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Farm Management: What Is It? Where Is It Going?

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This paper is based on some extracts from a review of the post World War II literature in farm management - production economics. What has been extracted are those points considered to be helpful to further discussion at this meeting of the future of farm management. The paper is organized into two sections. The first enumerates some developments in the post World War II period that point to limitations of the methodological framework of static, production economics, theory and profit maximization. This framework is considered to be the basic foundation on which most of our efforts in farm management - production economics have been built in this period. With this background the second section then speaks to the outlook for the future for farm management.

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Some Developments Pointing to Limitations of the Methodological Framework of Static Economic Firm Theory and Profit Maximization

In the post World War II period, the methodological base for most of the work in farm management and production economics was static, production economics theory with profit maximization as the goal or norm. The work was largely problem oriented and problems were defined or identified mostly by departures from the equilibrium conditions of economics and firms were considered to be in equilibrium when maximizing profits. Moreover, profit maximization under the competitive conditions that were considered to prevail in most of agriculture was viewed as synonymous with resource efficiency.

Given the values and goals of farm-household decision-making units and given the dynamic environment in which these units operated, the methodological base of static, production economic theory with profit maximization or resource efficiency as the guiding motive was subjected to a great deal of strain from the very beginning. Throughout the post World War II period several developments took place, most of which were deliberate attempts to ease the stress on this relatively narrow methodological base.

One such development was the conceptualizations and model constructions for handling risk and uncertainty, such as the mathematical programming and simulation models with stochastic properties and multiple objective functions.

Another development was the rather far-reaching efforts devoted to a study of managerial processes or functions, to the study of finding ways of measuring the management input and to the study of how to improve management. Most of these efforts had their foundation in a behavioral theory of the firm which was a shift away from the narrower framework of static, production economics theory with profit maximization as the norm.

Farm and home development or planning with its impact on teaching (particularly in extension) and research also pointed to limitations of static, production economics theory of the firm with profit maximization as the goal. In this planning effort the farm firm and the household were viewed as an integrated decision-making unit with multiple goals. Incorporating time into programming models made it possible to provide planning information for getting from the existing farm-home situation to some future situation in contrast to timeless planning that provides no information between the existing and the optimum.

The change in the structure of agriculture, emphasizing an increase in farm size (firm growth) has also emphasized the shortcomings of the methodological framework built on static economic theory and profit maximization.

Growth models that incorporate time, imperfect knowledge, household consumption, financial flows and other variables are not much akin to the timeless models, assuming perfect knowledge and profit maximization by the firm with no household constraints.

Another development pointing to limitations of static firm theory is the fixed asset concept advanced by Glenn Johnson and associates. In traditional firm theory, the acquisition cost of an asset equals its salvage value and in equilibrium these two values are equal to the marginal value product of the asset or resource. Johnson and associates argued that these conditions may hold for some assets but for others, acquisition costs and salvage values differ considerably and that an asset is fixed if its marginal value product falls between its acquisition

cost and its salvage value. This concept has been applied to problems in forage evaluation and used in programming models for estimating supply responses.

In the post World War II period, several articles have been written that raise questions about what farm management really is [140, 153, 154, 155]. Glenn Johnson has argued that it is far broader than economics but that it has become a subfield of production economics. He has suggested that perhaps it is an impossible discipline, that perhaps it is just a point of view. Williams has viewed production economics as only one of the basic disciplines of farm management and Rutten holds that farm management has never resolved satisfactorily the question of whether it should confine itself to the economics of farm management or whether production economics, is simply one of the applied behavioral, social, biological and physical science disciplines on which the field of farm management is based. In short, farm management faces an identity crisis and if we don't know what farm management is then most assuredly it becomes difficult to know what its methodological orientation or foundation is or should be. With this and the other aforementioned developments, we now turn to view what the outlook is for the future of farm management.

