The evolution of computerized programs for farm data. Processing and management education in the United States

Vincent H.W.

Agriculture et informatique

Paris : CIHEAM
Options Méditerranéennes; n. 1

1970
pages 42-45

par Warren H. VINCENT

Professor,
Agricultural Economics
Department
Michigan State University
East Lansing

The Evolution of Computerized Programs for Farm Data. Processing and Management Education in the United States

I. — INTRODUCTION

Computer technology advances most rapidly with the convergence of at least a few necessary conditions. A minimum list of these conditions include :

(a) **Financial ressources which are sufficient to undertake** and sustain EDP systems development. Utilizing the potential capability of the computer can be a radical change from former methods of data analysis and the departure from the previous methods can involve unexpected setbacks and disappointing results unless the effort is permitted to evolve subject to modification over time.

(b) Sufficient trained or potentially trainable **personnel** to conceive, develop, implement, and maintain operational programs.

(c) Evidence that, for at least some definable long-term period, the potential **benefits** from the new system will justify the necessary expenditure of time and money.

(d) Appropriate means to overcome potential problems of **communication** (or lack of communication) among various individuals and groups within the effected system.

The items in this list of desirable conditions are not necessarily mutually exclusive nor completely exhaustive. However, an understanding of them helps to explain why, in the case of computer applications to agricultural problems, the initiative for the work did not originate with individual farmers. Contrary to the case in some non-agricultural industries, individual farmers cannot meet the necessary criteria. Therefore, a survey of the evaluation of computer applications to agriculture in the United States is primarily a matter of reviewing the work of public-supported institutions and noting the response of the private sector to that work.

Before noting highlights of the work of public-supported institutions in this area, understanding may be enhanced by a few brief observations and possible implications of treating the subject in this manner.

(a) Agricultural colleges in the United States have more than 60 years of commitment to the extension education of farmers. The Extension Service has traditionally supplied or promoted services such as milk testing, soil testing, book-keeping and a wide range of advisory services associated with them. Thus, with the advent of the electronic computer, new EDP programs were frequently merely the computerization of old programs. In earlier times the full potential of the computer was usually under-estimated and the resulting programs, in many instances, lacked innovation beyond doing an old activity much faster.

(b) Colleges of agriculture (like other areas of the university) usually have difficulty in receiving sufficient funding for large scale innovative projects that cannot be implemented in a short period. Reallocations within a fairly fixed budget seldom provide adequate resources for the development of a comprehensive data processing and information system. Thus, those universities with the most « daring » programs during the past ten years have been those which have received new forms of support such as foundation grants, special project support from the federal government or by subscription of fees from participating farmers.

(c) The states without the opportunity for sizable financial injections were more-or-less forced to adapt a policy of « wait-and-see ». With limited funds and personnel, the appropriate strategy was to allow leaders in other states to take the developmental risks and to eventually have a product which could be adapted with or without modification in the home state. This policy, without doubt, minimized the amount of risk capital required in total but it likely resulted in less than the optimum system for some states forced into the « adapter » rather than « innovator » role. This pattern of development helps explain the close similarity among the farm records EDP programs in many states.

(d) Management information a decade ago, was a difficult commodity to merchandize on a commercial basis. This was true then and to a lesser degree is true today whether the information being processed is prepared by computer or not. Over the years, several private firms have entered the field of farm data processing but few have made much profit from this activity unless it advanced the profit potential for the primary commodity or service offered by the farm in question. In a few instances it is likely that electronic book-keeping services have been offered as a form of goodwill to farmers or to enlarge the potential market for other goods and services. In general, it appears safe to say that private industry in the early years depended heavily on university work for its own decision making in this area and, thus, also adopted a « wait-and-see » policy.

In view of the above observations, attention will now focus on programs which have initiated primarily in the agricultural colleges. No claim will be made for the survey being comprehensive. Rather, recognition is given to the activities which, in retrospect, seem to have been significant developments or turning points in the evolution of a computerized agriculture information system. Regretably, this approach will lead inadvertantly or through lack of knowledge to oversights, errors of judgement and misplaced credits. Apologies for these errors are readily but sincerely offered.

2. Computerization of Farm Record-keeping :

One of the first usages of the computer for agricultural data processing was in the area of farm record-keeping. Projects sponsored by agricultural economics departments to collect, analyze, and interpret farm records were prevalent in many states prior to World War I. However, during the War when manpower in civilian life was curtailed, these projects dropped by the wayside. The task of collecting, auditing, tabulating, interpreting and returning individual account books was very labor intensive, thus, expensive and time consuming.

