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ASSESSING THE PERFORMANCE OF AGRICULTURAL ECONOMICS DEPARTMENTS: CONCEPTS AND METHODS

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and
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Introduction

At the 1987 CSRS workshop on Agricultural Economics Program Analysis we outlined an approach for evaluating agricultural economics programs in three areas: teaching, basic research, and applied research/extension (Beilock and Polopolus, CSRS). At this session, after briefly reviewing the overall approach, we will explore in more detail possible approaches to operationalizing the most difficult area, applied research/extension. It should be stressed that our intent is to solicit comments and ideas, rather than to present the work as the revealed truth.

The primary thrust of this work is to facilitate comparisons across departments. However, as units place different emphases on each activity area and some units have missions defined for only one or two of the activity areas, no attempt is made to merge into a single index performance indicators in the three areas of basic research, teaching, and applied research/extension. For internal analysis, some units may wish to develop variations on the proposed system that are more consistent with their particular mission.

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Review of the Overall Approach

The areas of activity of agricultural economics departments may be divided into teaching, basic research, and applied research/extension. The goals of these activities are:

AREA	GOAL
Teaching	Prepare individuals for useful roles in society
Basic Research	Develop new knowledge
Applied Research/Extension	Enhance social and economic welfare

Assuming that this taxonomy is accepted, the task remains of measuring progress within each activity category towards its goal. For this task, it is argued that relatively clear outputs can be defined with respect to Teaching and Basic Research, but not for Applied Research/Extension. Rather, for Applied Research/Extension a more indirect approach must be taken.

Teaching

If labor markets operate efficiently, then returns to labor should correspond to its contribution or value added. From this, it directly follows that the success of a teaching program can and should be gauged by the financial success of its graduates. Therefore, under the proposed system, surveys would be conducted of graduates to determine income levels. Consideration would have to be made for several factors, including:

Degree earned (B.S., Masters, Ph.D.)

University "halo effect" *

Years since graduation

Local cost of living/average salaries.

* the positive or negative effect of the University's reputation

Implicit in the above is that all returns to labor are financial. In the large majority of cases, outside academia, this assumption probably is reasonably accurate. However, most in academia are keenly aware of tradeoffs between financial and nonfinancial returns (academic freedom, prestige, job security). Also, most agricultural economics units with Ph.D. programs view the ability to place their graduates in faculty positions as a measure of success. Similarly, virtually all teaching departments regard the ability to place students for advanced degrees as a positive reflection on their programs.

Basic Research

Peer review of journal articles is intended to ensure that what is accepted contributes to the stock of knowledge. It is not surprising, therefore, that journal articles are usually used to gauge a unit's basic research output, either via article or page counts. However, the variable quality of articles, both across and within journals, is widely recognized. To address this problem, at least in part, Beilock, Polopolus, and Correal (1986) suggested an alternative approach which stressed the usefulness rather than the volume of a unit's output. Usefulness was measured by citations in professional journals. Not surprisingly, we believe that this approach is best.

There are at least four major (and several minor) issues related to creating an index of basic research productivity based upon citations. (Most of these issues also apply to systems based on article or page counts.) The first is whether to assign articles to a unit if the author is a current faculty member or, alternatively, if the author was a member when the article was published. The answer to this depends upon if a unit is

seen as a factory drawing its labor supply from a largely homogeneous pool or as a studio populated with essentially independent artists. If the former view is taken, assigning citations by location at the time of authoring would be proper, while assignment by the current location of the author would be appropriate if the latter view is taken. Reality, no doubt, lies somewhere between these extremes, both the organization and resources of the unit and the individuals it employs matter. Our feeling, however, is that the quality of the individuals is the paramount determinant of basic research productivity. Therefore, we chose to assign citations to the units at which faculty currently reside.

