Popular Informational Priorities in Agricultural Extension

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Due to agriculture's increasingly complex technical and economic environment, the diversity of information required for competitive and profitable farming is growing as never before. With constant and, in some cases, reduced resources for agricultural programs, Extension must exercise special care in prioritizing informational efforts to best meet farm-client needs and retain an important base of public support. This paper presents a method of identifying popular informational priorities in Agricultural Extension. The method is illustrated by application to dairy programming in Massachusetts.

Planning and implementing Cooperative Extension programs involve making difficult decisions amid considerable uncertainty. For example, projections of relevant future social, economic, and political changes can often be vague or nonexistent, requiring Extension administrators to pursue appropriate programming choices with much less information than desired. Successful planning of future programs generally requires coping with these unknowns as well as the many other difficulties in organizing resources to meet informational objectives. However, important concerns associated with programming decisions include not only support of client activities but also maintenance of client and public support for Extension and the land grant system (McDowell). The current emphasis on the marketing of Extension programs (Buchanan, Holt) is reflective of the latter concern during a time of very scarce resources.

While Extension administrators have traditionally faced difficult decisions with respect to establishing program priorities, the growing number of issues in agriculture that may be addressed is adding significantly to the trade-offs which must be accommodated in resource allocation. Structural and technological issues include the number of part-time farms, increased attention to direct marketing, adoption of low-input and alternative production and pest-management systems, computerization, and biotechnology. Concurrently, the set of social and institutional issues ranges from family stress management to environmental quality to taxation and government policy. All of these forces are expanding the scope of information needed for profitable and competitive farming as never before. In response to these informational needs, Extension programs need to become increasingly diverse as well as increasingly specialized with respect to informational content. Unfortunately, a major risk of such diversification without significantly expanded resources can be impaired excellence. The latter can lead to client dissatisfaction with, and decreased support for, both Extension programs and personnel.

The need for Extension information in many new and diverse subject areas requires especially skillful choices if effective programs are to be offered and a farm-client support level is to be maintained. In an era when some question the stability of the political support base of Extension (see e.g., Kohl, Shabman, and Stoevener), program relevance to Extension client needs is a crucial aspect of the program design and prioritization process. A well-implemented program, designed to provide clients with desired information, can reasonably be expected to be a popular program. In this regard, determination of informational priorities should be a very basic consideration because the likelihood of program success and retention of client support can be significantly influenced by this decision.

This paper presents a method of identifying popular informational priorities for Extension educational programs in agriculture. The first section defines terms and discusses the basic notions underlying the method. Following this, the role of Extension informational priorities in farm-client decisions is defined in an economic context. The model and an implementation procedure are then detailed. An application of the method to selection of informational priorities for dairy programming in Massachusetts is used to illustrate the approach.

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Terminology and Perspective

Throughout the following discussion, the term "information" is used as it has traditionally been used in economic decision analysis—a signal which may shed light on a decision maker's perception of parameters in the decision-making environment. Hence, information encompasses facts, data, and relationships relating to a subject area, or, as referred to subsequently, an informational alternative. For example, information can be a detailed description of government tax regulations or a single piece of data which helps to form expectations about the future price of an agricultural commodity. The term "education" is used here to refer to instruction in utilizing information. For example, training in economic decision analysis is education since such training shows how to use information rationally. Note that education relates only to the processing of information and is not regarded as altering perceptions concerning parameters in the decision maker's environment. Finally, an "Extension educational program" refers to both informational and educational activities. In terms of these definitions, the focus of the following is on identifying appropriate informational priorities for an Extension program (i.e., the relative emphasis which should be accorded provision of information in different subject areas). The focus is thus on decisions concerning only one product of Extension programming.

