralized decision-making system that allowed scientists to respond to the research demands of farmers in thousands of specific ecospheres in the U.S. The conclusion one can draw is not only that the authors of the Hatch and Smith-Lever Acts decided more wisely than they knew, but also that, in determining the institutional form chosen, nonmonetary values also helped determine the stations' ability to create new income streams.

Second, in the process of contributing to the development of American agriculture, the land-grant system has also contributed to the development of new values that come in conflict with those embedded in the system. These new values are a direct challenge to the scientific-strict constructionist complement and scientific-vocationalist compromise that has provided the system with the decentralized autonomy to determine a research agenda based on the demands of local constituents.

One challenge to the system comes from groups and agencies Hadwiger calls the externalities-alternatives coalition (70, pp. 150-68). These groups question the goodness of scientific progress on a number of issues, including animal rights, chemical and pesticide use, environmental quality, farm worker displacement, consumer safety, and corporate-college relations. Hadwiger identifies 60 such environmental, church,

and consumer groups that testified at congressional hearings on the 1977 farm bill on a wide range of issues (70, pp. 156-58).

Some groups, for instance, have criticized the close relationship between the colleges and agricultural corporations. Claiming that "hard times" accompanied the colleges' development of "hard tomatoes," Jim Hightower and Susan de Marco question the advancement of science at public expense when private companies are benefited: "No public money should be expended on research that principally serves the financial interests of agricultural in-put and out-put corporations--they may be part of modern agriculture, but they also are very big business and capable of their own profit-motivated research" (77, p. 395). Similarly, while discussing the displacement of workers by mechanization research, Al Meyerhoff, attorney for the California Rural Legal Assistance group, concluded, "People are recognizing that the social consequences of applied technology must be considered before enormous sums of public money are allocated" (108, p. 11).

The value of scientific freedom is also increasingly questioned in an economy where agriculture has developed into a mature industry, complete with large input and output corporations. According to animal rights advocates Jim Mason and Peter Singer, in such an environment, "'scientific objectivity' has vanished and the public has lost the benefit of expertise in finding the best technology for all of society" (105, p. 93). Author Wendell Berry has been even more blunt: "The objectivity of the laboratory functions in the world as indifference; knowledge without responsibility is merchandise, and greed provides its application" (27, p. 156).

It should not be surprising that, just as science found its complementarity with strict constructionism, the values of those challenging science today find complementarity with federalist values demanding stronger, centralized control of the research agenda. For example, Secretary of Agriculture Bergland commented in 1979, "I find it difficult, if not impossible, to justify the use of federal funds to finance research leading to the development of machines or other technologies that may increase production and processing efficiency but at the same time damage the soil, pollute the environment, displace willing workers, and reduce or eliminate competition" (106). Senator James Abourezk shared this view when he insisted, "Congress has been awakened . . . and land-grant appropriations can expect a tougher going over than in the past" (78, p. xvi).

Another source of criticism for the research of the colleges has been the National Science Foundation and National Academy of Sciences. These organizations place high value of scientific freedom and basic research, almost to the point of being anti-vocationalist in their outlook. This criticism presents a challenge to the system's historic commitment to the compromise of scientific and vocationalist values, i.e., that scientists should do research related to the problems of farmers.

In a 1972 report, the National Academy of Sciences criticized the colleges for neglecting basic science and supporting a "low quality of science and scientists." Administrators were accused of following philosophies "that reduce the decision-making power and freedom of movement, with repressive effects on the vitality of science," and causing a "proliferation of small branch stations" (178, pp. 45-47). And, from a

scientist's perspective, the system was accused of the ultimate impropriety the politicization of research: "The agricultural research system is politicized from crown to grass roots" (179, p. 932). The recommendations of the report included increased funding for basic research, especially on a competitive grant basis, instead of the traditional formula-funding basis; greater coordination of national, regional, and state research needs by consolidation of state stations; national peer review, such as that done by the National Institute of Health, to set priorities; and greater centralization of decision making in the setting of the research agenda (179, p. 937).[4]

The externalities-alternatives groups, who question the value of scientific progress and scientific freedom, and the scientific elite of the National Academy of Sciences who place high value on basic research and scientific freedom, have both placed the land-grant system on the defensive. A conflict between the values of science, vocationalism, and various public interest groups seems inevitable. The resolution of this conflict will determine the type of technologies the agricultural research system will produce in future years and, in accordance with the theory of induced innovation, the size and distribution of income streams that will be produced.[5]

Suggestions for Further Research

A number of areas need further research. The first is a more complete development of the theory and process of induced innovation, including emphasis on human capital, institutional behavior (including the behavior of alternative forms of research institutions), the

complementarities of innovations, and the role of nonmonetary values in the decisions that produce both technological and institutional innovations.

Another area of research would be comparative work on research systems of other countries. Why, for instance, do some countries have decentralized systems while others are centralized? What role did nonmonetary values play in such decisions?[6] What lessons can be derived for the benefit of developing countries?[7]

A third area would be research on the formation and acceptance of nonmonetary values. The conceptual framework developed in this thesis was adequate for tracing nonmonetary values through the decision process. However, it did not attempt to explain how decision makers arrived at their values or which values should have been chosen; instead, values were taken as given. Research on the discovery and importance of nonmonetary values in decision making will require multidisciplinary skills from philosophy, sociology, psychology, and anthropology.

A fourth area of research would be to compare the performance of different forms of research institutions and the values embedded in them. For instance, are institutions that place a higher value on scientific freedom more effective at producing new income streams? Such research could use the literature on returns to research to compare institutional forms across nations or states.

A final area of research would be the identification of the nonmonetary values embedded in such U.S. development institutions as the Farm Credit System, rural electrification, the Capper-Volstead Act, futures markets, Rural Free Delivery of mail, and the Homestead Act. These institutions share characteristics that, like the agricultural experiment

stations, make them particularly interesting. First, like the experiment stations, they have contributed to the development of agriculture. Second, they are also public policies explicitly intended to benefit farmers. Third, like the land-grant system, some of these institutions (such as the Farm Credit System and the Capper-Volstead Act) have come under criticism in recent years.

A complete understanding of the complex process of development requires more than a focus on conventional resources and technological development. It also requires an understanding of institutions, improvements in the human agent, nonmonetary values, decision processes, and the goals of national policy.

