Staff Paper 61 February, 1978

ISSUES INVOLVED IN USING COMPUTERIZED DECISION-MAKING MODELS WITH FARMERS

Larry D. Jones, David L. Debertin,
Charles L. Moore, Sr.

ABSTRACT

Issues Involved in Using Computerized Decision-Making Models with Farmers

This paper outlines three basic issues that states must consider before using computerized decision-making models with farmers. These issues were identified from our experiences using an advanced linear programming model with grain farmers. One issue is creating an awareness with clientele of what a computer can do to help solve management problems. A theme that needs equal billing is what a computer cannot do. Many producers do not realize that computer hardware is not sufficient to solve a problem--that computer software must also be developed. A second issue revolves around whether the development and extension of models should be publicly financed or user funded? The final issue examines the merits of bringing farmers into a central workshop in close proximity to a computer versus decentralizing computer access by using remote terminals. Based on our experiences we concluded that computerized decision-aids can be effectively used with farmers. Implementation of these programs is costly necessitating the liklihood of joint public and user financing. Effective delivery of computer management aids will likely consist of a mix between central workshops and remote terminals.

Issues Involved in Using Computerized Decision-Making Models with Farmers

by

Larry D. Jones, David L. Debertin, and Charles L. Moore, Sr.*

This paper outlines the experiences of Agricultural Economists at the University of Kentucky who conducted an extension workshop using a computerized decision-aid model with selected corn and soybean farmers. More specifically, this discussion considers three basic issues that extension personnel in any state must consider before using computerized decision-making models with farmers.

Our experiences are based on a workshop using an advanced linear programming model of corn-wheat-soybean-silage production which we labeled as the KASH PROFITS Workshop [1, 2]. The model consisted of three major components, (1) a program which converts input into a form to be solved by the computer, (2) a solution algorithm utilizing the IBM, MPS algorithm, and (3) a report writer which converts the problem solution into a readable form.

The workshop was attended by 31 farmers representing 26 farm operations. Farmers had the option of inputing 657 different pieces of information (Table 1), which was used to answer many questions that farmers encounter in their management decision-making process (Table 2).

---

*Larry Jones and Charles Moore are Associate Extension Professors while David Debertin is Associate Professor. All are Agricultural Economists at the University of Kentucky.

Table 1. Summary of Information Requested in KASH PROFITS Input Form

Table No.	Description
1	Farm Characteristics, Acreages, Rents, Available Acreage.
2	"Present Plan" Cropping Acreages of Corn, Soybeans, Wheat, and Silage.
3	Farm Storage and Drying Capacities and Costs.
4	Crop Prices
5	Yield Levels and Input Costs for Corn by Planting and Harvesting Period.
6	Yield Levels and Input Costs for Single Crop Soybeans by Planting and Harvesting Period.
7	Yield Levels and Input Costs for Wheat.
8	Yield Levels and Input Costs for Double Crop Soybeans.
9	Acreages and Yields of Silage.
10	Spring and Summer Field Time, Labor and Tractor Availability.
11	Fall Field Time, Labor, and Tractor Availability.
12	Machinery and Labor Working Rates for Corn and Soybean Land Preparation and Planting Operations.
13	Machinery and Labor Working Rates for Wheat and Double Crop Soybeans Land Preparation and Planting Operations.
14	Harvest Requirements and Field Capacities.
15	Harvesting Custom Rates.
16	Machinery Fixed Costs.
17	Machinery Fuel and Repair Costs.
18	Alternate Plans Input Form.

Source: [3]

Table 2. Questions Farmers Have Answered with KASH PROFITS.

1. How much money am I currently making from my cropping operation?
2. Given today's crop prices, or the expected crop prices when I sell this year's harvest, how much of my acreage should be planted to corn, how much to soybeans, and how much to wheat?
3. Given my own machinery and labor, when should I plant my corn and soybean?
4. If the price of soybeans goes up 25¢ per bushel, and corn stays the same, should I plant more soybean?
5. Will double cropping be profitable for me?
6. Am I underinvested, or overinvested in machinery?
7. Will a larger tractor or combine make me more money?
8. What can I afford to pay for hired labor during planting and harvest?
9. Is it more profitable to hire extra labor and run my present equipment, or buy larger equipment?
10. Should I hire custom work for harvest?
11. Given my present labor and machinery setup, is it profitable to rent an extra 80 acres?
12. If I rent an extra 80 acres, how much more machinery and labor will I need?

Source: [4]

The remainder of this paper is based on our experiences using the KASH PROFITS model. We will discuss issues and problems faced by researchers in developing computer software and the problems faced by extension personnel in implementing sophistocated computer software into extension programs.