Formal reliance on traditional welfare economics criteria as a basis for Extension programming decisions has been rare if not nonexistent. This is not to say that Extension programming decisions do not consider welfare criteria. It is quite likely that perceptive Extension staff and administrators do attempt to apply welfare criteria in an intuitive manner in making program choices. The usual difficulties associated with application of quantitative welfare criteria and the fact that an important Extension product is an information commodity have apparently come to be regarded as serious detriments to the formal application of such criteria. Of course, it is important to bear in mind that any basis for programming decisions will have economic consequences when followed, and that economic considerations may play a role in decision making implicitly even if impacts are not explicitly measured.[1]

As suggested earlier, numerous objectives involving economic, social, and political motives are possible in Extension programming activities. In particular, if maintenance of public support for Extension and the land grant system is an important consideration, then prudent decision making should consider the potential popularity of different informational priorities when developing an agricultural program. As resources have become scarcer, Extension's concern with client support appears to have grown in importance and may become an increasingly significant component of programming objectives. In this regard, few Extension programs will likely receive universal enthusiasm from all client groups. The likelihood is rather that client responses will vary depending on individual needs and perceptions. The mixture of popular responses (e.g., differential feedback received by an administrator) regarding an Extension program over a period of time is a reflection of this phenomenon.

A sustainable approach to programming decisions may require that an assessment of the popular response to potential choices be made prior to implementation. Opinion gathering, both formal and informal in nature, has often been used by Extension as well as other public information agencies to ascertain client preferences concerning various aspects of informational activities (see e.g., Carlson), though a rigorous basis for analysis of program choices has rarely been offered. The premise of this paper is that practical procedures for collection and analysis of such client-preference information will enhance the likelihood of meaningful results if based on economic theory. A relationship with economic theory will provide a context for interpretation of results, facilitate comparison of results with traditional welfare economics criteria, and identify limitations of alternative approaches. Practicality is an obvious requirement to ensure that Extension can proceed with the expectation of gaining useful programming direction at reasonable cost.

Pursuing a relationship between the procedure used to assess client priorities and economic theory has an important procedural implication. Since an Extension program is invariably an amalgam of informational alternatives, determining client preference for individual elements provides only very limited information on overall program priorities. In fact, attempted analysis of client preference among diversified alternatives (information in a number of subject areas) based on individual component preferences is generally not meaningful.[2] Hence, direct

[1] Extension programming based on issues ("issues programming") does not escape the need for economic evaluation since such programming also has economic-welfare implications. Moreover, the method presented subsequently for identifying popular informational priorities might also be used to identify "issues of wide public concern arising out of complex human problems" in order to "address selected issues through knowledge-based education to improve peoples' lives" (U.S. Department of Agriculture).

[2] For example, given three subject foci A, B, and C, suppose that a client regards information on A as more valuable than information on B and information on B as more valuable than information on C. Due to synergistic effects, these facts do not generally imply that information on A *and* B is more valuable than information on B *and* C.

determination of client preference among diversified alternatives is required to shed light on the potential popularity of an Extension program. Unfortunately, the sheer number of alternatives may preclude such assessment in practice. The following sections detail an approach that permits formulation of a practical procedure. A key element of the approach is collection of a client's optimal program priority (as defined in a later section) through identification of its origin in the expected value of information.

Extension Informational Priorities and Farm-Client Behavior

As described earlier, special care in establishing Extension informational priorities is needed not only to support farm-client decision making, but also to maintain client support of Extension. The traditionally difficult job of establishing program priorities has been made more difficult by the increasing diversity and specificity of farm informational needs in a time of relative Extension resource scarcity. A useful analytical approach to assist in programming decisions should be related to economic theory and should be practical.

If there are n prospective informational alternatives and a_k denotes the proportion of the available Extension budget allocated to alternative k, then the proportions $a_1, a_2, \ldots, a_n$ ($\sum_k a_k = 1$; $a_k \geq 0$) define an Extension program according to its relative informational content. Note that in theory the a_k may be viewed as continuously variable; however, significant indivisibilities may typically restrict the extent to which resources can be reallocated and redirected and limit the range of programs that can be conceived. Even so, a substantial number of different programs may be possible. Similarly, a prioritization of informational alternatives is defined by equality/inequality relationships among the a_k. Hence, a prioritization is defined to depict only the relative emphasis a program places on informational alternatives rather than providing specific allocations. For example, if there are three alternatives ($n = 3$), a particular prioritization is given by $a_1 > a_2 > a_3$. This prioritization indicates that greatest emphasis is placed on alternative 1, followed by alternative 2, and then alternative 3. The prioritization $a_3 > a_1 = a_2$ indicates that most emphasis is placed on alternative 3 with less but equal emphasis placed on alternatives 1 and 2.