Notes to Chapter VI

1. Although this thesis did not consider the larger social context in which these decisions were made, a larger trend of social reform should be recognized. There was, during this period, a growing attitude in American society that the federal government should act aggressively for the welfare of the nation. Some of this change in attitude arose out of President Lincoln's aggressive use of federal power in the Civil War, including the unprecedented use of power to draft soldiers for a national militia, suspension of the writ of habeus corpus, a national real estate tax, withholding of taxes on interest and dividends, control of the press and the mail, national control of banking, and the issuing of money. Although many of these controls were abandoned following the war, they did set precedents for actions the government might take in the interest of the national welfare (39, pp. 214-33). The federal government was also gradually expanding its influence into the economic affairs of the nation for the welfare of the citizens. Significant legislation during this period included the Interstate Commerce Act (1887), the Sherman Antitrust Act (1890), the Federal Food and Drug Act (1906), the Meat Inspection Act (1907), the Federal Reserve Act (1913), the Federal Trade Commission Act (1914), and the Clayton Antitrust Act (1914). Thus, the Hatch and Smith-Lever Acts were part of a larger trend toward more aggressive federal action in the affairs of the nation.

2. There is, however, some question whether the values of agrarian fundamentalism were really believed to be true or whether they were a defense mechanism for farmers overwhelmed by a rapidly changing society. Richard Hofstadter has argued that by the late nineteenth century fundamentalism had become a defense mechanism:

> Rank in society! That was close to the heart of the matter, for the farmer was beginning to realize acutely not merely that the best of the world's goods were to be had in the cities and that the urban middle and upper classes had much more of them than he did but also that he was losing in status and respect as compared with them. He became aware that the official respect paid to the farmer masked a certain disdain felt by many city people. In time the eulogies of country life that appeared in farm journals lost their pleasantly complacent tone and took on some of the sharpness of a 'defensive gesture against real or imagined slurs' (83, pp. 33-34).

Furthermore, it should be recognized that anti-agrarian values also existed, especially among urbanites and social reformers. Concerned with the bad aspects of farm life, one social worker claimed in 1903, "Life in rural districts tends toward idleness, vulgarity, animality, and drunkeness." According to another, "The moral conditions among our country boys and girls are worse than in the lowest tenement in New York." These values led many urban reformers to support the work of the Commission on Country Life and, therefore, the establishment of the extension service (50, pp. 28-33). However, no evidence was found that such values affected the institutional form chosen.

3. Paarlberg recognizes that changes in nonmonetary values may require a long lag time: "The old rhetoric is still voiced, long after technology has invalidated it and even after political action has accepted the change . . . . In part this is a smoke screen. Behind it and obscured by it, the necessary changes can be and are being made. In this respect it serves a useful purpose and we should not be too critical" (117, pp. 7-12).

4. This conflict between the practical orientation of the stations and those preferring basic research is really as old as the stations. An 1883 editorial in Science magazine criticized the stations for doing practical research amounting to little more than "cheap experiments, easily and rapidly made, and of little permanent value" (138, pp. 687-88). One year later, the magazine repeated the charge, claiming the stations should be "primarily a scientific institution, intended to promote the advancement of the science of agriculture and capable of the highest and most permanent usefulness, only when it fulfills this intention as far as possible." Practical research "should not be, or appear to be, the chief end of the station" (139, pp. 508-09). E. W. Hilgard, director of the California station, responded that the magazine had a "narrow view of the proper functions of experiment stations." It was the duty of the stations, he added, to provide farmers with answers to the problems encountered in the unsettled west and to eliminate the "slow tentative process of blind experimenting" usually followed to solve practical problems (79, p. 23). The magazine's final response was to assert that basic research "should be held in higher esteem, and that the constituency of the station should, if possible, be brought to so regard it, because its results are of vastly more permanent value." Furthermore, the magazine concluded that, since there would always be popular pressure for practical results, neglect of applied research was unlikely. On the other hand, it argued, "There is danger that this pressure for immediate and striking results may lead to a neglect of the scientific functions of such a station" (140, p. 21).

5. It should be recognized that the establishment of the experiment stations and extension service was the result of a social movement that intended to change the values of society for the benefit of a deprived class of citizens (farmers) and, as such, was led by an intellectual elite. Those who dismiss the values of public interest groups or the National Science Foundation-National Academy of Sciences coalition as the beliefs of an intellectual few have failed to learn the lessons of history. Such a failure will likely lead to an underestimation of the future political influence of such groups and, therefore, to defeats for the colleges in the political decision process.

6. For instance, Ruttan briefly mentions but does not explain the centralization of research and de-emphasis of basic research in Germany during World War II (135, p. 75). One possible explanation of this unfortunate "innovation" could be the anti-intellectual values of the Nazi government. In Mein Kampf, Hitler had written, "The whole of education by a national state must aim primarily not

at the stuffing with mere knowledge but at building of bodies which are physically healthy to the core." The soft "so-called intelligensia," he said, would not survive "in a time where not the mind but the fist decides" (82, p. 345). These values were put into policy in 1933 when Bernhard Rust, the Minister of Science, Art, and Education, boasted that he had succeeded overnight in "liquidating the school as an institution of intellectural acrobats" (146, pp. 248-56).

7. One lesson for all countries is that a sustained national policy is necessary for improved productivity. Noting the criticism of later generations of scientists and economists that early research work was ineffective, Jane Porter defends the early accomplishments of the experiment stations:

> [Research], like a masonry structure, must be built from the ground up. Also without research, agricultural productivity declines rather rapidly. The growth economists have failed to take account of the fact that the experiment stations began to function just as the supply of good new agricultural land was running out. Already much land in the East had been abandoned because of its declining productivity. Probably the greatest achievement of the stations in their first half-century was in halting this process, stabilizing productivity in the Middle West, and reversing the decline in the East and South so that the United States could develop a 'permanent agriculture' (120, pp. 100-101).

While a sustained national policy is important in any country, it is especially necessary for a developing country in the early stages of institution building.

APPENDICES

APPENDIX A

THE MORRILL ACT OF 1862

APPENDIX A

THE MORRILL ACT OF 1862*

AN ACT DONATING PUBLIC LANDS TO THE SEVERAL STATES AND TERRITORIES WHICH MAY PROVIDE COLLEGES FOR THE BENEFIT OF AGRICULTURE AND THE MECHANIC ARTS.