Issue I: What a Computer Can and Cannot Do

While the public has been exposed to computers through such uses as computerized billing and computerized checking account statements, lay audiences are largely unaware of precisely what a computer is and how it can be used as a decision-making tool. The media have fostered an understanding of computers which would seem to give computers an almost lifelike quality that goes far beyond calculator skills of addition, subtraction, multiplication and division. The public believes that computers have a magical ability to solve problems. Data need merely be somehow "fed into" a computer and a perfect solution to problems will be instantaneously forthcoming. Moreover, the public may believe that the availability of computer hardware is sufficient to insure that a problem can be solved. The large amount of effort required to develop software computer programs necessary to solve a problem is not understood, or at best underestimated.

The paramount theme of the workshop using computerized decision aids in farm management is "what the computer can do for you in solving your farm management problems". A theme that needed equal billing

is "what the computer cannot do for you in solving your farm management problems". Some lessons from our experience include the following:

(1) Any computer program that closely models a farmer's actual situation requires a large amount of information. KASH PROFITS requires 600 separate data items.

(2) Information required by a computerized farm management model is often not the kind of information that even a farmer with extensive farm records may keep.

(3) The quality of the output from the computer is no better than the input data.

(4) Even with "good" information supplied by the farmer, there are normally a number of characteristics of each farmer's operation so unique that no extension computer model can hope to consider them.

(5) Frequently, there exists a communication gap between the model builder and model user. The model builder must use laymen's language in designing both the model's input and output.

In short, the perfect model has yet to be invented. The challenge for the agricultural economist involved in design and implementation of computerized models for use in decision-making is in developing computer programs which abstract from reality and yet capture the salient features of the phenomena being modeled in sufficient detail to be useful to decision makers.

Issue II: Should Computerized Decision-Aids be Publicly Funded or User Funded?

The land grant system has traditionally provided extension educational programs, materials and information to farmers and other clientele groups without direct cost to the clientele. The charging of user fees at a level required to cover the variable costs associated with running a workshop represents a major break with the traditional extension philosophy. The fee charged to each farmer at the KASH PROFITS Workshop was $100. One of the major concerns of the workshop team was that of evaluating the acceptability to farmers of a comparatively large fee for an extension program run by a land grant university. Some of the questions raised by the charging of such a fee include:

(1) Should extension try to run programs which cannot be provided free to clientele groups?

(2) What are the costs and benefits of segregating clientele based on user fees?

(3) Do farmers object to fees?

Programs such as the KASH PROFITS Workshop are not at all similar to traditional extension programs. Such programs differ in that they convey information designed to be useful only on an individual farmer's operation. Traditional extension information has been general in the sense that what is learned by an individual farmer could probably be applied to a wide variety of farming situations with nearly equal success. Extension emphasis has usually been on educational material

that does not markedly change in its application from farm to farm. Information on a wide variety of agricultural topics including variety selection, herbicide and insecticide use rates and steps to prevent disease in livestock, should and do apply equally well to a large number of farmers. Extension delivery for such information through the media is inexpensive and comparatively efficient.

The kind of information a farmer obtains from a computerized management tool such as KASH PROFITS does not have any degree of broad application across farms. It is specifically designed to be information that is unique to a single farmer. Indeed its worth lies in this uniqueness. This has some important ramifications for extension delivery systems. First, delivery of such information is going to be more costly than delivery of information in traditional programs. Second, the total cost of such information per farmer in terms of hours of professional time, computer time and equipment and other resources, is so great that questions can be raised as to whether or not such programs ought to ultimately be funded at taxpayer expense?

A program such as KASH PROFITS represents a substantial change in the approach used in extension education. Yet, over time, our clientele groups have changed. We are aware that many commercial producers feel that they have "out-grown" extension. To a large degree, the local county agent no longer serves the role he once did in the extension education process. It is unrealistic to think that a county agent could provide sufficient information to supply all needs within a complex farming operation. This is particularly true with regard to

management decisions dealing with major resource allocation issues such as acreages of alternative crops to be grown, and machinery and equipment investment decisions. It is only with the assistance of a computerized decision aid that a county agent can begin to help farmers with these kinds of problems. In terms of time, the one-on-one work is extremely expensive. The charging of user fees that largely cover the cost of such a program may ultimately become the only way in which such programs can be conducted.

The charging of a fee for an extension workshop may restrict the size of the clientele group. The idea of limiting an extension clientele group to only those who can afford to pay the fee runs counter to principles that many believe to be sacred to the land grant function. Since its inception, agricultural extension has pursued a "shotgun" approach to educational programs. The reaching of the largest possible number of farmers is the primary goal of many extension programs.

A major issue raised by the charging of user fees for extension programs is centered around the notion that by charging a fee, the program will be made available to only those clientele who are willing to pay the price. Of course, extension programs have never been "free". They have been funded at taxpayer expense. Hence, the major issue really centers around whether such programs ought to be funded out of general governmental revenue at taxpayer expense, or rather funded by those who stand to benefit from the program through user fees.