Two issues concern the valid types of citations: should only first or first and joint author citations be counted, and should self-citations carry equal (or any) weight? In Beilock and Polopolus (1988) the ramifications of these were explored. They found that, as a practical matter, these decisions were of little importance. Employing a database of citations from the AJAE and the regional agricultural economic journals (including the CJAE), using or not using joint author or self-citations resulted in an average change in rank of less than two positions (Table 1). Even Narcistic Florida only declines by eight positions if self-citations are omitted.

The single most important issue in ranking basic research is determining the universe of valid journals from which to draw citations. Using a broad base of social science journals, such as that employed for the Social Science Citations Index (SSCI), results in a much different ranking than when citations are limited to those in the AJAE and the agricultural economics regional journals (AGEC). Among the top 50

TABLE 1: The Impacts of Inclusion of Citations by Joint Authors and Self-Citations, and of Journal Database on Agricultural Economics Department Rankings by Citations[1]

Comparison	Top 50 Departments		Top 10 Departments
	Average change in rank	Largest change in rank	Average change in rank
Use/nonuse of citations for joint authors[2]	1.8	7	1.1
Use/nonuse of self-citations	1.5	8	1.4
SSCI and AGEC databases[3]	6.2	20	4.9

NOTES: 1. Based upon faculty at departments in 1984.

2. Using the AGEC database, comprised of citations from the 1980-1984 volumes of the AJAE, the regional journals, and the CJAE.

3. SSCI database is comprised of citations for the period 1980-1984 found in the Social Science Citations Index

SOURCE: Beilock and Polopolus, 1988

departments, the average change in rank was 6.2 positions (Table 1); one unit (Stanford) changed by 20 positions, and 13 departments changed by at least 10 positions. It can be argued that these differences are reflective of differences across units in their missions within basic research. A unit largely devoted to research in commercial agriculture would be expected to fair better using the AGEC database relative to using the SSCI, than would a unit emphasizing a wider range of economic and related research. This line of reasoning suggests the need for developing alternative citation indices based upon different sets of journals or, at least, constantly keeping in mind the basic research mission implicitly assumed by the selection of a journal set.

Applied Research/Extension

Measuring applied research/extension output is easily the most difficult and, probably, the most important task. According to Busch and Lacy (1983), nearly three quarters of the research in our profession is applied. To this can be added extension and service work to communicate applied research results. How does one measure the quality and quantity of these efforts? In other words, how can the resulting enhancement of social and economic welfare be gauged? The inevitable answer is that it cannot. There is neither the theoretical know-how to formulate a reasonable index nor the funds to generate the types of data that undoubtedly would be required.

Our fall-back position is to examine the correspondence of effort, rather than output, in applied research/extension to State needs in five areas. Effort is defined as the number of professional man years, and the five areas are:

1. Farm management
2. Marketing
3. Policy
4. Community development
5. Natural resources

Areas 1, 2, and 3 are the most traditional, directly addressing problems in the food/fiber system. All five, however, have gained general recognition as valid areas of concentration for agricultural economics departments. The determination of levels of effort in each area would be obtained via a survey of faculty members or, possibly, department heads.

Clearly there are several difficulties with this approach. First, it measures inputs, rather than outputs. This will differ from an output measure if faculty productivities vary systematically across departments. Second, it assumes consistency across respondents with regard to the basic research/applied research/extension split and to the boundaries of the five areas. The most serious problem, however, is the determination of the levels of need in the five areas. The remainder of this paper is devoted to a discussion of how this may be accomplished.

Measuring Need In The Five Areas

The five areas (farm management, marketing, policy, community development, and natural resources) are sufficiently broad to encompass the areas of actual and/or potential work of virtually all units. Moreover, the large majority of units devote at least some applied research/extension efforts in each of the areas. For allocative decisions within a department, the levels of need across areas may be determined via an informal or political process. However, for cross-department analysis, there must be a systematic method for establishing levels of need in each state in each area. To do this requires:

1. Economic and social indicators of need available across all states, and
2. A weighing system to transform the indicators into a needs-level index.