Section 1. Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, That there be granted to the several States for the purposes herein mentioned an amount of public land, to be apportioned to each State a quantity equal to thirty thousand acres for each Senator and Representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty: Provided, that no mineral lands shall be selected or purchased under the provisions of this act.

Section 2. And be it further enacted, That the land aforesaid, after being surveyed, shall be apportioned to the several States in sections or subdivisions of sections not less than one-quarter of a section; and whenever there are public lands in a State subject to sale at private entry at one dollar and twenty-five cents per acre, the quantity to which the State shall be entitled shall be selected from such lands within the limits of such State, and the Secretary of the Interior is hereby directed to issue to each of the States in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said State may be entitled under the provisions of this act, land scrip to the amount in acres for the deficiency of its distributive share; said scrip to be sold by said States and the proceeds thereof applied to the uses and purposes prescribed in this act, and for no other use or purpose whatsoever: Provided, that in no case shall any State to which the land scrip may thus be issued be allowed to locate the same within the limits of any other State, or of any Territory of the United States; but their assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents or less per acre: And provided further, that

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*Statutes at Large of the United States, XII, 503-505.

not more than one million acres shall be located by such assignees in any one of the States: And provided further, that no such location shall be made before one year from the passage of this act.

Section 3. And be it further enacted, That all the expenses of management, superintendence and taxes from the date of selection of said lands previous to their sales, and all expenses incurred in the management and disbursement of the moneys which may be received therefrom shall be paid by the States to which they may belong, out of the treasury of said States, so that the entire proceeds of the sale of said lands shall be applied, without diminution whatever, to the purposes hereinafter mentioned.

Section 4. And be it further enacted, That all moneys derived from the sale of the lands aforesaid by the States to which the lands are apportioned, and from the sale of land scrip hereinbefore mentioned provided for, shall be invested in stocks of the United States, or of the States, or some other safe stocks, yielding not less than 5 per centum per annum upon the par value of said stocks, and that the moneys so invested shall constitute a perpetual fund, the capital of which shall remain forever undiminished (except so far as may be provided in section 5 of this act), and the interest of which shall be inviolably appropriated by each State which may take and claim the benefit of the act to the endowment, support and maintenance of at least one college, where the leading object shall be, without excluding other scientific and classic studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts in such manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.

Section 5. And be it further enacted, That the grant of land and land scrip hereby authorized shall be made on the following conditions, to which, as well as to the provisions hereinbefore contained, the previous assent of the several States shall be signified by legislative acts:

First--If any portion of the funds invested as provided by the foregoing section, or any portion of the interest thereon, shall by any action or contingency be diminished or lost, it shall be replaced by the State to which it belongs, so that the capital of the fund shall remain forever undiminished, and the annual interest shall be regularly applied, without diminution, to the purposes mentioned in the fourth section of this act, except that a sum not exceeding 10 per centum upon the amount received by any State under the provisions of this act may be expended for the purchase of lands for sites or experimental farms whenever authorized by the respective Legislatures of said States.

Second--No portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation or repair of any building or buildings.

Third--Any State which may take or claim the benefit of the provision of this act shall provide, within five years, at least, not less than one college as described in the fourth section of this act, or the

grant to such State shall cease, and said State shall be bound to pay the United States the amount received of any lands previously sold, and that the title to purchase under the State shall be valid.

Fourth--An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their costs and results, and such other matters, including State, industrial and economical statistics, as may be supposed useful, one copy of which shall be transmitted by mail free, by each to all other colleges which may be endowed under the provisions of this act, and one copy to the Secretary of the Interior.

Fifth--When lands shall be selected from those which have been raised to double the minimum in price, in consequence of railroad grants, they shall be computed to the State at the maximum price, and the number of acres proportionately diminished.

Sixth--No State, while in a condition of rebellion or insurrection against the Government of the United States, shall be entitled to the benefits of this act.

Seventh--No State shall be entitled to the benefits of this act unless it shall express its acceptance thereof, by its Legislature, within two years from the date of its approval by the President.

Section 6. And be it further enacted, That the land scrip issued under the provisions of this act shall not be subject to location until after the first day of January, one thousand eight hundred and sixty-three.

Section 7. And be it further enacted, That the land officers shall receive the same for locating land scrip, issued under the provisions of this act, as is now allowed for the location of military bounty land warrants under existing laws: Provided, their maximum compensation shall not be thereby increased.

Section 8. And be it further enacted, That the Governors of the several States to which scrip shall be issued under this act shall be required to report annually to Congress all sales made of such scrip, until the whole appropriation has been made of the proceeds.

Approved July 2, 1862.

APPENDIX B

THE HATCH ACT OF 1887

APPENDIX B

THE HATCH ACT OF 1887*

AN ACT TO ESTABLISH AGRICULTURAL EXPERIMENT STATIONS IN CONNECTION WITH THE COLLEGES ESTABLISHED IN THE SEVERAL STATES UNDER THE PROVISIONS OF AN ACT APPROVED JULY 2, 1862, AND OF THE ACT SUPPLEMENTAL THERETO.

Section 1. Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under direction of the college or colleges, or agricultural department or colleges, in each State or Territory established, or which may hereafter be established, in accordance with an act approved July 2, 1862, entitled "An Act donating lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "Agricultural Experiment Station": Provided, that in any State or Territory in which two such colleges have been, or may be, so established, the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the Legislature of such State or Territory shall otherwise direct.

Section 2. That it shall be the object of said experiment stations to conduct original researches or experiments on the physiology of plants and animals; the diseases to which they are severally subject with the remedies for the same; the chemical composition of plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States and Territories.

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*Statutes at Large of the United States, XXIV, 440-442.

Section 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigations or experiments; to indicate from time to time such lines of inquiry as to him shall seem most important, and, in general, to furnish such advice as will best promote the purposes of this act. It shall be the duty of each of said stations, annually, on or before the first day of February, to make to the Governor of the State or Territory in which it is located, a full and detailed report of its operations, a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the Commissioner of Agriculture, and the Secretary of the Treasury of the United States.

Section 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far as the means of the station will permit. Such bulletins or reports, and the annual reports of said stations, shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster General may from time to time prescribe.

Section 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of $15,000 is hereby appropriated to each State, to be specially provided for by Congress in the appropriations from year to year, and to each Territory entitled under the provisions of section 8 of this act, out of any money in the treasury proceeding from the sales of public lands, to be paid in equal quarterly payments, on the first day of January, April, July, and October in each year, to the treasurer or other officer duly appointed by the governing board of said college to receive the same, the first payment to be made on the first day of October 1887; Provided, however, that out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding 5 per centum of such annual appropriation may be so expended.

