

## *A Systems Approach to Extension*

**Extension can benefit from the computer's ability  
to speedily store and retrieve information—  
but if computers are ignored, extension  
education faces possible obsolescence**

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COOPERATIVE EXTENSION in the United States has been in transition ever since it came into being. Two kinds of evolving technology forced the continual change, and stimulated the organization's dynamics. First, rapid changes in the technology of agricultural production and marketing and technology in the home resulted in continuous shifts in program content. Second, more gradual changes in the technology of transportation and communication saw extension education move from the horse to the automobile to the air, and from the personally conducted result demonstration to the printed word, to radio and television. While the clientele actually substituted new technology for old, the extension educator generally added the new, preserving the old.

Now, a dramatic new communication tool—the computer—has come into being. More than any other such device, it offers a potential for more effective and more efficient service. The computer is already having significant impact on education and research.<sup>1</sup> With its tremendous memory and data retrieval possibilities, along with the use of remote stations in many distant locations from the central unit, it may prove to be a tool for carrying on extension education that will make all others obsolete.

<sup>1</sup> John Caffrey and Charles J. Mossman, *Computers on Campus* (Washington, D.C.: American Council on Education, 1967).

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### The Agricultural Information System

To take advantage of this technology, the information flow in agriculture should be considered as a system.<sup>2</sup> Such a view can be useful to extension administrators and program developers even without the computer. Any agricultural information system—in a given township, county, state, or nation—can be said to have five major components. These are production, supply, marketing, research, and education/extension.

*Production* includes the tillers of the soil and the managers of farming operations, along with the communities of which they are a part. The *supply* component consists of the individuals, organizations, and agencies which supply inputs (such as seed, fertilizer, pesticides) to the production component, and the credit or other financial arrangements which make it possible for supplies to flow. *Marketing* includes the individuals, organizations, and agencies which receive what production component produces and either store, transport, process, or otherwise consume it. The component which studies the operations of the first three, along with possible alternative operations, and generates new knowledge which will be useful to the system is called *research*. The *education/extension* component trains personnel for all other components, and usually also expedites the flow of information among them.

These five components are related to each other through ten linkages, or clusters of channels. Also, each component has linkages with outside systems. Each linkage has a certain capacity for carrying information, and its own fidelity and memory. For example, the typical linkage between the education/extension component and the production component includes such channels as extension bulletins and folders, newspaper articles, talks by specialists at meetings, farm visits by the county agent, and radio talks. Between the research and education/extension components the linkage usually includes such channels as personal discussion, research reports, telephone, and conferences.

The capacity of a linkage can be increased by expanding the number of channels it includes. Some channels, like the printed word, have better memory than others. A handbook can be referred to over and over again, while a radio program, once broadcast, usually cannot be retrieved. The fidelity is higher in a demonstration actually carried on by the target farmer than in the experience of another which is relayed to him secondhand.

<sup>2</sup>James C. Miller, "Living Systems: Cross-Level Hypotheses," *Behavioral Science*, X (October, 1965), 380-411.

Scholars concerned with development of agriculture are turning, more and more, to systematic models such as this. This is because models offer a practical approach to highly complex situations and tend to prevent investigations from overlooking crucial variables.

Usually, a change in any component or linkage of such a system affects the entire system. This is true of the system of information flow in agriculture. Each system has sub-systems within it, and supra-systems of which it is a part. Also, each component may be considered a system, made up, in turn, of sub-components and linkages.

To avoid confusion, it is essential to focus on only one level of analysis at a time, and to concentrate on relationships—on efficiency and effectiveness—at that level only.

### **Simulation and Research Opportunities**

There are many research opportunities open to those interested in studying various uses of the computer as a tool for agricultural extension education. One of the most promising applications is using the computer to determine what method of extension education is the best in a given situation. This can be done by using a simulation technique. Scholars<sup>3</sup> have already experimented with machine simulations of information diffusion in small rural communities.

Combining the information gained using simulation techniques with an analysis of the agricultural information system "in reality" could provide a better decision-making management tool to extension educators than anything now in use. It could help determine what should be added or subtracted from a given program of communication. At one level the whole system could be simulated. At another level, each component could be simulated. At a third, and perhaps more practical level, two components and the linkage between them could be simulated.