The opportunities to use, first, punched card accounting machines and, later, electronic computers opened the way to substitute machines for man in the post-war years. Records mailed to the processing centers on a monthly basis replaced the highly seasonal task of auditing records books at the completion of the accounting year. Computer programs operating routinely replaced the tedious hand calculations. Monthly or quarterly computer output supplemented or replaced the annual summaries which were frequently delivered to the farmers as long as seven months into the next year.

The pioneering work in this area was done at Michigan State University beginning in 1955 with 50 participating farmers, followed in 1956 with 500 cooperators (1, p. 7). Shortly thereafter (1959) the University of Arizona initiated a trial system on one farm utilizing double entry accounting principles, a monthly trial balance and enterprise analysis (2, p. 113). Although the number of cooperators from within the sparsely populated state of Arizona has been relatively small, the system has had appeal especially to the large farm units in Southwestern United States. States in the Northeast region of the United States innovated with organizational structure. In 1964, a non-stock, non-profit corporation (named ELFAC) was formed to serve the needs of several states. With a central processing center, records were processed for 526 farmers located primarily in New York, Vermont, Maine, New Hampshire, and Massachusetts with scattered enrollment in seven other states and two provinces of Canada.

So, the beachhead for the electronic processing of farm management was established roughly ten years ago. Since that time at least 24 processing centers have been established and the annual farmer enrollment in some type of university sponsored EDP program numbers approximately 6,000 (3, p. 18).

Thinking only of the record-keeping aspects of these programs, the least that farmers receive in accounting services will be data necessary to file the farm business portion of the federal income tax form.

3. Computerized Farm Business Analysis :

The oldest farm planning approach, pre-dating World War I, is called the « comparative analysis », or « direct comparison » method. Standards of performance are developed by studying individual farms or groups of farms and the results obtained by individual farmers are compared with these standards (4, p. 2). Although developed prior to the application (indeed, the formulation) of deductive models of economics, production and management, it has stood the test of time and is currently the most common planning method employed in farm management advisory programs in the United States and other parts of the world. Therefore, it is no surprise that as EDP programs were developed in the several states that the comparative analysis method was programmed in the systems.

Double entry accounting has been difficult to teach and implement in programs where farmers do their own record-keeping. Experience has shown, however, that computer programs can be written to accomplish the mechanics of double entry accounting providing the cooperators follow relatively simple instructions for recording data on a transmittal form. This realization has encouraged complete cost accounting services on a total farm business basis in some states and enterprise cost analysis in other places.

The introduction of computer programs to accomplish cost accounting and the increasing importance of sound record-keeping methods for the acquisition of needed agricultural credit have assisted in the teaching of improved farm financial management. The value of an accurate financial statement has been recognized by both farmer and money lender. Thus, the stigma of revealing one's debt status has been broken and the amount and repayment of agricultural loans has become an integral part of university sponsored EDP projects.

Thus, the evolution of computer applications to farm business analysis is a combination of the improved usage of computer software and hardware and the gradual changes in the American farmer's assessment of what kinds of data and in what form are needed for management in modern agriculture.

4. Computerized Farm Business Planning.

Agricultural economists in the past decade have paid increasing attention to the strategic and growth aspects of agricultural production units. The desire to optimize plans has diverted some attention from earlier planning methods whereby decisions for change were based largely on judgement or on a limited number of comparative budgets. Prescription and prediction by linear programming is reaching higher and higher levels of refinement. The literature grows rapidly with applications of linear programming to agricultural problems. Many modifications in basic programming techniques have been developed and will continually be developed to better cope with the complex agricultural production phenomena. Some of these developments include stochastic models, parametric models, dynamic and recursive model, models to qualify the objective function and models to qualify the restraints (5, p. 1400-1414). Some of these efforts are still in a « textbook » status but with the ever-increasing capability of the computer in terms of speed, capacity and the impro-

vements in computer language, all aspects of agricultural production are becoming under the tent of sophisticated analysis. Currently, the problems handled include inventory management, cost minimization, enterprise organization, total business organization, growth and investment management, transportation and location, machinery systems organization, best procedures for buying and selling plus a host of others.

5. Computerized Simulation and Gaming :

The desire for more realistic description, interpretation and utilization of data for improved decision making plus the growing capabilities of modern computers has led quite naturally to the development of simulation models of many economic, social, political, physical and biological phenomena. A system amenable to description by a mathematical but where the correct analysis of the model is beyond the mathematical sophistication of the analysist is a system appropriate for simulation. Likewise, a system so complex that it is not anemable to mathematical description may be suitable for computer simulation (6-p. 5). Some applications of this technique in analyzing U.S. agriculture include simulation of : individual farm business firms, agricultural markets, agri-business firms, machine systems, livestock feeding systems and integrated sub-systems of an agricultural sector (7).