Section 6. That whenever it shall appear to the Secretary of the Treasury, from the annual statement of receipts and expenditures of any of said stations, that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

Section 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

Section 8. That in States having colleges entitled under this section to the benefits of this act, and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations established by such States; and in case any State shall have established, under provisions of said act of July 2 aforesaid, an agricultural department or experimental station in connection with any university, college or institution not distinctively an agricultural college or school, and said States shall have established or shall hereafter establish a separate agriculture college or school which shall have connected therewith an experimental farm or station, the Legislature of such State may apply in whole or in part the appropriation by this act made to such agricultural college or school; and no Legislature shall, by contract expressed or implied, disable itself from so doing.

Section 9. That the grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories to the purposes of said grants: Provided, that payments of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of the Legislature meeting next after the passage of this act shall be made upon the assent of the Governor thereof, duly certified to the Secretary of the Treasury.

Section 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the treasury to any or all of the States or institutions mentioned in this act; but Congress may at any time amend, suspend or repeal any or all of the provisions of this act.

Approved March 2, 1887.

APPENDIX C

THE SMITH-LEVER ACT OF 1914

APPENDIX C

THE SMITH-LEVER ACT OF 1914*

AN ACT TO PROVIDE FOR COOPERATIVE AGRICULTURAL COLLEGES IN THE SEVERAL STATES . . . AND THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Be it enacted by the Senate and House of Representative of the United States of America in Congress assembled:

Section 1. That in order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same, there may be inaugurated in connection with the college or colleges in each State now receiving, or which may hereafter receive, the benefits of the act of Congress approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts" (Twelfth Statutes at Large, page five hundred and three), and the act of Congress approved August thirtieth, eighteen hundred and ninety (Twenty-sixth Statutes at Large, page four hundred and seventeen and chapter eight hundred and forty-one), agricultural extension work which shall be carried on in cooperation with the United States Department of Agriculture: Provided, that in any State in which two or more such colleges have been or hereafter may be established the appropriations hereinafter made to such State shall be administered by such college or colleges as the legislature of such State may direct: Provided further, that pending the inauguration and development of the cooperative extension work herein authorized, nothing in this act shall be construed to discontinue either the farm management work or the farmers' cooperative demonstration work as now conducted by the Bureau of Plant Industry of the Department of Agriculture.

Section 2. That cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons

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*Statutes at Large of the United States, XXXVIII, 372-374.

information on said subjects through field demonstrations, publications, and otherwise, and this work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the State Agricultural College or colleges receiving the benefits of this act.

Section 3. That for the purpose of paying the expenses of said cooperative agricultural extension work and the necessary printing and distributing of information in connection with the same, there is permanently appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $480,000 for each year, $10,000 of which shall be paid annually, in the manner hereinafter provided, to each State which shall, by action of its legislature assent to the provisions of this act; Provided, that payment of such installments of the appropriation hereinbefore made as shall become due to any State before the adjournment of the regular session of the legislature meeting next after the passage of this act may, in the absence of prior legislative assent be made upon the assent of the governor thereof, duly certified to the Secretary of the Treasury: Provided further, that there is also appropriated an additional sum of $600,000 for the fiscal year following that in which the foregoing appropriation first becomes available, and for each year thereafter for seven years a sum exceeding by $500,000 the sum appropriated for each proceding year, and for each year thereafter there is permanently appropriated for each year the sum of $4,100,000 in addition to the sum of $480,000 hereinbefore provided: Provided further, that before the funds herein appropriated shall become available to any college for any fiscal year plans for the work to be carried on under this act shall be submitted by the proper official of each college and approved by the Secretary of Agriculture. Such additional sums shall be allotted annually to each State by the Secretary of Agriculture and paid in the manner hereinbefore provided, in the proportion which the rural population of each State bears to the total rural population of all the States as determined by the next preceding Federal census: Provided further, that no payment out of the additional appropriations herein provided shall be made in any year to any State until an equal sum has been appropriated for that year by the legislature of such State, or provided by State, county, college, local authority, or individual contributions from within the State for the maintenance of the cooperative agricultural extension work provided for in this act.

Section 4. That the sums hereby appropriated for the extension work shall be paid in equal semiannual payments, on the first day of January and July of each year, by the Secretary of the Treasury, upon the warrant of the Secretary of Agriculture, out of the Treasury of the United States, to the treasurer or other officer of the State duly authorized by the laws of the State to receive the same; and such officer shall be required to report to the Secretary of Agriculture, on or before the first day of September of each year, a detailed statement of the amount so received during the previous fiscal year, and of its disbursements, on forms prescribed by the Secretary of Agriculture.

Section 5. That if any portion of the moneys received by the designated officer of any State for the support and maintenance of cooperative agricultural extension work, as provided in this act, shall by any action or contingency be diminished or lost, or be misapplied, it shall be replaced by said State to which it belongs, and until so replaced no subsequent appropriation shall be apportioned or paid to said State, and no portion of said moneys shall be applied, directly or indirectly, to the purchase, erection, preservation, or repair of any building or buildings, or the purchase or rental of land, or in college-course teaching, lectures in colleges, promoting agricultural trains, or any other purpose not specified in this act, and not more than 5 per centum of each annual appropriation shall be applied to the printing and distribution of publications. It shall be the duty of each of said colleges, annually, on or before the first day of January, to make to the Governor of the State in which it is located a full and detailed report of its operations in the direction of extension work as defined in this act, including a detailed statement of receipts and expenditures from all sources for this purpose, a copy of which report shall be sent to the Secretary of Agriculture and to the Secretary of the Treasury of the United States.

Section 6. That on or before the first day of July in each year after the passage of this act the Secretary of Agriculture shall ascertain and certify to the Secretary of the Treasury, as to each State, whether it is entitled to receive its share of the annual appropriation for the cooperative agricultural extension work under this act, and the amount which it is entitled to receive. If the Secretary of Agriculture shall withhold a certificate from any State of its appropriation, the facts and reasons thereforeshall be reported to the President, and the amount involved shall be kept separate in the Treasury until the expiration of the Congress next succeeding a session of the Legislature of any State from which a certificate has been withheld, in order that the State may, if it should so desire, appeal to Congress from the determination of the Secretary of Agriculture. If the next Congress shall not direct such sum to be paid, it shall be covered into the Treasury.

