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Effects on Farm Management Decisions of the Institutional Environment, Including Adoption of New Techniques

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Institutions involve public management. Thus my topic deals with public and private management of both technological advance and of the use of productive resources in agriculture. As such it is concerned with the world-wide quest for better private and public management of agricultural resource use, production and technological advance. If I interpret the world situation correctly, no country—socialist or fascist—centrally controlled or decentralized—free enterprise or totally planned—developed or under-developed—is really satisfied with the management of its agricultural economy.

The Approach of this Paper

On the philosophical and theoretical side, the paper is based on five propositions listed below and then discussed in separate sections. My conclusions and recommendations will deal with how policy and farm management insights can best aid in creating more appropriate combinations of public and private controls over investment, production and technological advance.

The five propositions are:

(1) Management, whether public or private, is best viewed separate and apart from production though, of course, in control of it.[1]

(2) Decisions on best agricultural investments, preferred patterns of resource use, levels of production, and appropriate institutional, technological and human developmental projects depend on: (a) normative as well as (b) non-normative concepts and (c) the decision rule employed, the selection of which depends on (a) and (b) and decision rules to use in choosing decision rules.

1 Johnson, Glenn L., 'Methodology for the Managerial Unit', *The Management Input in Agriculture,* Agricultural Policy Institute, Southern Farm Management Research Committee, Farm Foundation, U.S.A., April, 1963 and 'A Note on Non-Conventional Inputs and Conventional Production Functions', *Agriculture in* Economic Development, eds. Eicher, Carl and Witt, L. W., McGraw Hill, New York, 1964, Chapter 6.

(3) Control over agricultural investments, resource use, production, and technological advance is over that which it is advantageous to expand or contract—thus, the theory of resource fixity or variability is crucial to our discussion of private and public management.[2]

(4) In selecting the 'best' course for private and/or public action, certain conditions must be met before the existence of the 'best' which is sought is guaranteed. Though these conditions are commonly met in static economic theory, they are not met for many dynamic problems encountered by private and public managers. See the corresponding section below for further details.

(5) Interdisciplinary originality and creativity are important in conceiving of new technologies, institutions and forms of human capital.

Space limitations dictate that, instead of furnishing data and repeating arguments presented elsewhere, I extensively cite other works of my own. I hope to be forgiven for so seeking brevity. The citations contain ample references to those to whom I am indebted.

Managerial and Entrepreneurial Functions Viewed Separately from Agricultural Production

When we ignore the separation *between* the production of managerial services *and* production of agricultural products, the result is poorer understanding of how agriculture actually operates.[3] How are decisions made? How are resources used to make decisions? How do managerial units enforce decisions about how resources are to be used in production? How are decisions made and controls exercised in more or less economical manners?

The Interstate Managerial Study did much to develop our understanding of the processes whereby private or decentralized managerial units make decisions about resource use in the production activities. The processes were viewed to be six in number:[4] problem definition, observation, analysis, decision making, action or execution and responsibility bearing.

They were conceived as interrelated with extensive feedbacks. An economics was apparent in the performance of such processes, i.e., that there are more or less optimum amounts of observation and analysis to be performed in solving managerial problems. Further, it became clear that responsibilities borne in avoiding various badnesses and in attaining various goodnesses determine specifications for choices among alternative open courses of action. Then, too, it became evident that opportunity and ability to act—to control and to execute—determine specification for choices, and hence, the optimum amounts to observation and analysis to perform [5]

2 Edwards, Clark, 'Resource Fixity and Farm Organization', *Journal of Farm Economics*, November, 1959.

3 Johnson, Glenn L., *op. cit.* (Footnote 1)

4 Johnson, Glenn L., *et al.*, eds, *A Study of Managerial Processes of Mid-western Farmers*, Iowa State University Press, Ames, Iowa, 1961, p. 172.

5 *Ibid.*, Johnson, Glenn L., 'Action Taking and Responsibility Bearing', Chapter 8.