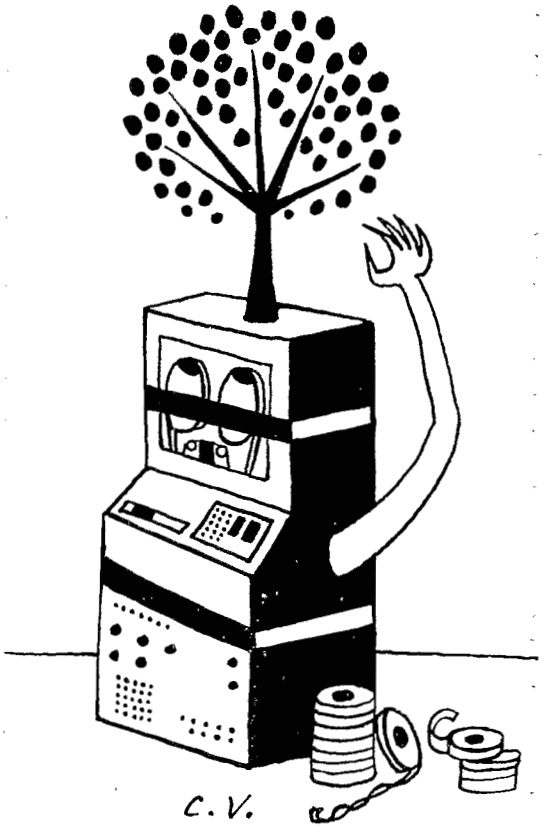
The management game represents a special class of simulation. In the examples mentioned above, the concern is with the analysis or design of a simulated system. When the interest is with the behavior of the operator of the simulated system, there is a role to be performed by a game. The systems operator (management student, farmer, trainee, etc.) will be allowed to evaluate the output for the first and subsequent simulated time periods with the priviledge or responsibility of altering the system with each successive computer run. Practice in making and evaluating decisions has been an important aid in developing management skills. The computer through the processing of games has, thus, made a significant contribution to management education.

6. Private Industry and EDP.

Various types of agri-business firms have engaged in the electronic processing of agricultural data. The least successful in this activity from a profit and loss point of view are those which have attempted to sell farm management analysis without sufficient trained personnel to perform as teachers. Commercial interests face the dilemna of charging a low rate to entice large numbers of clients (in which case it may take a long time to reach a break-even point) or to charge a high rate with the expectation that the number of clients will be small (in which case overhead costs may be excessive). Income tax service for farmers can be an attractive commercial item and some accountants have utilized computers in their tax accounting business. Data are lacking as to the extent and profitability of this venture.

Some Agricultural input industries (particularly feed and fertilizer) have developed specialized computer programs to provide farm planning and diagnostic services for their farmer clientele. These programs may range from soil analysis or herbicide diagnosis through computing least cost rations to complete farm planning by linear programming. The logical strategy is to maximize profits from the sale of primary products and it is likely that some of these programs contribute to that goal. Again, no comprehensive surveys are available as to the scope and impact of these programs.

The most visable and perhaps viable private industry engaged in agricultural EDP is that offering credit and financial management services to farmers. A 1967 survey by the American Bankers Association revealed 20 different computerized bank-offered record keeping plans (3, p. 22). Most of the banks identified are located in the Mid-west, the center of U.S. commercial agriculture. These programs have proven beneficial for both lender and borrower of capital.



REFERENCES CITED

1. Proceeding of IBM Agricultural Symposium, Endicott, New York ; February 5-7, 1962.
2. Proceeding of IBM Agricultural Symposium, Endicott, New York ; May 10-13, 1965.
3. Proceeding of Computer Use in Farm Management Analysis and Production Decisions Workshop, U.S. Department of Agriculture, Federal Extension Service, Washington, D.C. ; November 20-22, 1968.
4. Vincent, Warren H. and Larry J. Connor, « An Orientation for Future Farm Planning and Information Systems », Ag. Econ. Misc., 1968-5, Michigan State University, East Lansing, Michigan ; 1968, Mimeo).
5. Hutton, Robert F., « Operations Research Techniques in Farm Management : Survey and Appraisal », **Journal of Farm Economics,** Vol. 47, No. 5, December 1965, p. 1400-1414.
6. Schmidt, J. W. and R. E. Taylor, **Simulation and Analysis of Industrial System,** Richard D. Irvin, Homewood, Illinois, 1970.
7. Vincent, Warren H., « Methods and Models in Managerial Economics : A Bibliography », Agricultural Economics Report No. 108, Michigan State University, East Lansing, Michigan ; July, 1968.
8. Bradburn, J. R. « Where is the Computer Industry Heading ? », **Computers and Automation,** Vol. 19, No 1 ; January, 1970.
9. McLeod, Pohn, « A Statement of Personal Beliefs and Intentions », **Computers and Automation,** Vol. 18, No. 12, p. 14-15 ; November, 1969.
10. Berkeley, Edmund C., « The Future of Automatic Computers », **Computers and Automation,** Vol. 19, No 1, p. 18-26 ; January, 1970.