Section 7. That Congress may at any time alter, amend, or repeal any or all of the provisions of this act.

Approved May 8, 1914.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Arnon, Issac. Organization and Administration of Agricultural Research. Amsterdam: Elsevier Publishing, 1968.

2. Association of American Agricultural Colleges and Experiment Stations. Report of the Committee on Station Work. Washington, D.C.: Government Printing Office, 1888.

3. _____. Proceedings of the Second Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Miscellaneous Bulletin No. 1, 1889.

4. _____. Proceedings of the Third Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Miscellaneous Bulletin No. 2, 1890.

5. _____. .Proceedings of the Fourth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Miscellaneous Bulletin No. 3, 1891.

6. _____. Proceedings of the Fifth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Experiment Station Bulletin No. 7, 1892.

7. _____. Proceedings of the Sixth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 16, 1893.

8. _____. Proceedings of the Eighth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 24, 1895.

9. _____. Proceedings of the Ninth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 30, 1896.

10. _____. Proceedings of the Tenth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 41, 1897.

11. _____. Proceedings of the Eleventh Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 49, 1898.

12. _____. Proceedings of the Twelfth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 65, 1899.

13. _____. Proceedings of the Twentieth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 184, 1907.

14. _____. Proceedings of the Twenty-second Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 212, 1909.

15. _____. Proceedings of the Twenty-third Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. United States Department of Agriculture: Office of Experiment Stations, Bulletin No. 228, 1910.

16. _____. Proceedings of the Twenty-fourth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. Montpelier, Vt.: Capital City Press, 1911.

17. _____. Proceedings of the Twenty-fifth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. Montpelier, Vt.: Capital City Press, 1912.

18. _____. Proceedings of the Twenty-sixth Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. Montpelier, Vt.: Capital City Press, 1913.

19. _____. Proceedings of the Twenty-seventh Annual Convention of the Association of American Agricultural Colleges and Experiment Stations. Montpelier, Vt.: Capital City Press, 1914.

20. Bailey, Joseph Cannon. Seaman A. Knapp: Schoolmaster of American Agriculture. New York: Columbia University Press, 1945.

21. Baker, Gladys. The County Agent. Chicago: University of Chicago Press, 1939.

22. Baker, Gladys L.; Rasmussen, Wayne D.; Wiser, Vivian; and Porter, Jane M. Century of Service: The First 100 Years of the United States Department of Agriculture. Washington, D.C.: United States Department of Agriculture, Economic Research Service, 1963.

23. Barger, Harold and Landsberg, Hans H. American Agriculture 1899-1939: A Study of Output, Employment and Productivity. New York: National Bureau of Economic Research, 1942.

24. Bartlett, Randall. Economic Foundations of Political Power. New York: The Free Press, 1973.

25. Beal, W. J. History of the Michigan Agricultural College. Lansing, Mi.: Wynkoop, Hallenbeck, and Crawford, 1915.

26. Benedict, Murray R. Farm Policies in the United States, 1790-1950: A Study of Their Origins and Development. New York: The Twentieth Century Fund, 1953.

27. Berry, Wendell. The Unsettling of America: Culture and Agriculture. New York: Avon Books, 1978.

28. Bettersworth, John K. People's University: The Centennial History of Mississippi State. Jackson: University Press of Mississippi, 1980.

29. Binswanger, Hans P. and Ruttan, Vernon W., eds. Induced Innovation: Technologies, Institutions, and Development. Baltimore: Johns Hopkins Press, 1978.

30. Blaisdell, Thomas C., ed. Semi-Centennial Celebration of Michigan State Agricultural College. Chicago: University of Chicago Press, 1908.

31. Bonnen, James T. "Some Observations on the Organizational Nature of a Great Technological Payoff." Journal of Farm Economics. 44(1962): 1279-94.

32. _____. "Agriculture's System of Developmental Institutions: Reflections on the U.S. Experience." Paper read at 1981 Symposium on Rural Economics: Quebec Agriculture and Food Economy and its Development Potential in the 1980's, October 1981, at University of Lavol, Quebec, Canada. Mimeographed.

33. _____. "Technology, Human Capital, and Institutions: Three Factors in Search of an Agricultural Research Strategy." In The United States and Mexico: Agricultural and Rural Development. Palo Alto: Stanford University Press, forthcoming.

34. Boulding, Kenneth E. Conflict and Defense: A General Theory. New York: Harper, 1962.

35. Brown, A. J. Youngson. The American Economy: 1860-1940. New York: Library Publishers, 1951.

36. Browne, Eric C. Coalition Theories: A Logical and Empirical Critique. Beverly Hills: Sage Publications, 1973.

37. Buchanan, James M. and Tullock, Gordon. The Calculus of Consent: Logical Foundations of Constitutional Democracy. Ann Arbor: University of Michigan Press, 1962.

38. Buck, Justus Solon. The Granger Movement: A Study of Agricultural Organization and Its Political, Economic and Social Manifestations, 1870-1880. Lincoln: University of Nebraska Press, 1913.

39. Burgess, John W. The Civil War and the Constitution. Volume II. New York: Charles Scribner's Sons, 1901.

40. Cahill, Robert S. and Goldstein, Marshall N. "Notes on a Theory of Political Actualization: A Paradigm of the Political Process." In The Making of Decisions: A Reader in Administrative Behavior, edited by William J. Gore and S. W. Dyson. New York: The Free Press of Glencoe, 1964.

41. Carey, James C. Kansas State University: A Quest for Identity. Lawrence: Regents Press of Kansas, 1977.

42. Carman, Harry J. Jesse Buel: Agricultural Reformer. New York: Columbia University Press, 1947.

43. Carstensen, Vernon. "The Genesis of an Agricultural Experiment Station." Agricultural History. 34(1960): 13-20.

44. Cochrane, Willard W. The Development of American Agriculture: A Historical Analysis. Minneapolis: University of Minnesota Press, 1979.

45. Cole, Arthur H. "Agricultural Crazes: A Neglected Chapter in American Economic History." American Economic Review. 16(1926): 622-39.

46. Colman, Gould P. "Pioneering in Agricultural Education: Cornell University, 1867-1890." Agricultural History. 36(1962): 200-206.

47. Commission on Country Life. Report of the Commission on Country Life. Chapel Hill: University of North Carolina Press, 1944 (Originally published in 1911).