V. Outlook for the Future

This chapter began with a quote from Heady to the effect that advancement in a scientific field grows not out of unqualified acceptance of the status quo but of frequent appraisal of the road ahead. Through the years since World War II, we have been enriched by a number of excellent reviews and appraisals, some of which focused broadly on agricultural economics while others were specific to production economics -- farm management and already referenced.^{31/} As was mentioned at the start, as students of social science, our central focus is to work not only to increase the power and capacity of our science -- its methodology, its analytical tools and techniques so as to become more effective in solving current social problems but to apply this capacity to solving problems of growing social concern. Looking at the production function work and the development in mathematical programming, simulation and other analytical techniques that have extended theory to include time, imperfect knowledge and various decision criteria, I have the impression that considerable progress has been made in increasing the power of our applied science in handling the growing complexity of our problems. To be demonstrated yet, it seems to me, is whether this development will have any pay-off in solving problems of growing social concern. As Williams has

^{31/} See Johnson, G., "Results from Production Economic Analysis" JFE37:206-222, May 1955; Heady, E. O., "Public Purpose in Agricultural Research and Education" JFE43:566-581, Aug. 1961; Johnson, G., "Stress on Production Economics," Australian Journal of Agr. Econ. 7:12-16, June 1963; Ruttan, V., "Issues in the Evolution of Production Economics, JFE49:1490-1499, Dec. 1967; Ruttan, V., "Production Economics for Agricultural Development" Indian Journal of Ag. Econ. 23:1-14, Apr-June 1968; Williams, D., "Production Economics, Farm Management and Extension" AJAE51:57-70, Feb. 1969; Castle, E., "Priorities in Agricultural Economics for the 1970's" AJAE52:831-840, Dec. 1970; Heady, E. O., "Allocation of Colleges and Economists" AJAE54:934-944, Dec. 1972.

pointed out, ". . . The growing emphasis on uncertainty, and on inter-disciplinary approaches to input-output analysis on the biological side, and to decision making and behavioral studies on the social science side has been well-meaning enough. But these new efforts have not yet paid off in terms of their influence upon practitioners of either extension or farm management"
[p. 65, 136].

It is to the point of our effectiveness and our dedication to solving problems of economic or social concern that I address my remaining remarks, because in the final analysis as applied scientists we are going to be judged by our dedication and skills in solving problems of social concern. As a basis for increasing our effectiveness it may be helpful to focus on the farm management identity crisis and on some orientation questions.

The Farm Management Identity Crisis^{32/}

In the previous section we noted Ruttan saying that the question of (a) whether farm management, as an academic field, should confine itself to the economics (or production economics) of farm management or (b) whether production economics is simply one of the applied behavioral, social, biological and physical science disciplines on which the field of farm management is based, remains unsolved. We saw Glenn Johnson say that farm management had become a narrow problem-solving sub-field of production economics, which in turn is a sub-field of economics.

^{32/} Identity problems are really not peculiar to farm management. Given the various names that are now being used for units previously identified as Agricultural Economics, it is quite clear that Agricultural Economics too, has an identity problem. Even colleges or Institutes of Agriculture have identity problems.

From its very beginning farm management was a multidisciplinary study. Originally what was known in farm management as a study came directly from the farms. Farms produced crops and livestock and used land, seed, buildings, labor, tools, machinery, management, etc. for production of crops and livestock, and data gathering on these outputs and inputs was originally the study of farm management. Over time, specialized bodies of knowledge and information have developed which are often called disciplines, and the disciplines reflected in the data gathered in the early days of farm management were mostly the technical fields, such as crops, livestock, farm power and machinery.

Before it was very old, farm management found use for principles, theory and information from economics and later from agricultural economics. From its beginning, farm management study involved subject matter from statistics, at least of a descriptive sort. However, some time elapsed before farm management as a study actually began to integrate the theory and tools -- sampling theory, regression, frequency distributions, etc. from modern statistics into its study and analysis. Later, farm management study drew upon concepts and techniques (Bayesian analysis, game theory, mathematical programming) from various areas such as statistics, mathematics, social psychology, econometrics, for handling risk and uncertainty considerations and for maximizing or minimizing specified objectives in decision making. With the advent of computer technology, farm management study has drawn on concepts from applied mathematics in the form of simulation techniques for handling problems of risk and uncertainty for a farming system and for measuring the consequences of introducing changes into the system. Again farm management study has drawn on concepts from operations research in

handling management problems related to inventory, resource allocation, sequencing, replacement, information search and competition.

The Interstate Managerial Study, conceived to obtain knowledge of managerial processes, provided first-hand empirical support to the widely held view of farm management as a broad, problem solving, interdisciplinary study. Farm operator performance of the functions of observing and gathering information on prices, production, institutions and people; of analyzing the information; of deciding, of acting and accepting consequences for action taken showed or revealed the broad interdisciplinary nature of this performance.