The American Farm Bureau and the State Farms Bureaus have been active in developing and implementing EDP programs. At present there are about 5,000 farmers located in at least 26 states being served by State Farm Bureaus in 13 processing centers.

Finally, the Farm Credit Administration through its intermediate credit banks has been very active in developing farm record systems. The current status is not readily available but based on 1968 performance and its expected rate of growth in this area, it is possible that 1970 enrollments through member Production Credit Associations will exceed the total of all other record-keeping systems combined. An examination of the characteristics of this institution would undoubtedly show that it meets very well the criteria set forth at the beginning of this paper.

7. A look to the Future :

The future holds the promise for even more dramatic changes in computer technology and information utilization than we have known to date. Faster computation is inevitable. Scientists have developed an optical converter which may someday form the basis for a laser computer capable of moving data 10,000 times faster than possible today (8-p. 12).

More efficient and more compatible computer languages are being developed. Languages such as APL for terminal systems and specialized simulation languages will reduce the tedium of programming and provide better performance.

The problem of rapid data transmission will be eased. Farmers having questions answered by computers in a communication mode will become common-place. Terminal devices will bring the computer close to the problems of management.

One of the forces which will bring about these changes is the concept of information systems. Much attention is being given the concept at present. The question is no longer how to computerize farm records or fertilizer recommendations. That has been done. The new question is how to develop a bank of relevent, timely, easily accessible information which is sensitive to the needs of a heterogenous population of agricultural producers.

Two quotations will serve to restate the situation and to propose one aspect of the response of computer technology to that situation.

« I believe that the trend in world affairs is now such that our very survival might well depend on our... making proper use of information available to us. Computers can sort, store, manipulate and evaluate the vast amount of information that is pertinent to our problems... consequences can be evaluated **before** action is taken. » (9-p. 14).

« In the future, the great majority of people will have first-hand contact with computers, and with operating computers so as ta obtain useful information. In the days to come, anyone will be able to get 15 minute's access to a computer for 25 cents ; and the great majority of us will know how to ask the computer questions, and how to make the computer's answers useful to us. » (10-p. 26)

COMPUTERS SERVE AUSTRALIAN FARMERS

Computers have quickly pervaded Australia's secondary and tertiary industries.

They are noff analyzing farm records for better management in primary industry.

Rapid growth in the use of computers has lent a new excitement to the development of management science in Australia.

A computer installed in 1959 by the Australian Mutual Provident Society, one of the country's biggest insurance companies, was the first to be operated by a commercial firm in Australia.

Now there are more than 500 computers in universities, Government departments and commercial firms throughout the country.

The computer's capacity for rapid, low-cost processing of huge volumes of routine scientific, accounting and administrative information has lead to the remarkable growth in the number of computers installations.

High cost prevents a farmer from buying his own computer but he can make use of the services of a computer bureau.

These services are provided for Australian farmers at two centres. One, the Farm Management Service of the University of New England, provides services to all parts of Australia.

The University of New England is Australia's only rural university. Its 838-acre campus is situated at Armidale, centre of a rich pastoral district in north-eastern New South Wales.

In the past four years it has been developing low-cost techniques of business analysis suitable for use by farmers.

It now provides these services to more than 1000 farms, mostly in Victoria and New South Wales.

The other centre, the Farm Management Service Laboratory in the University of Western Autralia, provides a specialised service for Western Australia.

To make use of these services farmers form a group and enlist the aid of a competent adviser to co-ordinate the collection of data and interpret the output of computer programming.

For instance, a groupe of 23 graziers in the Bengworden district of East Gippsland in south-eastern Victoria used the New England Scheme to analyse farm records for the 1967-68 financial year, after a symposium on farm management conducted by the Gippsland Sheep Breeders' Association.

The properties ranged from 500 to 5000 acres, producing wool, fat lambs and beef. The data were submitted to 3 computer programmes, more and more precise. Total cost to each farmer was $ 15.

NEWS FROM AUSTRALIA.