48. Conover, Milton. The Office of Experiment Stations: Its History, Activities and Organization. Baltimore: Johns Hopkins Press, 1924.

49. Curti, Merle and Carstensen, Vernon. The University of Wisconsin. Madison: University of Wisconsin Press, 1942.

50. Danbom, David B. The Resisted Revolution: Urban America and the Industrialization of Agriculture, 1900-1930. Ames: Iowa State University Press, 1979.

51. Danhof, Clarence H. "Agricultural Technologies to 1880." In The Growth of the American Economy: An Introduction to the Economic History of the United States, edited by Harold F. Williamson. New York: Prentice Hall, 1944.

52. Davis, Joseph S. "Agricultural Fundamentalism." In Readings in Agricultural Policy, edited by O. B. Jesness. Philadelphia: Blakiston, 1949.

53. Davis, Lance E. and North, Douglass C. Institutional Change and American Economic Growth. Cambridge: The University Press, 1971.

54. Demaree, Albert L. The American Agricultural Press: 1819-1860. New York: Columbia University Press, 1941.

55. Deutsch, Morton. "Socially Relevant Science: Reflections on Some Studies of Interpersonal Conflict." American Psychologist. 24(1969): 1076-92.

56. Eddy, Edward. Colleges for Our Land and Time: The Land-Grant Idea in American Education. Westport, Conn.: Greenwood Press, 1957.

57. Einstein, Albert. "The Laws of Science and the Laws of Ethics." In Readings in the Philosophy of Science, edited by Herbert Feigl and Mary Brodbeck. New York: Appleton-Century-Crofts, 1953.

58. Eschenbacher, Herman F. The University of Rhode Island: A History of Land-Grant Education in Rhode Island. New York: Meredith Publishing, 1967.

59. Evenson, Robert E.; Waggoner, Paul E.; and Ruttan, Vernon W. "Economic Benefits from Research: An Example from Agriculture." Science. 205(September 14, 1979): 1101-7.

60. Faulkner, Harold U. American Economic History. 8th rev. ed. New York: Harper and Row, 1960.

61. Fite, Gilbert C. and Reece, Jim E. An Economic History of the United States. 2nd rev. ed. New York: Houghton-Mifflin, 1965.

62. Fite, Gilbert C. American Farmers: The New Minority. Bloomington: Indiana University Press, 1981.

63. Fitzharris, Joseph C. "Science for the Farmer: The Development of the Minnesota Agricultural Experiment Station, 1868-1910." Agricultural History. 48(1974): 202-14.

64. Galbraith, John Kenneth. Money: Whence It Came, Where It Went. New York: Bantam Books, 1975.

65. Gardner, Charles M. The Grange--Friend of the Farmer. New York: Little and Ives, 1949.

66. Gates, Paul W. Agriculture and the Civil War. New York: Alfred A. Klopf, 1965.

67. Getman, A. K. and Gregory, R. W. Contributions of Leading Americans to Agriculture. Des Moines: Meredith Publishing, 1940.

68. Glover, W. H. Farm and College: The College of Agriculture of the University of Wisconsin, A History. Madison: University of Wisconsin Press, 1952.

69. Gray, James. The University of Minnesota: 1851-1951. Minneapolis: University of Minnesota Press, 1951.

70. Hadwiger, Don F. The Politics of Agricultural Research. Lincoln: University of Nebraska Press, 1982.

71. Hatch, Richard A. An Early View of the Land-Grant Colleges. Urbana: University of Illinois Press, 1967.

72. Hathaway, Dale E. Government and Agriculture: Public Policy in a Democratic Society. New York: MacMillan, 1963.

73. Hayami, Yujiro and Ruttan, Vernon W. Agricultural Development: An International Perspective. Baltimore: Johns Hopkins University Press, 1971.

74. Hedrick, Ulysses P. A History of Agriculture in the State of New York. Albany, N.Y.: J. B. Lyon, 1933.

75. Hicks, John D. The Populist Revolt: A History of the Farmers' Alliance and the People's Party. Lincoln: University of Nebraska Press, 1961.

76. Higgs, Robert. The Transformation of the American Economy: 1865-1914. New York: Wiley, 1971.

77. Hightower, Jim and deMarco, Susan. "Hard Tomatoes, Hard Times." In Food for People Not for Profit, edited by Catherine Lerza and Michael Jacobson. New York: Ballentine Books, 1975.

78. Hightower, Jim. Hard Tomatoes, Hard Times. Cambridge, Mass.: Schenkman Publishing, 1978 (Originally published in 1973).

79. Hilgard, E. W. "Letters to the Editor: The Functions of Experiment Stations." Science. 5(January 9, 1885): 23.

80. Hirschman, Albert O. Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations, and States. Cambridge: Harvard University Press, 1970.

81. Hirshleifer, Jack. Price Theory and Applications. 2nd rev. ed. Englewood Cliffs, N.J.: Prentice-Hall, 1980.

82. Hitler, Adolf. Mein Kampf. Translated by John Chamberlain, et al. New York: Reynal and Hitchcock, 1939.

83. Hofstadter, Richard. The Age of Reform: From Bryan to F. D. R. New York: Random House, 1955.

84. _____. Anti-Intellectualism in American Life. New York: Random House, 1962.

85. Holcombe, Arthur N. Our More Perfect Union. Cambridge: Harvard University Press, 1950.

86. Hutchinson, Harry D. Money, Banking, and the United States Economy. 3rd rev. ed. Englewood Cliffs, N.J.: Prentice-Hall, 1975.

87. Johnson, Glenn L. and Zerby, Lewis K. What Economists Do About Values: Case Studies of Their Answers to Questions They Don't Dare Ask. East Lansing, Mi.: Department of Agricultural Economics, Center for Rural Manpower and Public Affairs, Michigan State University, 1973.

88. Johnson, Glenn L. "Philosophy and Economics With Some Stress on Agricultural Problems." East Lansing, Mi.: Department of Agricultural Economics, Michigan State University, 1982. Mimeographed.

89. _____. "Values in Decision Processes: Productivity, Efficiency, and Equity/Equality Considerations." Seminar, Department of Agricultural Economics, Michigan State University, June 1982. Mimeographed.

90. Keith, John A. H. "Agricultural Education." In Readings in the Economic History of American Agriculture, edited by Louis B. Schmidt and Earle D. Ross. New York: MacMillan, 1925.