The north central regional project on management, the human factor (later known as Management Resource in Farming) was planned for the purpose of measuring the managerial ability of farmers. This attempt to measure managerial ability indirectly through factors such as age, experience, education and other variables of a socio-economic, psychological nature, also lent support to the view of farm management as a study stretching across numerous disciplines. Hence, given the nature of the unit on which the study of farm management focuses, given the functions that a manager of such a unit must perform to solve the problems he encounters, farm management as a study must necessarily continue in a multidisciplinary vein.

Ruttan observed that, "If farm management is defined as a field which is concerned with the application of the full range of behavioral, social, biological, and physical sciences (or even of the social and behavioral sciences) to the management of the farm firm, the implications for the organization of agricultural economics, as an academic field, become extremely difficult" [p. 1494, 154]. Not only will it be difficult for agricultural

economics as an academic field, it will be difficult for farm management, unless some integrating force exists. Questions that need to be resolved for farm management are: What is management? What is to be managed? Who does the management? What is the unit of analysis? Who are the clientele? What are the decision criteria? What are the allocative principles? For if farm management is multidisciplinary encompassing behavioral, social, biological and physical sciences as per Ruttan or encompassing statistics, logic, sociology, home economics, psychology, philosophic value theory, physical and biological sciences and economics as per Glenn Johnson [140], then an important question is whether these many disciplines exist as parallel fields, each with its own methodology, key variables and fundamental relationships, allocative principles and decision criteria as these pertain to management in each discipline or are there linkages among the variables from each discipline that tie the disciplines together into a general theory serving as a foundation for a managerial science? Or is there one of these many disciplines that is an integrating discipline, or is the manager a multi-person who is at one time a psychologist at another time an agronomist and at another time an economist and making disciplinary decisions?

Ruttan suggested that one response to farm management defined as the application of multidisciplines to the management of the farm firm would be for agricultural economics departments to achieve a broader staffing pattern, like in business schools with a management science approach, which would, as a minimum, bring in staff members trained in the several social and behavioral sciences [p. 1494, 154]. This response would serve to bring several disciplines concerned with management under one administrative unit but it is questionable that it would serve as an integrating force on various

disciplines, because if Ruttan has in mind primarily the business management component of business schools then the approach to management may be no more integrated than in farm management-production economics. My understanding is that business management uses several approaches to management -- approaches that involve several disciplines.^{33/} One approach is the productivity approach that emphasizes scientific management, personnel management, internal financial management, and technological aids to productivity. A second approach is the behavioral approach which emphasizes human relations, communication and how people behave under varying conditions. A third approach is the rationalistic model approach which centers on micro economic theory, how a firm should behave to maximize profits, game theory, systems analysis and operations research techniques. A fourth approach is the institutional with emphasis on an understanding of the practices, customs and laws under which a manager operates.

A second response, according to Ruttan, is to follow a pattern evolving in many agribusiness programs of establishing a close program integration with the business schools. The effect of this response, as Ruttan sees it, would be to restructure agricultural economics specializations with (a) the firm-oriented farm management and agricultural business management curriculum and research programs more closely integrated with similar programs in the schools of business and (b) with the policy oriented areas in agricultural economics continuing their close association with departments of economics [p. 1494, 154]. There certainly are structural changes in agriculture,

^{33/} See for example, Newman, W. H., Sumner, C. E., Warren, E. K., "The Process of Management" Ch. 2, Prentice-Hall, Inc., New Jersey, 1967.

such as vertical integration and the rapidly growing capital base of farm firms calling for increased attention to financial flows and management, and there is common understanding and usage of many of the same analytical techniques, all of which provide a logical base for a closer association. However, as a means of integrating multidisciplines as an approach to management it appears to face the same problems as Ruttan's first response.

But if farm management is defined less broadly, i.e., as the economics of farm production or as the production economics of the farm firm then Ruttan sees no conflict with the trend in the evolution of the two fields of farm management and production economics during the last several decades. The academic field of farm management would focus on the production economics and the economic organization of the farm firm, leaving the commercial farm manager, or his advisers, (as per Ruttan) to integrate the findings from agricultural economics and from other disciplines for decisions at the firm level. This has been the approach of farm management economics where economics with the use of various decision criteria and allocative principles is, in the hands of the manager or his advisers, the integrating discipline. This approach appears to be a practical approach to the farm management identity problem. It doesn't solve the "problem vs departments and disciplines" dilemma of the applied sciences. Farm management economics requires an overriding commitment to problem solving and problem solving requires the ability to perceive and use concepts and factual relations from many disciplines. But all applied sciences have a problem focus and to the extent that problems are multifaceted (and most of them in the real world are that way) their satisfactory solutions call for information and knowledge from more than one discipline -- at least given the structure of colleges, universities and the

development of knowledge. Disciplines or branches of learning or fields of study are man-made and man can define these broadly or narrowly. Whether he can develop them broadly for satisfactory applications to and solution of problems is quite a different matter. The modern dilemma is that with the explosion of knowledge, man, if he is to know a field in depth has of necessity been forced either to define disciplines more narrowly or to divide a discipline into subdisciplines at the very time when problems have become increasingly complex, requiring information from a broadening spectrum for satisfactory solution.