IMS research indicated that managerial problem solving is highly interdisciplinary. Both the information used and the theoretical constructs employed go far beyond economics to involve the technical sciences, statistics, philosophy and the behavioral sciences. Approximately 50 per cent of the information 'bits' passing into the managerial units were technological in nature.

The information flows and analytical techniques were clearly found to be both normative (the values being non-monetary as well as monetary) and non-normative. Intensive empirical investigations of insuring, for instance, revealed the maximization of non-monetary values to offset the expected losses in monetary values which result from participation in insurance schemes.[6]

Frank Knight's distinctions between risk, uncertainty and profit were extended in the IMS, on the basis of A. Wald's theories of sequential analysis, to risk-choice (action), learning, inaction, forced action, forced learning, and uncertainty,[7] With this expansion comes improved understanding of the processes whereby technological information is diffused and adopted or rejected. The diffusion process, for instance, can be regarded as complete when an entrepreneur makes a risk choice not to use a new technology because it is disadvantageous as well as when the decision is to adopt because adoption is advantageous.

The NC 59 studies of management, under the leadership of James Nielsen and others, avoided repetition of the IMS stress of managerial process and concentrating on the characteristics (including past experiences) of managers and upon results of managerial activity. It is the processes which produce decisions on resource use and, hence, the results which are affected by characteristics of managers. Thus, NC 59 researchers had difficulty determining how managerial characteristics were related to results.[8]

At the public level and in all governments, there are processes corresponding to the private managerial processes. They include political activity. Perhaps these processes are best understood in the contexts of different kinds of government. I for one hope to acquire at this conference a greater knowledge of these processes in East European countries and would greatly encourage discussion of them while we are in this area of the world.

Normative Concepts–Values, Goals and Acts

Economics is often normative. We maximize or minimize the difference (depending on sign) between good and bad. Often the good is income or utility while the bad is expense or disutility. Dynamic theories of public and private decision-making in the presence of imperfect knowledge must deal

6 *Ibid.*, Mawby, Russel G., and Haver, Cecil B., 'Types and Sources of Information Used by Farmers', Chapter 2, and Johnson, Glenn L., 'Some Reflections on the Nature of the Managerial Problems', Chapter 9.

7 *Ibid.*, Johnson, Glenn L., and Lard, Curtis, 'Knowledge Situations', Chapter 3.

8 Wirth, M.E., *Pattern Analytics: A Method of Classifying Managerial Types*, Quarterly Bulletin, Michigan State Agricultural Experiment Station, Michigan State University, East Lansing, Michigan, November 1964, pp. 166-198.

with the formation of the normative concepts on which maximizing decisions are based. The same is true with respect to the non-normative or positive concepts used in decisions.[9]

Several philosophies have important bearings on the question of whether or not objective normative knowledge is possible, each of which persists and makes useful contributions to our understanding.[10] *Positivism* is based on the presumption that objective normative knowledge is impossible and, as such, rejects the possibility of objective normative information contained in prices, land values, capital values and concepts of utility. *Pragmatism* accepts workability as a criterion of truth and, in doing so, accepts the possibility of objective knowledge of the normative, so long as the truths of both normative and non-normative concepts are viewed as interrelated and mutually dependent on each other. Though appearing at times to be unnecessarily cumbersome when primarily normative or non-normative answers are needed, pragmatism permits problems to be stated and solutions found. Strangely, in the U.S., pragmatism has played only a minor role in the study of farm management though it has been of major importance as an underlying philosophy for agricultural extension, vocational agricultural teaching and American education. At the public decision making level, pragmatism has had a major impact via Wisconsin institutionalism on domestic and international agricultural development programs. *Conditional normativism* assumes prior answers to normative questions thereby avoiding the need to investigate normative issues either in defining or in solving problems.[11] Pareto-better welfare economics, but taking the values of individuals as given, is a form of conditional normativism. Plain or outright *normativism*, as the opposite of positivism, exists in a variety of forms postulating the possibility of objective normative knowledge independent of positive or non-normative knowledge and, in some instances, to the exclusion of positive knowledge. It has not been of great importance in agricultural economics except where political theories and dogma have produced strongly held normative concepts, particularly from the right and/or left. In recent years *existentialism* has had a small but increasing impact on agricultural economics, particularly among certain of the younger more activistic graduate students, both in the U.S. and Europe. The existentialist emphasis on the reality of existence and, hence, on the need for freedom to establish *self-identity* has led, in extreme instances, to holding freedom in such high regard that neither logic nor experience have been permitted to interfere! When such an extreme form of existentialism is combined with (1) the positivistic postulate that objective knowledge of the