91. Kellogg, Charles E. and Knapp, David C. The College of Agriculture: Science in the Public Service. New York: McGraw-Hill, 1966.

92. Kelly, Alfred H. and Harbison, Winfred. The American Constitution: Its Origin and Development. 4th rev. ed. New York: Norton, 1970.

93. Kendrick, John W. Productivity Trends in the United States. Princeton, N.J.: Princeton University Press, 1961.

94. Knight, Frank H. Risk, Uncertainty and Profit. New York: Augustus M. Kelley, 1964 (Originally published in 1921).

95. Knoblauch, H. C.; Law, E. M.; and Meyer, W. P. State Agricultural Experiment Stations: A History of Research Policy and Procedure. United States Department of Agriculture, Miscellaneous Publication No. 904, May 1962.

96. Koch, Adriene. Jefferson. Englewood Cliffs, N.J.: Prentice-Hall, 1971.

97. Kuhlmann, Charles B. "The Processing of Agricultural Products After 1860." In The Growth of the American Economy: An Introduction to the Economic History of the United States, edited by Harold F. Williamson. New York: Prentice-Hall, 1944.

98. Kuhn, Madison. Michigan State: The First Hundred Years, 1855-1955. East Lansing: Michigan State University Press, 1955.

99. Land-Grant College Engineering Association. Proceedings of the Second Meeting of the Land-Grant College Engineering Association. 1913.

100. Larrabee, Eric. "Science and the Common Reader." Commentary. 41(1966): 43-48.

101. LeDuc, Thomas. "State Disposal of the Agricultural College Land Scrip." Agricultural History. 28(1954): 99-107.

102. Lewis, C. I. The Ground and Nature of the Right. New York: Columbia University Press, 1955.

103. Lu, Yao-chi; Cline, Phillip; and Quance, Leroy. Prospects for Productivity Growth in U.S. Agriculture. United States Department of Agriculture: Economics, Statistics, and Cooperative Service, Agricultural Economic Report No. 435, September 1979.

104. Martin. O. B. The Demonstration Work: Seaman A. Knapp's Contribution to Civilization. Boston: Stratford Publishers, 1921.

105. Mason, Jim and Singer, Peter. Animal Factories. New York: Crown Publishers, 1980.

106. McCarthy, Coleman. "Bergland's Food for Thought." The Chicago Tribune, November 1979.

107. McConnell, Campbell R. Economics. 6th rev. ed. New York: McGraw-Hill, 1975.

108. Meyerhoff, Al. "Big Farming's Angry Harvest." Newsweek. (March 3, 1980): 11.

109. Michigan Agricultural College. Triennial Catalogue of Officers and Graduates of the State Agricultural College. Lansing: Michigan Agricultural College, 1885.

110. Moore, G. E. Principia Ethica. Cambridge: Cambridge University Press, 1956 (Originally published in 1903).

111. Moores, Richard G. Fields of Rich Toil: The Development of the University of Illinois College of Agriculture. Urbana: University of Illinois Press, 1970.

112. Nevins, Allan. The State Universities and Democracy. Urbana: University of Illinois Press, 1962.

113. North, Douglass C. Growth and Welfare in the American Past: A New Economic History. 2nd rev. ed. Englewood Cliffs, N.J.: Prentice-Hall, 1974.

114. Osborne, Elizabeth A. From the Letter-Files of S. W. Johnson. New Haven: Yale University Press, 1913.

115. Oser, Jacob. The Evolution of Economic Thought. 2nd rev. ed. New York: Harcourt, Brace and World, 1970.

116. Ostrom, Elinor. "Issues in Improving the Performance of Local Government from the Citizen's Point of View." Paper presented at the 1974 National Public Policy Education Conference, September 13, 1974, at Osage Beach, Missouri. Mimeographed.

117. Paarlberg, Don. Food and Farm Policy: Issues of the 1980's. Lincoln: University of Nebraska Press, 1980.

118. _____. "Power and the U.S. Food Policy Agenda." Food Policy. 6(1981): 158-62.

119. Parsons, Talcott. "On the Concept of Influence." Public Opinion Quarterly. 27(1963): 37-62.

120. Porter, Jane M. "Experiment Stations in the South, 1877-1940." Agricultural History. 53(1979): 84-101.

121. Presthus, Robert. The Organizational Society: An Analysis and a Theory. New York: Random House, 1962.

122. Primack, Martin L. and Willis, James F. An Economic History of the United States. Menlo Park, Cal.: Benjamin-Cummings, 1980.

123. Proctor, Samuel. "The Early Years of the Florida Experiment Station, 1888-1906." Agricultural History. 36(1962): 213-21.

124. Rainsford, George N. Congress and Higher Education in the Nineteenth Century. Knoxville: University of Tennessee Press, 1972.

125. Rand, Frank P. Yesterdays at Massachusetts State College: 1863-1963. Amherst: Massachusetts State College, 1963.

126. Riker, William H. The Theory of Political Coalitions. New Haven: Yale University Press, 1962.

127. Roberts, Issac P. Autobiography of a Farm Boy. Albany, N.Y.: J. P. Lyon, 1916.

128. Robinson, Joan. Economic Philosophy. London: C. A. Watts, 1962.

129. Rosenberg, Charles E. "The Adams Act: Politics and the Cause of Scientific Research." Agricultural History. 38(1964): 3-12.

130. _____. "Science, Technology, and Economic Growth: The Case of the Agricultural Experiment Station Scientist, 1875-1914." Agricultural History. 45(1971): 1-20.

131. Ross, Earle D. "The Land-Grant College: A Democratic Adaptation." Agricultural History. 15(1941): 26-36.

132. _____. "The Emergence of Agricultural Regionalism." In The Growth of the American Economy: An Introduction to the Economic History of the United States, edited by Harold F. Williamson. New York: Prentice-Hall, 1944.

133. Rossiter, Margaret W. The Emergence of Agricultural Science. New Haven: Yale University Press, 1975.

134. Rulon, Phillip Reed. Oklahoma State University Since 1890. Stillwater: Oklahoma State University Press, 1957.

135. Ruttan, Vernon W. Agricultural Research Policy. Minneapolis: University of Minnesota Press, 1982.

136. Salisbury, Robert H. "An Exchange Theory of Interest Groups." In Interest Group Politics in America, edited by Robert H. Salisbury. New York: Harper and Row, 1970.