Client opinion regarding alternative programs/prioritizations can have an important impact on the popularity of Extension informational activities. Unfortunately, it will be impractical to elicit client opinion among more than a very few of such alternatives. Even if consideration is limited to prioritizations, complete rankings will be difficult to establish if n is large.

Formulation of an approach to gain information about client preferences among Extension informational priorities is facilitated by a framework providing some rationale for client decisions. While numerous decision frameworks are possible, it seems appropriate to assume that farm clients possess behavioral characteristics similar to those commonly attributed to decision makers by economic theory. Specifically, clients are assumed to behave as if maximizing the present value of expected utility while using Bayesian decision procedures to incorporate information provided by Extension into the process.[3] Under these assumptions, Extension information serves to revise the prior beliefs that enter into client decision processes and will be valued according to the expected impact on outcomes. A behavioral model consistent with these assumptions is given by

$$(1) \qquad \max_{(x_t)} \sum_t d_t E_i[U_i(x_t) \mid a_k], \quad \text{subject to } x_t \in X_t,$$

where d_t is a discount factor consistent with client i's preferences for future versus present consumption; $U_i(\cdot)$ is utility depending on a vector of client i's decisions X_t; the a_k ($k = 1, 2, \ldots, n$) reflect Extension informational priorities as defined earlier; and X_t defines feasible decisions. The optimal outcome of the decision model (1) (i.e., the maximum present value of expected utility) can be conveniently denoted as a function of the Extension program by $V_i(a_k)$. Implicit in assumptions concerning client behavior is that client opinion regarding an Extension program will be derived from the expected value of the associated information. For example, client i's preference for Extension program a_k' over a program with alternative resource commitments a_k'' will reflect that $V_i(a_k') > V_i(a_k'')$.

The model (1) is very similar to standard economic decision models and provides a familiar point of departure. However, because of their relative simplicity, prioritizations may be preferable as a tool for learning about client preferences. A convenient way to denote a prioritization utilizes pairwise comparisons between the proportions a_k via an equality/inequality relation (say $\rho_{mj} \in \{<, =, >\}$; $m = 1, 2, \ldots, n-1$; $j = m+1, \ldots, n$). With this notation, the pairwise comparisons

[3] For recent criticisms of models of this type, see Machina and Shanteau.

are denoted by $a_m \rho_{mj} a_j$. For example, if there are three informational alternatives ($n = 3$), then $m = 1, 2$ and $j = m + 1, 3$. The possible pairwise relations are defined by ρ_{12}, ρ_{13}, and ρ_{23}. If ρ_{12} is "=," ρ_{13} is "<," and ρ_{23} is "<," then the specific pairwise comparisons reveal that $a_1 = a_2$, $a_1 < a_3$, and $a_2 < a_3$. Note that these pairwise comparisons imply that $a_3 > a_1 = a_2$; hence, these ρ_{mj} define the prioritization considered in an earlier example. A behavioral model analogous to (1) but based on informational priorities is given by

$$(2) \qquad \max_{(x_t)} \sum_t d_t E_i[U_i(x_t) \mid a_m \rho_{mj} a_j],$$
$$\text{subject to } x_t \in X_t,$$

where $\rho_{mj} \in \{<, =, >\}$; $m = 1, 2, \ldots, n-1$; $j = m + 1, \ldots, n$. The optimal outcome to (2) can also be expressed analogously to (1) as $V_i(\rho_{mj})$; that is, for each prioritization defined by the ρ_{mj}, $V_i(\cdot)$ expresses the largest achievable present value of expected utility.[4] Client rankings of alternative informational priorities will again be based on expected value.