Glenn Johnson saw the problem orientation of farm management following World War II as differing markedly from the preceding fact-finding orientation [p. 4, 153]. But he also saw a serious flaw in this new orientation which he described as the narrowness of the problems considered. These, he said, tended to be defined in terms of the disequilibria of static, production economics theory. Johnson reasoned that this concentration had made farm management a narrow problem-solving subfield of production economics. Johnson added that problems definable in terms of disequilibria are solvable through recommendations for establishing equilibriums and that as long as the marginality conditions are met for an equilibrium, existing problems are not directly discernable or solvable solely within the theory and hence can easily be overlooked. Here he suggested that the focus of economic theory on disequilibria can distract attention away from the really relevant problem of inadequate resources of some of the units making up the initial asset ownership pattern.

At least part of the solution to this problem is to build models that are less constricting. One approach here is for professionals with interests in farm management economics and production economics to expand the theory

and models by relaxing the basic assumptions underlying static, production economics theory. The basic assumptions taken as given are: perfect knowledge, the state of the arts, tastes and preferences, timelessness, institutions and motivations. If we have the skills, interests, and energy to work towards incorporating these "givens" into the theoretical systems and models, production economics theory would be broader in scope and should more nearly meet the needs of solving important problems in managing farms and other units. Progress has been made in incorporating some of these "givens" as variables into our models and in expanding the objective function beyond profit maximization. Just what the pay-off from this progress will be is difficult to predict but most assuredly specialized training and skills are required to formulate complex models, to develop computer software and to operate the equipment, that will generate problem solutions. Only large commercial firms and governmental units may be able to afford these investment and operational outlays while small firms and small governmental units will need to purchase the services. Also, there is also a question of how sophisticated decision-making units really wish to get. As Baker pointed out, many farmers may be willing to pay a relatively high price for the privilege of being non-rigorous in decision making [see footnote reference 26], and as Langham suggested in our attempts to help the decision maker we may be replacing him with adverse effects to the decision maker and to the quality of the human decision [see footnote 28].

Some Suggested Orientations for the Future

For the foreseeable future, at least, research, resident and extension teaching as related to the farm firm (and household wherever appropriate)

should be conceived as farm management economics, but with a focus on problems of concern to the specified clientele and with a methodological base that combines the standard model of profit maximization under certainty with behavioral theories or constructs that have something to say about how individuals and organizations respond to imperfect knowledge, risk, uncertainty and multiple goals. With this orientation, the subject matter discipline of farm management economics will have a home in agricultural or applied economics, complementarities will exist between farm management economics and production economics and the available theory, tools and techniques can be put to work in solving crucial economic and social problems. At the same time efforts should be directed toward the possibility of tying the various disciplines or parts of disciplines together into an integrated managerial theory and science that can be applied to both private and public, individual and group, decision making. Perhaps Dreze has suggested the germ of such integration [155]. He suggested that a decision problem under uncertainty can be decomposed logically into four steps which are: (1) define the set of acts, (2) define a utility on the consequences, (3) define a probability measure on the events, and (4) find an act which is optimal in terms of expected utility. Dreze, at the cost of oversimplification, suggested that positive economics should help in defining the set of acts, that is, the range of alternatives and their consequences on the states. It seems that the behavioral sciences generally and the physical and biological sciences would also be of assistance here. Dreze called on normative economics to help in defining utility, on statistics and econometrics to bring empirical observations to bear on assessment of the probabilities and on mathematical programming techniques to help in determining the optimal act.