Consider, for example, the linkage between the education/extension component and the production component. In any given situation, the linkage is made up of a variety of channels. Also, each component is really a sub-system which, in turn, is com-

<sup>3</sup>For example see Paul J. Deutschmann, "A Machine Simulation of Information Diffusion in a Small Community," mimeographed report (San Jose, Costa Rica: Programa Interamericano de Informacion Popular, 1962); J. David Stanfield, Nan Lin, and Everett M. Rogers, "Computer Simulation of Innovation Diffusion in a Peasant Village," mimeographed revised version of paper read at a joint session of the American Sociological Association and the Rural Sociological Society, Chicago, 1965 (available from the Diffusion Document Center, Michigan State University); and Julian Wolpert, "A Regional Simulation Model of Information Diffusion," *Public Opinion Quarterly*, XXX (Winter, 1967), 597-608.

prised of a variety of components. Taking one state's agriculture as a case, it should be possible to enumerate all categories of information senders and receivers in both the education/extension component and the production component, and also to list all channels which comprise the linkage between them.

On the basis of past research in regard to these channels, it should then be possible to postulate numerical relationships of an input-output nature in regard to this linkage. Its effectiveness can be determined by measuring the *number of people reached*, multiplied by the *impact per person*. Its efficiency can be measured by dividing the effectiveness by its *cost*.

Since it is possible to estimate the number of people reached, the impact per person, and the cost of using any particular channel with any particular message intended for any particular audience, it should be possible to build a linear programming model in which alternative channels, or alternative combinations of channels, can be compared with each other.

Using such a model in making the management decisions of the Cooperative Extension Service would be an aid in planning which channels are to be used for the transmission of any message to any audience—when to use radio rather than a publication, or a demonstration instead of a lecture. The programmed decision making suggested by Christensen<sup>4</sup> in a recent issue of this journal could be achieved with this type of technique.

Further, as data are accumulated in regard to the nature of the production component, and with respect to the nature of the education/extension component, it ought to be possible to simulate this sector of the entire model. Eventually, by repeating similar kinds of operations with the other three components, it should be possible to simulate the whole system.

### **The Computer as a Channel**

Another, and even more exciting computer application involves the use of the computer, with remote units, as one of the channels of communication between the extension component and the other components—production, supply, marketing, research. Picture a county agent dialing in a farmer's question on apple tree insect control to the computer at staff headquarters, and receiving an immediate response based on current spray recommendations, today's weather, today's chemical prices, and the apple price outlook.

<sup>4</sup>Robert L. Christensen, "The Nature of Decision Making," *Journal of Cooperative Extension*, VI (Spring, 1968), 25-26.

A systematic approach to this would involve an analysis of what kinds of messages are presently flowing through the system. Where is the fidelity high, and where is it low? Where is the capacity adequate, and where is the capacity inadequate? Where is memory limitation?

Much of the technical information presently handled by Extension field staff could readily be stored in the computer. This includes information on soil tests, insect and disease control, feed mixtures, outlook information, farm management records, DHIA data, building plans and specifications, and many other areas. As technical agricultural information increases geometrically, local Extension staff can avoid drowning in the deluge by substituting computer information storage and retrieval for their overcrowded files, inadequate libraries, outdated handbooks, and slow distribution systems.

Already, advanced systems developers at IBM are exploring the use of a computer as a diagnostic aid in the medical profession. The physician types information onto a typewriter-like keyboard, and reads printed responses back from a cathode ray tube similar to a television screen. The computer screen then asks the next logical question. The physician asks the patient; and then types in the response. The machine does the sorting and comes to the next question. Similar equipment and programming may have a place in agricultural extension work.

Another significant area of investigation relates to the specific Extension system in which the computer is to be utilized. For example, what are all the possible alternatives in the location of remote units around a particular state? In county Extension offices? On farms? In regional centers? What is the relative cost and potential effectiveness? What are the costs of a mobile field in-putting and out-putting unit? What are the possible starting points on a pilot basis?

The computer should be studied by extension educators. What kinds of equipment are available which could connect county offices with a central computer in the staff headquarters? What kinds of messages can best be handled by each kind of machine? What of the relative costs?

### **Conclusion**

Some day, people will reckon man's intellectual history from the beginning of time to the printing press; then from the printing press to the computer; and then after the computer. Yes, it is this "gadget" which evolved, during the lifetime of most of us, from a desk calculating machine to a string of calculating machines hooked

together, and then to a device which could store and retrieve information at tremendous speed in great quantities in a very small space. Not only does it manipulate data rapidly, but it also prints at the rate of 1100 lines a minute, makes charts and graphs, talks by teletype or telephone, stores the equivalent of 40 books in the space of one phonograph album, and carries information from place to place at the speed of light.

In one sense, the computer is just another tool. Like the telephone, the slide projector, television, and the automobile, extension educators will use it to make themselves of greater service to their clientele.

But in another sense, the computer is as great a revolution in the business of transmitting information as the printing press was—and because of this, it should actually revolutionize agricultural extension education. If the professional staff of the Extension Service has the creative genius, appropriate application of the computer can assure Extension's place in the future. Without such flexibility and adaptability, the computer could be the machine which pushes the present system of Extension Services into obsolescence.