In the next subsection, possible economic and social indicators for each area are discussed. Ideally, the indicators should gauge the importance of the sector or area (on the assumption that the needs of many outweigh equally urgent needs of the few); the degree or urgency of need; and, the hardest of all, the potential for success. By "potential for success" is meant both the potential that the problem can be solved by anyone and the potential for agricultural economists to address the problem. Focus will be upon desired measures, rather than existing ones. It is hoped that this will stimulate comment regarding possible alternative data sources.

Economic And Social Indicators

Farm Management

By Farm management is meant "all commercial activity within the farm gate." Possible indicators of the importance and needs of this part of the food/fiber system are presented in Appendix Table 1a. Again, it should be stressed that the list is of possible desired indicators, rather than a finalized list of those currently available. The rationale for the indicators of importance is fairly straightforward. Importance is addressed in terms of dollars generated, population directly involved, and national importance of the output generated. The inclusion of indices on input supply cooperatives is justified on the assumption that cooperatives may require different levels and types of support than would farms

operating entirely as independent units. Debt/equity ratios and return on investments are included to measure financial stress.

Price, production, disappearance, input cost, farm, and farm population trends are included on the assumption that economic analysis and information is likely to be more useful in times of change (positive or negative).

Indicators of potential for success and appropriateness are the most difficult to develop. The structure of the farm sector is a possible candidate. It seems reasonable that, ceteris paribus, the more atomistic the structure, the less able is the industry to develop the economic intelligence necessary for adapting to changing conditions. It is sometimes argued that flexibility is a hallmark of smaller firms. However, we submit that industries with smaller firms appear to adapt easily only because the death and creation of firms is not as noticeable as when firms are very large. The timely infusion of economic information may facilitate small firms adapting to changes, rather than being replaced by new entities. Of course, this line of reasoning implicitly assumes that adaptation of firms is somehow better (more efficient or more acceptable politically) than a more evolutionary death and replacement process.

Marketing

Possible marketing indicators are presented in Appendix Table 1b. As with the farm management measures, marketing importance is gauged by revenues, employment, and national prominence. Other important marketing indicators include value added from processing and marketing services, per capita consumption trends, marketing costs, and industry structure.

Policy

Identification of policy sensitive areas are made by separating out commodities subject to government programs, including tariff or quota protections. Increasingly important is the prospective role of the public policies regarding commodities with health or morality concerns, such as milk, red meats, tobacco, liquor, and marijuana. Also, policy indicators could include public expenditure levels for domestic and/or international food aid (Appendix Table 1c).

Community Development

The possible measures of need and importance in the Community Development (Appendix Table 1d) area relate to the size, composition, and financial and educational status of the rural population; and to the adequacy and types of services and infrastructure. Potential for success/appropriateness is determined by the presence of alternative agencies to address these issues. This might be viewed as an indirect measure of the departmental mission. That is, alternative agencies may not exist if the unit itself has been charged with problem solving in the specific area of need.

Natural Resources and Environmental Quality

The measures selected in this area (Appendix Table 1e) are intended to reveal the amount and importance of environmentally sensitive lands, seriousness and sources of pollution, degree of soil erosion, and the economic importance of woodlands and recreational areas. Determination of pollution sources is particularly important because if they are agricultural, the obligation of agricultural economics units to address the

issue is likely to be stronger and the problem is likely to encompass farm management, policy, and even marketing. Again, the presence of alternative agencies is used as an indicator of potential for success/appropriateness.

Creating Indices To Measure Relative Intensities Of Need In The Five Areas

As discussed earlier, for intradepartmental applied research/extension resource allocation decisions, it is possible, though not necessarily desirable, to adopt a subjective, unsystematic approach for determining relative need levels in the five areas. However, for comparisons across units of resource allocations, a systematic approach is required. Assuming that the problems of selection and acquisition of need indicators is solved, there are two basic approaches for using the data.