A clearer, more specific orientation to our clientele is needed, whoever they are. If we are engaged in problem-solving activities we must know our clientele's problems, their goals, their values -- possibly working with them in articulating them. If we are involved in education we must decide what goes into our packages. We must identify clearly our units of analysis--- a farm firm, a farm firm household, a set of farm feed processing firms, an area, a region, a nation. We must identify the decision or policy makers of these units. If our clientele are both private and public then our analysis needs to single out those alternative acts that compete and that complement each other in private and public areas and show what the private and social costs are of attaining and of not attaining compatibility where interests and objectives deviate. The same kind of analysis is needed within the private sector where various parties with some diverse interests and objectives enter into a decision making process, such as tenant-landlord, father-son, farm firm-household, partnership, corporation, etc., if the clientele are public, such as the people living within an area or region then the interests, the goals, the problems of various groups of people within the area need to be identified and the analysis needs to show how policy interventions affect the needs and objectives of these different groups.

Farm management-production economics, it has been said, has become oriented towards research techniques, research methods and theory rather than problems [153, 154, 136]. Perhaps this might also be described as professional orientation vs. problem orientation. Certainly a profession must devote a portion of its energies and efforts to the tools of its trade but hiding behind computers, techniques and models is not going to solve our social and economic problems. I do think our university system

does encourage a diversion of staff energies toward getting materials published in professional journals. To the extent that this is the avenue to salary increases and promotion, there is probably a sufficient amount of pragmatism in all of us so that this avenue appears clear and open. But with decreasing student enrollments and budget cutbacks here and before us I think the signals are rather strong for us to get personally involved in finding solutions to problems growing out of technical, social and political change.

Farm management-production economics has been accused of being identified too much with positivism, that it must become more normative [153]. Glenn Johnson has suggested that specialization and a tendency toward positivism have been responsible for lack of productivity in terms of problem solving. Certainly if such a tendency represents a diversionary tactic to stay away from problem solving then again we are treading dangerous water. It is difficult to assess what the right amount of positivism and normativism is in an applied science, but it seems to me that Ciriacy-Wautrup has wisely suggested we use some of both [139]. He suggested that normative farm management research is significant to making adjustments after a policy has been put into effect. Wautrup may not have included firm policy here but it seems to me we can think of policy here as established by any decision-making unit. But for establishing policy, Wautrup added, research dealing with how farmers do respond is of greater significance. In this sense, it appears to me that farm management-production economics needs some orientation in both directions.

It has been suggested that research in farm management-production economics has been oriented primarily to provide information relevant for

private rather than public decision making [141, 154]. Flaxico and Wiegmann, drawing on information from their review of past and current research in farm management-production economics, suggested that estimates of interfarm and interindustry relationships have been considered to have little value relative to intra-farm relationships. Flaxico and Wiegmann made that review in the late 1950's. My review of journal articles, technical and station bulletins suggests that this lack of emphasis has changed little, if any, since then. But perhaps if one looks at the use of production economics in the areas of resource and regional economics the conclusion would be different. Ruttan argued, particularly in reference to developing countries, that it is a misuse of professional talent to treat farm operators, and even extension workers, as the primary clientele for micro-economic research and he emphasized the importance of producing information on the consequences of alternative public decisions to administrators and policy makers. It seems to me there was a time (during the 1930's and 1940's) when there was a great deal of interest and effort devoted to evaluating the expected consequences of alternative agricultural policies on farm resource use. Interest in agricultural price and income policy has dwindled but there are many other state and natural policies or lack thereof that influence resource use. As various groups, agricultural and non-agricultural, bid for various resources -- land, water, fuel, labor there are both private and social costs that need to be weighed against returns in alternative uses. Handling waste and effluent suggest similar kinds of analyses. As agri-business firms and industries move in to provide more and more managerial services to farmers, consideration certainly should be given to shifting professional resources to study of interfarm and interindustry problems and relations and to a study of the micro effects

of alternative policies with policy makers and administrators as the primary clientele -- also in the United States.

Through a review of literature of a professional group it is possible to learn something about the objectives underlying the professional efforts or work of that group. On the basis of his appraisal of pronouncements on the state of agricultural economics made by a group of leading agricultural economists. Glenn Johnson in 1954 distilled a list of beliefs and values that appeared to be held by a substantial portion of the professions. Within that list three dealt with objectives underlying the work of the profession. These are [p. 830, 2]:

"Agricultural economics research exists to serve farmers and if it fails to do so it will cease to exist. It is also widely held that research exists to serve non-farm groups handling and consuming farm products. A very substantial number of our profession hold that it also exists to serve society in general. These beliefs and convictions fairly well define the problems on which agricultural economists are expected to work."

"Service research, teaching and extension work are crowding out fundamental research work to the long-run detriment of the profession."