9 Johnson, Glenn L.; Zerby, Lewis K., 'Values in the Solution of Credit Problems', *Capital and Credit Needs in a Changing Agriculture*, eds. Baum E.L., *et al.*, Iowa State University Press, Ames, Iowa, 1961. Also see Johnson, Glenn L., 'Value Problems in Farm Management', *Journal of Agricultural Economics*, Vol. 14, 1960, pp. 13-25.

10 See *The International Encyclopedia of the Social Sciences*, The McMillan Co., and the Free Press, Vol. 12, p. 394, 1968 for a discussion of positivism as a passe' philosophic position.

11 Parsons, Kenneth, *Value Problems in Agricultural Policy, Agricultural Adjustment Problems in a Growing Society*, Heady, Earl, *et al.* eds., Iowa State College Press, Ames, Iowa, 1958.

normative is impossible and (2) a pragmatic emphasis on techniques to the exclusion of descriptive, positivistic knowledge about societies and economies, the result is lethal for both private and public management as the combination puts answers to questions of good and bad, hence, to questions about right and wrong actions beyond *appeal to logic and experience.* With logical analysis, experimentation and observation eliminated, mainly force and violence are left for use in deciding on right actions at the public policy level and even ardent pacificists become combatants! At the public level the barricades and demonstrations replace logical discussion and experience while, at the private level, managerial activity becomes unrealistic, illogical and, hence chaotic and irresponsible. The future of both private and public management would be grave, indeed, if such a philosophy were to dominate thinking (or the lack thereof) about management.

In managerial theory (public or private) the formulation and development of normative concepts are crucial and haphazard adherence to any of the philosophic positions discussed above is likely to restrict ability to understand and improve managerial performance.[12] As a minimum an appropriate philosophic basis for studying management seems to have to grant the possibility of objective normative knowledge.[13]

By objective knowledge I mean concepts which have been subjected to and have not yet failed to pass the tests of (1) logical consistency with other previously accepted concepts, (2) logical consistency with new concepts based on new experiences and observations, (3) clarity (interpersonal transmissibility) and (4) workability when used to solve problems. The possibility of objective normative knowledge depends, fundamentally, on (1) whether or not the goodness and badness of conditions, situations and things can be experienced as can weight, mass and volume, (2) accepting the proposition, that goodness and badness are undefinable primitive terms on the normative side in the same sense as weight, mass and distance are on the positive side and (3) recognizing that concepts can never be compared directly with reality but only with another concept. Entrepreneurs and policy makers can also be defined as objective if they are willing to subject their concepts to the above tests and to abide by the results. A moment's reflection will reveal that these definitions of objectivity preclude the possibility of absolute knowledge by any managerial unit. Mistakes, therefore, will be made, a point of crucial importance in the section on control over investments.

Entrepreneurial Control Is Over That Which It is Advantageous to Control

Effective entrepreneurial decisions should concentrate on those investments, resources and outputs which it is advantageous to control. The problems worth the effort of a manager or policy maker are those involving situations in which it is advantageous (taking both monetary and non-monetary values into account) to make changes, i.e. to exercise control.

12 Johnson, Glenn L., 'Problems Involved in the Specification and Quantification of Policy Goals' to be published in forthcoming proceedings of NC 56 Conference (March 1969) by Iowa State University Press, Final citation will be furnished with final document.