The first method, which we call the Central Tendency Approach, involves the following:

1. Survey agricultural economics units to determine their distributions of applied research/extension efforts across the five areas.
2. Perform multivariate analysis to "explain" the distributions using the need indicators as explanatory variables.
3. Determine the 'correct' distribution of applied research/ extension efforts for an individual unit by using the associated values for the need indicators in the estimated equation(s).

The Central Tendency Approach is probably the easiest. It recognizes the difficulties inherent with quantifying needs and, instead, attempts to model the determinants of current decision making processes. However, it suffers from two main flaws. The first and most serious problem is that The Central Tendency Approach is based on the assumption that the average or mainstream approach to applied research/extension resource allocations

is correct. The second problem is that the results of such an estimation process are likely to be very weak.

The second or Direct Approach involves the translation of the individual need indicators into a common unit to facilitate the development of Aggregate Need Expressions for each of the five areas. We submit that money is the most tractable unit of measure. For example, using a very small subset of the candidate need measures, the aggregate need measures for the five areas could be as follows:

Farm Management

W1 = Gross farm receipts

Marketing

W2 = Value added on food/fiber products

Policy

W3 = Direct government payments and purchases plus
Gross farm receipts and value added of politically sensitive crops

Community Development

W4 = The sum of the differences between average per capita income and the actual income of individuals in rural areas who have below average incomes. (This should exclude welfare payments and food stamps to avoid "masking" of poverty.)

Natural Resources and Environmental Quality

W5 = Revenues from natural resource-oriented tourism

Admittedly, the appropriateness of some of the above dollar values is open to question. Moreover, incorporating inherently nonmonetary measures and measures of change will be difficult and require essentially subjective weighing assignments. Still, it does seem that the creation of a

reasonably complete and sensitive Aggregate Need Expression for each area is possible.

Recognizing that agricultural economics departments traditionally have had and continue to have special obligations to certain sectors of the society, the relative values of the Aggregate Need Expression for each area should not be expected to correspond exactly to the relative applied research/extension efforts in each area. Rather, variations from the mean relative magnitudes of the Aggregate Need Expression should be expected to correspond to variations from the mean relative magnitudes of applied research/extension efforts in the five areas. For example, if the magnitude of a unit's Farm Management Aggregate Need Expression accounts for five percent more of the sum of its Aggregate Need Expression across the five areas than is true for the average department, then that department should devote five percent more of its total applied research/extension efforts to Farm Management than does the average department.

Mathematical description of the Direct Approach

Define the following variables:

W1 ... W5 = values of the Aggregate Needs Expressions for each of the 5 areas of applied research/extension emphasis for an individual unit.

E1 ... E5 = numbers of manhours at an individual unit devoted to each of the 5 areas of applied research/extension.

EnA, WnA = Averages across all units of the Aggregate Needs Expression and the number of manhurs for the nth area of applied research/extension.

Then, the proportion of the toal needs in the nth area in the individual unit's state is:

(1) $PWn = Wn/(W1 + W2 + W3 + W4 + W5)$,

and the mean proportion of need in the nth area across all states is:

(2) $PWnA = WnA/(W1A + W2A + W3A + W4A + W5A)$

Similarly, the proportions of effort in the nth area in the individual unit and across all units are:

(3) $PEn = En/(E1 + E2 + E3 + E4 + E5)$

(4) $PEnA = EnA/(E1A + E2A + E3A + E4A + E5A)$

The appropriate proportion of effort is assumed to be allocated to area n if equation (5) is true:

(5) $PWn/PWnA - PEn/PEnA = 0$.

If equation (5) holds for all 5 areas, the unit is given a score of 1 (one). Lower scores are assigned using the following formula if misallocations of effort are indicated:

(6) $SCORE = 1 - ((ABS1 + ABS2 + ABS3 + ABS4 + ABS5))$

where: ABSn = the absolute value of the lefthand side of equation (5) for the nth area.