"The traditional efficiency norm of economics is a necessary but insufficient basis for judgment in doing research on the problems addressed to agricultural economists."

At about the same time Ratchford outlined the objectives of extension economics work and in referring to the Smith-lever Act stated that under it we could work to improve the welfare of individual farm families, the welfare of agriculture or the economic welfare of society in general [156]. Ratchford emphasized economic welfare of society in general.

In 1948, Heady wrote, "Farm Management research relates to the study of the economic efficiency and productivity of farm resources. Its specific objectives are (1) to guide individual farmers in the best use of their resources and in a manner compatible with the welfare of society and (2) to

provide fundamental analyses of the efficiency of farm resource combinations which can serve as a basis for bettering the public administration of resources where agricultural policy or institutions which condition production efficiency are concerned" [p. 205, 17]. In the same article, Heady stated, "The individual farm and broader industry or social objectives are sometimes looked upon as incongruous. They are not however. Both channel to the same end in respect to resource efficiency. . . . Agriculture as a competitive industry provides an environment in which the best use of resources by the individual firm can result in the most efficient use of resources from the standpoint of society with the exceptions noted" [p. 203, 17].^{34/}

Hence, even though the objectives as outlined above from Johnson and Ratchford might imply incompatibility between those who set out to serve the interests of farmers and those who keep society's interests to the fore, I think most farm management specialists and production economists in the post World War II period proceeded on the basis that in most instances devoting efforts to serving either actually served both in terms of resource efficiency. Moreover, I think fairly strong evidence exists to support the argument that the farm management-production economics recommendations for agricultural adjustment in the post World War II period were compatible with national policy. The recommendations in terms of profit maximization for individual farms and over-all resource efficiency were bigger and fewer farms, substitution of capital for labor and movement of labor out of agriculture into off-farm employment where its value product or wage was

^{34/} The exceptions were the divergencies that grow out of uncertainty and other imperfections in the market, leasing arrangements and other institutional factors and segments in agriculture that are not competitive.

assumed to be higher. These recommendations do not appear to be at odds with national policy that has encouraged unionization of labor, minimum wages, has subsidized research and education in agriculture, has subsidized credit in agriculture which cheapened capital costs in agriculture and decreased demands for labor as labor saving technology was substituted for labor.

But I think we have entered a period marked by a reorientation in objectives. In 1969, Williams wrote that he hoped that in retrospect, the 1960's would be seen as the period when the influence of humanism in the sciences, including economics, matured [136]. In 1970, Castle referred to a recurrent theme running through discussion in land grant education circles which was that if universities could but reorder their priorities and organize to tackle 'real' social problems rather than simply increasing agricultural output then we would be giving rebirth to the land-grant philosophy [157]. At the same time Castle characterized agricultural economics of the 1960's as a time when small conceptions of social problems were discarded and subspecializations such as farm management, marketing and resource or land economics tended to yield to broader categories, as did agricultural economics itself. In 1972 Heady wrote, "Over the long run, institutions are likely to be better financed and gain broader public support if they concern themselves more with the people and problems of greatest social urgency" [p. 936, 158]. In the same year, Daniel Fusfeld of the University of Michigan wrote, "The problems of the present indicate the path of the future. A reconstruction of economics -- a new synthesis and a new paradigm -- will have to move toward greater concern for humane values, toward a humane economy on a worldwide scale. A humane economy requires more than prosperity and economic growth, more than efficient allocation of

resources. It demands changes in the framework of economic institutions to achieve greater equality and freedom.^{35/} It requires dispersal of the economic power and governmental authority that support the present disposition of income, wealth and power. It requires a social environment that brings a sense of community and fellowship into human relationships. It demands compatibility among man, his technology, and the natural environment. And all of these things must be done on a worldwide scale. These are the goals of the future, to which economists and everyone else will have to devote their energies" [159]. I close with a plea for farm management-production economics to move ahead in this spirit, to move ahead with the times.

^{35/} In a recent seminar, Ruttan argued that in recent years much had been done in measuring the contributions of the natural sciences and technology to growth in agricultural and industrial output, but that similar progress had not been made in conceptualizing the contribution of new knowledge to the process of institutional change. Ruttan reasoned that the value of new knowledge in the social sciences comes primarily from its contribution to the process of institutional change. Hence, the primary rationale for public investment is the development of the capacity in the social sciences is to produce institutional innovations that are more efficient than current institutions.