13 *Ibid.*

The theory of resource variability and fixity has been long neglected and inadequately handled and still needs further development at the static level; nevertheless, it must be considered in discussing management. Fragments of the theory are considered under such headings as opportunity cost; quasi-rents; long, short and intermediate runs; shadow prices; user costs; replacement costs versus salvage values; etc.. Perhaps the most general approach is the simple one of defining a resource as fixed if it is not worthwhile to acquire more of it at replacement or acquisition costs or to dispose of some or all of it at its salvage value.

It is of crucial importance in managerial theory (and in dynamic economic theory) to recognize (1) the possibility that $^{\infty} \gtrless Px_i$ acquisition $\gtrless Px_i$ salvage $\gtrless^{\infty}$ and (2) that knowledge is imperfect.[14] Such recognition leads to the endogenous determination of resource fixity or variability which is crucial to the definition of meaningful managerial problems i.e. if opportunity cost exceeds Px_i acquisition' it is worthwhile increasing the use of x_i and if it is less than $Px_{i\ \text{salvage}}$' it is worthwhile decreasing it. Further, when opportunity costs are less than acquisition costs and greater than salvage value, it is clear that a loss minimizing adjustment (with respect to acquisition costs) is involved which will impose non-Pareto better capital losses on the firm and its resource owners. Still further, under uncertainty, errors in organizing production make it clear that such adjustments will cause output to exceed quantities which can be sold at prices simultaneously covering acquisition costs for all inputs. Neither $Px_{i\ \text{acquisition}} \gtrless Px_{i\ \text{salvage}}$ nor imperfect knowledge are *individually* sufficient conditions for overproduction (in this sense) and for the imposition of non-Pareto–better capital losses; however, *jointly*, they are sufficient, though not the sole, conditions for the existence of such losses and overproduction. Thus, there is a close linkage among (1) entrepreneurial theory with respect to managerial problem solving and decision-making assuming imperfect knowledge, (2) economic variability or fixity of resources as determined by $Px_{i\ \text{acquisition}}$' $Px_{i\ \text{salvage}}$ and $MVPx_i$ (the marginal value product of x_i) and (3) the poor performance in different countries of various combinations of public and private management of agricultural resource use, production, and technical advance.

This linkage helps in prescribing remedies when private or decentralized decision makers are trapped into over-extending their use of

14 Johnson, Glenn L., and Hardin, Lowell, *The Economics of Forage Evaluation*, Purdue Agricultural Experiment Station Bulletin 623, 1955; Edwards, Clark, *op. cit.*, footnote 2, Johnson, Glenn L., 'Supply Functions–Some Facts and Notions', *Agricultural Adjustment Problems in a Growing Economy*, Heady, Earl, *et al.*, eds., Iowa State College Press, Ames, Iowa, 1958., Johnson, Glenn L., 'The State of Agricultural Supply Analysis,' *Journal of Farm Economics*, May, 1960, pp. 441-2; Johnson, Glenn L., 'Implications of the IMS for Study of Responses to Price,' *op. cit.* footnote 4; recent examples of policy and farm business applications of this theory include Hathaway, Dale E., *Government in Agriculture*, the McMillan Co., 1963, and the Phase II Model of the NC 54 Study of Feed Grain and Livestock Production in the Midwest. Other applications are y Heidhues, Theordore, 'A Recursive Programming Model of Farm Growth in Northern Germany', *Journal of Farm Economics*, August, 1966, Young, Robert, *An Economic Study of the Eastern Beet Sugar Industry*, Michigan State University Agricultural Experiment Station, Bulletin 9, 1965.

resources. At public decision making levels, it appears that institutional restrictions often widen the gap between acquisition costs and salvage values and that managerial resources used at the public level are seldom sufficient in number, quality and motivation.[15]