Concluding Remarks

Our profession has heretofore given almost exclusive attention to the ranking of the basic research function of agricultural economics units. In reality over three-fourths of total research and extension resources at Land Grant universities are committed to applied research and extension activities. The purpose of this paper, then, is to attempt to conceptualize a method for evaluating or ranking the applied research/extension programs across units.

In developing our yardstick of "quality" of applied research/extension programs, we have shunned measures of output, such as applied/extension

papers published, number of people attending meetings, etc. Our notion is to examine the effort of agricultural economics units in relation to social and private needs of people in five subject areas - - farm management, marketing, policy, community development, and natural resources.

Using the suggested monetary approach, the distribution of total dollars involved with farm management, marketing, policy, community development, and natural resources could be compared for each state with that state's distribution of effort in those areas. For example, in a rural-oriented farm state, such as North Dakota, one would expect the distribution of "needs" to be heavily concentrated in farm management, as opposed to marketing, policy, community development, and natural resources. If the actual distribution of agricultural economics "effort" is heavily oriented toward natural resources, as opposed to farm management, our method of analysis will flag inconsistences between perceived needs and actual effort. Individual agricultural economics units could then be ranked on the basis of their congruence between "need" and "effort". Definitions of both "need" and "effort" are of course open to wide debate and discussion. Also, it may be advisable to develop different measures of need and effort depending upon variations in state economies and/or academic goals and objectives.

Developing state by state empirical measures of both social/private "needs" and "efforts" by agricultural economists are a necessary next step. Grant or other types of research funds are required to develop quantifiable indicators of need, as well as data on distributions of faculty effort.

APPENDIX TABLE 1: Selected Economic and Social Indicators to Measure Needs for Applied Research/Extension

Indicators
A. Farm Management
Gross farm receipts
Farm population & percent of total
National ranking or percent of U.S. production by crop
Supply cooperative membership & gross sales
Farm debt/equity ratios
Farm return on investment
Input cooperative return on investment
Price, production, and disappearance trends
Input cost trends
Farm and farm population trends
Farm structural measures
Percent change in number of farms and farmland
B. Marketing
Amount and percent of gross receipts from commodities that are exported
Marketing Cooperative membership & gross sales
Gross amount of value added in state
National ranking or percent of U.S. processed food and fiber production by commodity
Employment in food and agricultural product processing and marketing
Per capita consumption trends by product
Trends in marketing costs
Structural measures of processing industries
Generic advertising expenditures for agricultural and food products

Appendix Table 1 (continued)

Indicators
C. Policy
Amount and percent of gross receipts from direct government purchases
Amount and percent of gross receipts from commodities under a government program (including price support, land bank, and import quotas or tariffs)
Amount and percent of gross farm receipts from commodities subject to health or morality concerns (ex., milk, red meats, tobacco, liquor, marijuana)
Age or condition measures of the infrastructure supporting marketing (roadways, ports, produce markets, etc.)
Public expenditures for food stamps, school lunch programs, and commodity distribution
Public expenditures for international food aid
D. Community Development
Number and percent of population in rural areas
Rural population trends
Poverty rate, urban and rural
Percentages of rural populate over 65 and under 18
Percent minority population
Educational or literacy levels
Rural infrastructure measures (ex., percent unsafe or undersized bridges)
Rural services indices (ex.,MD's per capita, pupils per teacher)
Alternative agency existence, adequacy, and coverage

Appendix Table 1 (continued)

Indicators
E. Natural Resources and Environmental Quality
Percent of land that is environmentally sensitive
Urban pressure - population and urban land changes
Water quality and adequacy - percent imported/exported
percent farms irrigated
water table changes
pollution amounts, sources, and toxicities
Pesticide usage - amounts per acre
toxicities
proximity to population centers
Air pollution - amounts, sources, toxicities, and related medical expenses
Soil erosion - amounts
Gross sales of exhaustible resources
Stocks/usage rates of exhaustible resources
Forestry industry gross sales
Changes in forest land amounts and tree types and age compositions
Tourism - amount and economic contribution
Alternative agency existence, adequacy, and coverage

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