The Model

A procedure which may be used to shed light on the relative popularity of alternative Extension informational priorities can be based on the following method. Suppose that Extension is contemplating an informational program with n possible informational alternatives and that opinion gathering will be used to assess client priorities. Suppose further that clients are asked to reveal priorities by assigning an integer k ($k = 1, 2, \ldots, n$) to the alternatives with a "1" indicating "most preferred" and an "n" indicating "least preferred." Clients are also permitted to assign the same integer to different components indicating these alternatives are interchangeable in the prioritization. With these instructions, client response will consist of pairings between the prospective informational components and positive integers less than or equal to n.

An interpretation of client response in the procedure defined above can be based on (2). Since the procedure requests clients to identify the most-preferred informational priorities, the response of client i solves

$$(3) \qquad \max_{(\rho_{mj})} V_i(\rho_{mj}),$$
$$\text{subject to } \rho_{mj} \in \{<, =, >\}.$$

The response reveals Extension informational priorities (ρ_{mji}^*) expected to be most valuable to client i. While the elicitation procedure sheds no light on the optimal value $V_i(\cdot)$ in (3), its interpretation permits application and understanding of alternative programming objectives.

If, in response to the above procedure, all clients provide the same prioritization of informational alternatives, then establishment of programming priorities can proceed mindful of client desires. Even though there may often be a good deal of concurrence among client prioritizations, differences may exist over a client population due to differences in needs and perceptions. In this case, the priorities of all clients cannot be realized simultaneously; however, Extension programmers must nevertheless establish informational priorities. A model based on the preferences determined by the above procedure, from which numerous programming criteria can be considered as special cases, incorporates a weighting scheme $W_i(V_i)$ where W_i reflects the relative emphasis placed on meeting client i's informational needs. For example, a weighting $W_i(\cdot) = V_i(\cdot)$ for all i corresponds to program priorities which are consistent with the potential welfare criterion ("dollar voting"). At another point along the spectrum, weighting in the form of $W_i(\cdot) = 1$, if $\rho_{mj} = \rho_{mji}^*$ and $W_i(\cdot) = 0$; otherwise all i, j, and m corresponds to informational priorities according to a "one farm–one vote" majority-rule criterion. Appropriate forms of $W_i(\cdot)$ equally well permit programming which emphasizes the needs of specific client groups—for example, those with small farms, those that direct market, and those that practice integrated pest management.

Quantification of the $V_i(\cdot)$ contained in (3) permits application of a range of programming criteria. Explicit quantification with analytical relationships has rarely been pursued in Extension programming decisions as discussed earlier. However, the opinion-gathering procedure specified above facilitates use of a number of alternative criteria. A programming model that takes advantage of the procedure and permits programming stratified according to a specific client group, say G, is

$$(4) \qquad \max_{(\rho_{mj})} \sum_{i \in G} W_i\,(V_i(\rho_{mj})),$$
$$\text{subject to } \rho_{mj} \in \{<, =, >\}, \text{ and}$$
$$W_i(V_i(\rho_{mj})) = \begin{cases} 1, & \text{if } \rho_{mj} = \rho_{mji}^* \text{ for all } m, j; \\ 0, & \text{otherwise.} \end{cases}$$

Of course, G can also be defined to encompass an entire client population. Note that the model (4)

[4] Note that the expectation in (2) involves subjective probability distributions for programming corresponding to the prioritization.

serves to identify Extension informational priorities that are most valuable to the most members of a client group and may consequently be useful in maintaining popular support for Extension.

Use of the opinion-gathering procedure and programming model (4) will, as with any programming criterion, have economic consequences. As has been observed, "social welfare functions are employed implicitly, if not explicitly, in real-life social decision making every day" (Katzner). At least some light can be shed on the appropriateness of (4) by comparison with traditional welfare economics criteria. However, in the absence of any specific quantitative information on welfare impacts, it will not be possible to provide a quantitative evaluation of any potential prioritization that might be chosen as a solution to (4). Even a qualitative comparison to traditional criteria is difficult; however, under some specific conditions a comparison can be made.