There is no clear answer to this question. Should clientele who would like access to such a program but who feel they cannot afford

to pay the price be excluded entirely? The major benefit from a user fee is that it insures that only those who stand to benefit from the program will take advantage of it. Moreover, there may be a tendency on the part of some to feel that if a computerized management which does not cost anything cannot be worth anything. The charging of user fees may make the program worthwhile. No farmer participating in the KASH PROFITS Workshop objected to the charged $100 fee.

Issue III: Do You Take Farmers to the Computer (Batch Processing) or Do You Take the Computer to the Farmer (Terminals)?

Another issue posed by the use of computers in agricultural economics extension is the degree to which the computerized management tool is available at a centralized workshop versus availability at the local (county) level.

To the extent that computer decision-aids have been used in Kentucky the past few years has required centralized workshops in close proximity to the main computer. This has been true for more simple programs such as a least cost ration balancing routine where the farmer input requirements are small and simple all the way to more complex models such as KASH PROFITS where both input and output is far greater in quantity and complexity.

Our experiences with batch processing (physically bringing farmers to the site of the computer) suggests that this is a relatively inexpensive way for the University to reach these farmers with computerized

management tools. Minimal travel time on the part of state specialists is required. The kind of computer hardware needed is relatively simple assuming the availability of a main-frame computer. The central program enables state specialists to conduct the workshop minimizing the involvement of local extension staffs.

However, farmers have a bigger investment in time and travel expense. In addition, once a farmer is at the central location, the state specialist must have a great deal of confidence that the computer will not "go down" for repairs and that the printed output will be returned to the workshop in a reasonable amount of time.

Kentucky is considering implementing a system of county accessed terminals whereby farmers can access these management tools in the convenience of their local area. Farmers would save time and expense with this approach. Producers would be able to access a variety of programs without physically having to attend a variety of specialized workshops. Extension personnel at the state level are concerned about maintaining contact with local extension staffs. The terminal approach would help guarantee more local agent involvement.

At the same time a more decentralized computer access system does pose formidable problems: For example, a terminal system is more expensive to the University. Not only must a University's main frame computer be available, but somewhere there must be equipment that can effectively handle and coordinate any terminal network. Terminals positioned at locations away from the University must be purchased and

maintained. Phone bills between the terminal and the computer must be paid. Extension agents who would use this system must be trained and their acceptance of this new extension approach must be gained. Finally just administering such a system is cumbersome.

Our experiences suggest that we will have some mix between the centralized workshop versus local access to managementaids. Complex models that require large quantities of input and generate large quantities of output will be handled at the central level where high speed card readers and printers are available. In addition these programs likely will require a highly trained state specialist to conduct the workshop. Smaller models that require minimal input and generate relatively straightforward output can be handled at the local level by a county or area extension agent. One example is the least cost ration for livestock--a program that is accessed very frequently requiring a small amount of input and generating simple output.

Conclusions

We found that while computerized decision aids can be effectively used with farmers for providing management information, there exists several barriers to effective implementation of such programs.

(1) Farmers need to be aware of the difficulty of developing good extension software. Through the KASH PROFITS experience, we believe that farmers gained a better understanding of the difficulty of research and extension personnel have in develop-

ing good models. There are always unique aspects of any individual farmer's situation that probably cannot be modeled explicitly.

(2) Effective implementation of extension programs using computerized decision aids is extremely costly, particularly personnel costs involved both in the writing of the models and in the implementation. Such programs in the future will probably be funded through a mix of public funds as well as direct user charges.

(3) Effective delivery of computerized management aids will probably include a mix of facilities designed to support workshops requiring line printers at central locations and remote terminals at the county level. Central workshops are more effective when the need is for a wide range of professional expertise and the decision aid produces a large quantity of computer printout. Terminals within the county are more adapted to small models that do not require a great deal of input or printout and require only a minimum amount of expertise to run.

References

[1] Brink, Lars, Bruce A. McCarl, and D. Howard Doster, "Methods and Procedures in the Purdue Crop Budget (Model B-9): An Administrators Guide," Station Bulletin 121, Department of Agricultural Economics, Purdue University, West Lafayette, Indiana, March, 1976.

[2] Candler, Wilfred, Michael Boehlje, and Robert Saathoff, "Computer Software for Farm Management Extension." American Journal of Agricultural Economics, 52:1, February 1970.

[3] Debertin, D.L., C.L. Moore, Sr., G.L. Bradford, and L.D. Jones, "KASH PROFITS (Input Form)," Department of Agricultural Economics, University of Kentucky, Lexington, Kentucky, December, 1976.

[4] Moore, Charles L., Sr., et. al. "KASH PROFITS," Ag. Econ. Extension Information Series No. 22, Department of Agricultural Economics, University of Kentucky, Lexington, Kentucky, December, 1976.