Conditions Necessary for the Existence of a 'Best' or Optimum

In economics, we often maximize or minimize the difference (depending on sign) between good and bad. Often the good is income or utility while the bad is expenses or disutility. In either case a normative common denominator is available i.e. the monetary unit or utility. The existence of a common denominator combines with the laws of diminishing marginal productivity and/or utility to guarantee the existence of a best or right level of resource use, output and/or consumption. Under the assumption of perfect knowledge the decision rule is simple–maximize the excess of good over bad. With imperfect knowledge, the problem of selecting a decision rule becomes more complicated as the alternatives include, but are not limited to, maximization of the expected difference between good and bad, the present value of expected future differences between good and bad, minimaxing, satisfying etc.. The choice of which rule to use is, itself, a choice involving the existence of (1) a common denominator among the relevant 'goods' and 'bads', that common denominator being required to have interpersonal validity if the choice affects the distribution of goodness and badness among persons and (2) questions of order when the laws of diminishing productivity and utility do not settle or remove questions about the sequence or order in which actions are to be taken.

Creativity and Originality in Public and Private Agricultural Management

Great creativity and originality are required to solve the production and resource use problems of agriculture. More new technologies are required. So are institutional innovations. The human resources engaged in agriculture are, by and large, in need of the support of added investments to develop more fully their productivity capacity, to motivate and to control and constrain their reproduction capacity (ironically, the world constrains needed technological, institutional and social and psychological creativity but leaves man's unneeded reproductive creativity almost unmanaged).

At private managerial levels, creativity is constrained by institutional arrangements which grow out of still other and more fundamental constraints on public managers and decision makers.

The constraints for the public managers of both the centralized (controlled) and decentralized (less controlled) agricultural economies often

15 Johnson, Glenn L., 'The Modern Family Farm and Its Problems', *Proceedings of the International Economics Association Meetings*, Rome, Italy, September, 1965; and Johnson, G. L., Sorenson, Vernon L., 'The World Food Situation: Challenge and Opportunities Facing North America', *A North American Common Market*, Iowa State University Press, Ames, Iowa, 1969.

originate in political and economic dogma.[16] Thus, the public managers of decentralized economies often fail to redistribute ownership so as to convert needs into effective demand for fear of interfering with the effective operation of a free economy. Also, free enterprise dogma has prevented recognition that freely operating private agricultural economies tend to overcommit resources while imposing non-Pareto better capital losses on farm entrepreneurs. Among the public managers of centralized economies, an opposite planning and, perhaps, Marxist dogma has kept them from placing sufficient reliance on managers of basic producing units while distributing food claims, supposedly but seldom, on an egalitarian basis in excess of production. Three other dogmas have also tended to interfere with the operation of the centralized agricultural economies. One of these is the idea that increased size and efficiency necessarily go hand in hand, the second is the labor theory of value implication that capital is unproductive and the third is that non-farm production is preferable to farm production.

As to technical advance, strangely enough, it is the public managers of the decentralized economies that have probably most successfully socialized agricultural research though they have also placed substantial reliance on private research, private extension (advertising and salesmanship) and especially private production and distribution of the modern factors of production carrying the new technologies.

Sometimes it seems that the semi-planned underdeveloped countries of today have the poor public management of both the centralized and decentralized economies, a case in point being Nigeria. She has (1) the poor pricing policies and stress on non-farm development at the expense of agriculture and (2) socialized production and distribition of modern factors of production commonly found in the centralized economies. She also pays little attention to increasing effective demand though egalitarian distribution of greater per capita incomes despite a private overcommitment of resources to farm production, both of which are characteristics of the decentralized agricultural economies.[17]

Constrained creativity and productivity are also present among the researchers and academicians. In addition to politico-economic dogma they are constrained by philosophies, disciplinary interests and orientations toward fads and techniques. For some of the constraining philosophies, see the section above on 'normative concepts'. Concentration on economics to the inappropriate exclusion of the technical, institutional and human processes

16 Johnson, Glenn L., 'Food Supply, Agricultural and Economic Development', *Proceedings: Western Hemisphere Nutrition Congress,* San Juan, Puerto Rico, August, 1968; 'Capital in Agriculture', *International Encyclopedia of Social Sciences,* McMillan Co. and the Free Press, Vol 1., pp. 229-236, and *op. cit.* footnote 14.