If the resources to be allocated by Extension may be considered given, if market prices are presumed independent of changes in client decisions due to Extension information, and if programming is presumed to reflect a timely new set of priorities rather than an interruption of an existing program prior to its scheduled completion, then programming according to (4) will result in informational priorities for which clients' willingness to pay are simultaneously nonnegative. This conclusion can be drawn because Extension information value is, in accordance with (2), the expected value of information and is always nonnegative in a Bayesian context. While the same result can be achieved for virtually any allocation of information commodities under the perhaps plausible above conditions, it is nevertheless of some comfort to conclude that pursuit of popular Extension informational priorities need not conflict with established economic criteria. The result is also of interest because traditional welfare analysis has played such a minor role historically in programming decisions, and because the quantitative analyses needed to increase this role will probably not be common in the near future.

Massachusetts Dairy Programming

The dairy industry in Massachusetts has been declining for a number of years and there is some anecdotal evidence that the rate of decline may be increasing. Reasons often advanced for the decline include economic and environmental pressures due to the urban/rural interface, the high cost of feed and other agricultural inputs, and regional competition as exerted through supply-induced support-price reductions. Extension continues to face a difficult task in supporting the informational needs of an industry attempting to cope with such pressures.

A survey of Massachusetts dairy farmers utilizing the procedure described earlier was conducted during 1988. Analysis of the survey data illustrates the nature of results obtained using the procedure. Survey questionnaires were mailed to approximately 550 dairy farmers. Some general characteristics of the 113 responding farms were as follows. The average survey respondent's age was 50.2 years with 31 years experience in farming and 14.4 years of formal education. Average herd size was 92.3 cows with 45.3 heifers, while an average $151,017 worth of milk and milk products were marketed along with $7,183 worth of beef. An average of 245.2 acres were owned per respondent with 101 acres tillable. Tillable acreage rented averaged 73.5 acres. Handbooks and checkbooks accounted for 69% of the respondents' financial recordkeeping, while professional accountants provided financial recordkeeping for 23% of the survey respondents. Among the respondents, 61% participated in the Dairy Herd Improvement Association, 95% raised their own heifers, 61% grew their own hay and silage, 32% employed custom applicators for pesticide treatments, and 34% marketed some products directly to consumers. Respondents read an average of 5.3 commercial farm publications monthly and an average of 1.8 Extension publications monthly. Contacts with commercial agricultural consultants, lenders, and product representatives averaged 2.3 per month while contacts (in-person and telephone) with Extension averaged 0.5 per month. Respondents attended an average of 0.8 farm meetings monthly. Approximately 15% of respondents had an electronic feeding system, while 17% had a personal computer.

Client priorities among the following Extension informational alternatives were elicited: nutrition, reproduction, calf/heifer management, genetics, crop production, taxes, farm records, estate planning, decision making, labor management, family stress, and land preservation. Use of specific informational alternatives was advantageous in this case because it provided respondents with an opportunity to prioritize very specific and familiar terms. Clients were asked to prioritize these alternatives according to the most preferred–least preferred scale described earlier. Responses were also grouped according to size of farm and years of experience to examine program priorities most valuable to the majority of these groups.

Pursuit of a solution to (4) for all respondents as well as the two particular client groups under consideration was facilitated by averaging individ-

ual responses to construct priorities for information in Extension agricultural program areas defined as production technology (nutrition, reproduction, calf/heifer management, genetics, crop production), farm management (taxes, farm records, estate planning, decision making), human resources (labor management, family stress), and state programs/policy (land preservation). Informational alternatives were collapsed to four areas in this illustration to ensure identification of a unique solution to (4) for each of the three definitions of G utilized. It should be noted that increasing the sample size, perhaps through a follow-up to the mail survey, might have been sufficient to identify a unique optimal prioritization for each client group considered directly. However, the existence of multiple local optima in (4) cannot be ruled out *a priori* nor should it be. While not particularly interesting for illustrative purposes, identification of an absence of consensus among informational priorities in a particular client group may provide useful input to programming choices.