137. Schmid, A. Allan. Property, Power, and Public Choice: An Inquiry into Law and Economics. New York: Praeger, 1978.

138. Science. "New York Agricultural Station." 2(November 23, 1883): 687-8.

139. _____. "Comment and Criticism." 4(December 5, 1884): 508-9.

140. _____. "Comment and Criticism." 5(January 9, 1885): 21.

141. Scott, Roy V. The Reluctant Farmer: The Rise of Agricultural Extension to 1914. Urbana: University of Illinois Press, 1970.

142. _____. "Science for the Farmer: Comment." Agricultural History. 48(1974): 215-20.

143. Shaffer, James D. "Food System Organization and Performance: Toward a Conceptual Framework." American Journal of Agricultural Economics. 62(1980): 310-18.

144. _____. "Pricing Mechanisms--Some Questions of Policy: An Overview From An Institutional Perspective." Paper read at OECD Seminar on Price Formation, July 1, 1980, at Paris, France. Mimeographed.

145. Shaffer, James D. and Schmid, A. Allan. "Community Economics: A Framework for Analysis of Community Economic Problems." East Lansing: Department of Agricultural Economics, Michigan State University, Undated. Mimeographed.

146. Shirer, William L. The Rise and Fall of the Third Reich: A History of Nazi Germany. New York: Simon and Schuster, 1960.

147. Shryock, Richard Harrison. "American Indifference to Basic Science during the Nineteenth Century." In The Sociology of Science, edited by Bernard Barber and Walter Hirsch. New York: The Free Press of Glencoe, 1962.

148. Simon, Herbert A. Administrative Behavior: A Study of Decision-Making Processes in Administrative Organization. 2nd rev. ed. New York: The Free Press, 1957.

149. Smith, David C. The Maine Agricultural Experiment Station. Orono, Maine: Life Sciences and Agricultural Experiment Stations, 1980.

150. Smith, Wilson. "'Cow College' Mythology and Social History: A View of Some Centennial Literature." Agricultural History. 44(1970): 299-310.

151. Stemmons, Walter. Connecticut Agricultural College: A History. New Haven: Tuttle, Morehouse, and Taylor, 1931.

152. Strauss, Frederick and Bean, Louis H. Gross Farm Income and Indices of Farm Production and Prices. United States Department of Agriculture, Technical Bulletin No. 703, 1940.

153. Taylor, Carl C. The Farmers' Movement: 1620-1920. New York: American Book, 1953.

154. Tedeschi, James T.; Schlenber, Barry R.; and Bonoma, Thomas V. Conflict, Power, and Games: The Experimental Studies of Interpersonal Relations. Chicago: Aldine Publishing, 1973.

155. Tripp, Rhoda Thomas. The International Thesaurus of Quotations. New York: Thomas Y. Crowell, 1970.

156. True, Alfred C. A History of Agricultural Extension Work in the United States: 1785-1923. United States Department of Agriculture, Miscellaneous Publication No. 15, October 1928.

157. _____. A History of Agricultural Education in the United States: 1785-1925. United States Department of Agriculture, Miscellaneous Publication No. 36, July 1929.

158. _____. A History of Agricultural Experimentation and Research in the United States: 1607-1925. United States Department of Agriculture, Miscellaneous Publication No. 251, July 1937.

159. U.S., Congress. Congressional Record, 49th Congress, 2nd Session, 1887.

160. U.S., Congress. Congressional Record, 62nd Congress, 2nd Session, 1912.

161. _____. Congressional Record, 62nd Congress, 3rd Session, 1913.

162. _____. Congressional Record, 63rd Congress, 1st Session, 1913.

163. _____. Congressional Record, 63rd Congress, 2nd Session, 1914.

164. U.S., Department of Agriculture. Proceedings of a Convention of Agriculturalists Held in the Department of Agriculture. U.S. Department of Agriculture, Report No. 22, 1882.

165. _____. Yearbook of the United States Department of Agriculture, 1907. Washington, D.C.: Government Printing Office, 1908.

166. _____. Yearbook of Agriculture, 1920. Washington, D.C.: Government Printing Office, 1921.

167. _____. Yearbook of Agriculture, 1922. Washington, D.C.: Government Printing Office, 1923.

168. _____. Agricultural Statistics, 1942. Washington, D.C.: Government Printing Office, 1942.

169. _____. Economic Indicators of the Farm Sector: Production and Efficiency Statistics, 1979. Economics and Statistics Service, Statistical Bulletin No. 65, February 1981.

170. U.S., Department of Agriculture, Office of Experiment Stations. Experiment Station Record. 9(1898), No. 4.

171. _____. Experiment Station Record. 11(1900), No. 5.

172. _____. Experiment Station Record. 14(1903), No. 5.

173. _____. Experiment Station Record. 15(1903), No. 7.

174. _____. Experiment Station Record. 15(1904), No. 1.

175. _____. Experiment Station Record. 20(1908), No. 4.

176. U.S., Department of Commerce, Bureau of the Census. Historical Statistics of the United States: Colonial Times to 1970. 1975.

177. Viles, Jonas. The University of Missouri: A Centennial History. Columbia: University of Missouri Press, 1939.

178. Wade, Nicholas. "Agriculture: NAS Panel Charges Inept Management, Poor Research." Science. 179(January 5, 1973): 45-47.

179. _____. "Agriculture: Research Planning Paralyzed by Pork-Barrel Politics." Science. 180(June 1, 1973): 932-37.

180. Waksman, Selman A. Jacob G. Lipman: Agricultural Scientist and Humanitarian. New Brunswick, N.J.: Rutgers University Press, 1966.

181. Walters, J. D. History of the Kansas State Agricultural College. Manhattan: Kansas State Agricultural College, 1909.

182. Warren, George F. and Pearson, Frank A. Prices. New York: Wiley and Sons, 1933.

183. _____. Gold and Prices. New York: Wiley and Sons, 1935.

184. White, Leonard D. The Republican Era, 1869-1901: A Study in Administrative History. New York: MacMillan, 1963.

185. Willard, Julias T. History of the Kansas State College of Agriculture and Applied Science. Manhattan: Kansas State College Press, 1940.

186. Woodward, Carl R. and Waller, Ingred N. New Jersey's Agricultural Experiment Station: 1880-1930. New Brunswick: New Jersey Agricultural Experiment Station, 1932.

187. Young, Harold N. The Virginia Agricultural Experiment Station: 1886-1966. Charlottesville: University Press of Virginia, 1975.