17 Johnson, Glenn L., 'Obstacles of Growth', *Land and Water: Planning for Economic Growth,* papers of the 1961 Western Resources Conference, Boulder Colorado, 1967, and Johnson, G.L.; Scoville, O. J.; Eicher, Carl; Dike, George; *Strategies and Recommendations for Nigerian Rural Development 1969/1985,* Consortium for the Study of Nigerian Rural Development, Report 33, Michigan State University, East Lansing, Michigan, 1969.

prevents solution of problems.[18] Even within economics, constraining influences are found, a case in point being adherence to economic theories based on the assumptions that $Px_{i\ salvage} = Px_{i\ acquisition}$ and that knowledge is perfect (see the section on entrepreneurial control). Analytical techniques, too, constrain. For example, numerous published linear programming, production function and simultaneous equation analyses illustrate the use of the techniques but solve no problems.[19]

The problems which the central and decentralized managers of our agricultural economies are faced with are too serious, too interdisciplinary in nature and too widely distributed among politico-economic systems for us to be constrained by politico-economic dogma, philosophic commitments, disciplinary empire building and/or vested interest in empirical techniques. Managers (central and decentralized), researchers and teachers require freedom from constraints on their originality and creativity if they are to be able to[20] (1) design and bring into existence new managerial (decentralized) and institutional (centralized) controls over resource use and production, (2) create and bring into use new technologies and technological arrangements and[21] (3) design and bring about advances in the human beings who manage and produce our agricultural products.

Improving Policy and Farm Management Research on a More Appropriate Combination of Centralized and Decentralized Management of Agricultural Production

The following conclusions are based in part upon the discussion in the previous five sections and in part upon experiences and reasoning far too extensive to be summarized in those sections. I believe that efforts to design and implement more appropriate combinations of centralized and decentralized controls over agricultural production and technological advance will be improved by:

(1) viewing management separately from production and as exercised at both central and decentralized, but highly interrelated, levels. This appears crucial whether the economy involved is now centralized or decentralized–rightist, leftist or in the center–and developed or underdeveloped.

(2) approaching the task with a philosophy sufficiently flexible to permit objective investigation of the normative (about goodness and

18 Johnson, Glenn L., 'Stress on Production Economics', *Journal of the Australian Agricultural Economics Society*, Vol. 7, No. 1, June 1963, pp. 12-26; reprinted in *AEA Reading in the Economics of Agriculture*, Vol. XIII, Fox, Karl and Johnson, D. Gale, Selection Committee of the American Economic Association, R. D. Irwin, Inc., Homeward, Illinois, 1969, pp. 203-220.

19 *Ibid.*

20 Johnson, Glenn L., 'Removing Obstacles to the Use of Genetic Breakthroughs in Oil Palm Production: The Nigerian Case', Conference on Agricultural Research Priorities for Economic Development in Africa, Published–The Abidjan Conference edited by M.G.C. Dow, Washington, D.C. National Academy of Sciences, 1969.

21 *op. cit.*, footnote 12 also see

badness) as well as non-normative questions on which the selection of right actions depends.

(3) recognizing that problems which are poorly handled by the market mechanism often stem from the absence of conditions necessary for defining an optimal action. These absent conditions include a) lack of a common denominator among "goodnesses" sought and "badnesses" being avoided, b) lack of interpersonal validity in the common denominator mentioned above, c) lack of an established order or sequence in which different actions are to be taken if an optima is to be attained, d) lack of an agreed basis for choosing an optima when knowledge is imperfect.