A computer program was developed to solve (4) using the transformed client prioritizations as data and the three alternative definitions of G. The program requires the number of informational alternatives, number of respondents, prioritizations, and any accompanying indices for defining client groups as input. A solution to (4) is pursued by sorting and comparing the relative popularities of the prioritizations existing in the data base. A copy of the program in FORTRAN is available from the authors on request.

Results obtained from solving (4) are shown in Table 1. Note again that the solution to (4) is the prioritization that the largest number of clients in a group identified as the optimal one. The total client population sample placed the highest priority on state programs/policy followed by production technology, farm management, and human resources. An identical priority ordering resulted from the set of small farms (defined as dairies with less than $75,000 in annual milk sales revenue). For farmers with less than ten years of experience, production technology displaced state programs/policy as the top priority, although the order of other priorities was unchanged. The latter result could be anticipated since less-experienced farmers might be expected to place a higher priority on information related to the technical details of production.

The results in Table 1 can suggest areas where scarce Extension resources may be concentrated in order to best support the performance of the largest number of its clients and to, in turn, maintain popular support for Extension. Maintaining excellence in popular program components may be important for preserving a positive public image for Extension in the relatively lean budgets that a number of observers believe are likely in the years ahead.

Concluding Remarks

It is important to note that the popular informational priorities determined by the opinion-gathering procedure described above followed by the solution of the programming model do not provide specific programming prescriptions in terms of budgetary allocations. Hence, results can only be regarded as one source, among possibly many sources, of information to the programming process. Promoting awareness of informational priorities with economic value to farm clients and which are useful in preserving Extension's political support base can contribute positively to programming decisions.

References

Buchanan, Patricia Jarboe, ed. "Special Issue on the Marketing of Extension." *Journal of Extension* (1988).

Carlson, John E. "Farmers' Perceptions About the Management of Their Farms." *Journal of the American Society of Farm Managers and Rural Appraisers* 52(1988):91–96.

Table 1. Popular Informational Priorities Among Massachusetts Dairy Farmers, All Farmers and Selected Farmer Groups, 1988[a]

All Dairy Farmers	Small Farms[b]	Newer Farmers[c]
State programs/policy	State programs/policy	Production technology
Production technology	Production technology	State programs/policy
Farm management	Farm management	Farm management
Human resources	Human resources	Human resources

[a] Priorities are listed in descending order. Informational categories refer to nutrition, reproduction, calf/heifer management, genetics, and crop production in production technology; taxes, farm records, estate planning, and decision making in farm management; labor management and family stress in human resources; and land preservation in state programs/policy.
[b] Dairy farms with annual milk sales less than $75,000.
[c] Dairy farmers with less than ten years of experience.

Holt, John. "Managing Change in Extension." Paper presented at the annual meeting of the American Agricultural Economics Association, Knoxville, TN, 1988. 10 pp. Mimeo.

Katzner, Donald W. *Walrasian Microeconomics: An Introduction to the Economic Theory of Market Behavior*. Reading, MA: Addison-Wesley Publishing Company, 1988.

Kohl, David M., Leonard A. Shabman, and Herbert H. Stoevener. "Agricultural Transition: Its Implications for Agricultural Economics Extension in the Southeast." *Southern Journal of Agricultural Economics* 19(1987):35–43.

Machina, Mark J. "Choice Under Uncertainty: Problems Solved and Unsolved." *Journal of Economic Perspectives* 1(1987):121–54.

McDowell, George R. "The Political Economy of Extension Program Design: Institutional Maintenance Issues in the Organization and Delivery of Extension Programs." *American Journal of Agricultural Economics* 67(1985):717–25.

Shanteau, James. "Decision Making Under Risk." Paper presented at the Federal Extension Service workshop on Risk Management in Agriculture, Kansas City, MO, 1988. 12 pp. Mimeo.

U.S. Department of Agriculture. Cooperative Extension Service. "Issues Programming in Extension." ES-USDA, ECOP, and the Minnesota Extension Service. 1988.