(4) avoiding the constraining influences of particular academic disciplines, pseudo-disciplines, approaches and techniques such as economics, statistics, the technical agricultural sciences, sociology, diffusion studies, land tenure studies, area center studies, linear programming, simultaneous equations, Cobb-Douglas functions, etc. and concentrating, instead, on the problem at hand with whatever combination of disciplinary skills and techniques is available and appropriate to that problem

(5) confining attention, in defining and solving problems to changing only those things worthwhile changing, the appropriate theory here being a consequence of assuming that (a) $\infty \geqq Px_{i\ \text{acquisition}} \geqq Px_{i\ \text{salvage}} \geqq \infty$ and (b) knowledge is imperfect but improvable.

(6) taking into account, for problems not meeting the conditions for optimization listed in 3 above, both the historical and current approaches which have attained some success in handling such problems. *Historically,* such problems have been studied most successfully in close cooperation with the managers and policy makers by 1) in the case of *farm management,* budgeting or planning alternative courses of action through time and 2) in the case of *policy and central management,* projecting the consequences through time of following alternative courses of action. In both instances, these approaches have been interdisciplinary in nature, have employed a wide range of analytical techniques and have been at their best when researchers and decision makers (centralized or diffused) have interacted closely in seeking a) the relevant trade-offs (common denominators), b) order in which to execute different actions and c) in deciding on the relevant decision rule or basis for choice to use. Validation of such projections has tended to be according to the criteria for objectivity presented in the section on normative concepts, above. The *current development* to be taken into account is the vastly improved computational facilities now available in the developed world and now becoming increasingly available in the less developed world.[22] Along with such hardware, improved software is becoming available for using a wide variety of

22 Johnson, Glenn L., 'Review of *Planning Without Facts* by Wolfgang Stolper', *Economic Development and Cultural Change,* Vol. 18, No. 1, part 1, October, 1969.

analytical and predictive techniques in applying the two historically successful approaches discussed above. In fact those approaches are now merged into what is almost a single approach variously labeled 'systems science', 'simulation', 'operations research', etc..[23] The distinction between approach and technique is important for the simulation approach permits an analyst or team of analysts to use any number and combinations of techniques, philosophies and/or disciplines thereby avoiding disciplinary, philosophic and technical constraints on creativity and originality. Furthermore, the approach continues to permit the close interaction between decision makers and researchers so essential to the past success of farm management and policy budgets, plans and projections through time. Such interaction appears to be crucial in determining the appropriate common denominators (trade-offs) among the different goodnesses and badnesses involved and the appropriate decision rule to use. An interesting development is PERT (Program Evaluation and Review Technique) which is a particular technique which addresses itself to the problem of selecting the optimum sequence of actions through time in the presence of uncertainty.

(7) In connection with the approach advocated in 6, it should be noted that the computer a) does not increase data requirements either in quantity or quality. Data requirements change with magnitude and complexity of problems attacked, b) does greatly decrease the time and costs required to handle a problem of given magnitude and complexity and as a result permits somewhat larger, more complex, problems to be handled on a given time and monetary budget.

(8) Increasing but not yet conclusive evidence suggests that the appropriate combination of private and public controls being decided upon:[24] a) family farms will evolve into other forms as the main producing units for agriculture after the tendency of family farms to overcommit resources is eliminated. Such forms, however, will leave or place substantial control in the hands of managers of the individual units.[25] b) will rely on very large scale public and also private research organizations to produce new land and labor saving, biological and processing technologies, c) will rely on decentralized fairly autonomous (from government) and, in many cases private organizations, to produce and distribute modern factors of production, d) will rely on decision making by groups of managerial units of individual producing units to control investments, resource

23 Newell, Allen and Simon, Herbert, 'Simulation' Vol. 14 p. 262 and Rapoport, Anatol, 'Systems Analysis: General Systems Theory,' *The International Encyclopedia of the Social Sciences*, MacMillan and Free Press, Vol. 15, p. 452.

24 *op. cit.* footnote 15 and item 2 also *op. cit.* footnote 4, Chapters 10 and 11 and pages 183–184, in particular and Johnson, G. L., 'Agricultural Problems in the 1970's', *Fertilizer Marketing in a Changing Agriculture*, Proceeding of Tennessee Valley Authority Conference, Muscle Shoals, Alabama, October, 1969. pp. 4–9.

25 *op. cit.*, footnote 15 item 1.

use and output, and e) will rely on government for some decisions on total levels of output and on international trade as well as on infrastructural investments in support of agriculture.

SPECIAL GROUP D REPORT

Unfortunately, Professor Glenn L. Johnson's paper was not available in all four official languages of the Conference at the time this group met. The paper raises points that require deep thought.

Proposition (1) was considered inappropriate by several discussants since successful production depends so much on good management. However, the point seems to be that, *because* successful production depends so much on good management, it is that it is important to understand well the management function. And to reach a better understanding of management, the simpler and more efficient way is to study it separately from the other variables. Studying management separately from production does not imply losing the relationship between one and the other.

Propositions (1) and (2) were also not considered valid by some of the underdeveloped countries. If research is as important for underdeveloped countries as for developed countries, however, it is difficult to see the reason for the objection.

Over investment of resources in agriculture was a point stressed during the debates. What kind of institutional arrangements could prevent it? Are family size farms a cause of over investment of resources in the agricultural sector? Over investment of resources, as explained in the paper, is caused by a positive difference between acquisition price and salvage value of resources plus imperfect knowledge and possibly other factors. Family size farms would in turn be a consequence of over investment of resources, and not a cause.

Differences between centralized and decentralized systems with respect to management and decision-making were brought into the discussion. There is a tendency to over-invest in agriculture in decentralized economies and to under-invest in centralized economies. A possible explanation is that it seems difficult to get resources to agricultural investment out of central control boards, whereas the decentralized farms over-invest as mentioned above. Another difference is the larger amount of information that is fed into the producing units of centralized systems than into the units of decentralized systems.

With respect to the effects of over-investment of resources, they are thought to be serious. A viable institutional arrangement to avoid these problems in a decentralized economy would include some sort or production control by a 'farmers' organization'. Any monopoly power acquired by such organization would need to be regulated by government. But much more research is needed in this area, and this is an area that requires good researchers.

Differences between large and small farms were considered as relevant to questions related to management. Some remarked that differences in the

quality of inputs between large and small farms would in some cases be more important than differences in management ability. Another possibility here is a direct relationship between size of the farm and the economic ability to pay for more and/or better information. This might offset even inverse relationships between size of the farm and quality of inputs and/or managerial skills.

Risk and uncertainty were said to be 'crucial' problems for underdeveloped countries. Since they are also present in developed countries and were explicitly considered in the paper, although not in an extensive way, the question becomes one of degree.

A final area of discussion had to do with small farm operators. Are we giving the small farm operators all the attention they need? How do we distribute benefits between large and small farm operators? In a decentralized economy operating through the price system some kind of redistribution becomes necessary. Some countries, like Sweden and Switzerland, have accomplished that. Other countries, like India (in the Punjab) and Nigeria, have discarded old redistributional ways and have not yet found new schemes. Redistribution requires assessment of gains and losses to different people, and this implies the need for a common denominator of values. Land reform is one example of the need to assess gains and losses to different people. Finding a common denominator is not an easy task.

Many points in the paper were not discussed. Time was very scarce, as always. The suggestion that the theory of resource availability and fixity needs further development should have received more discussion. But it is regretable that proposition (5) has not been discussed. This proposition has very high importance, and more so for underdeveloped countries.

Among the participants in the discussion were G. M. Loza *U.S.S.R.*, T. Heidhues *W. Germany,* Q. B. O. Anthonio *Nigeria,* R. D. Laird *U.S.A.*, A. U. Narkswazdi *Thailand*, C. Leroy Quance *U.S.A.*, W. Peterson *U.S.A.*, A. S. Kahlon *India*, A. J. Barbashin *U.S.S.R.*, S. Johnson *U.S.A.*