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Data processing

1981

THE COMPUTER -- EXTENSION'S DELIVERY SYSTEM OF THE FUTURE
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You can hardly pick up a farm magazine today without seeing stories on "Computers -- Newest Farm Implements" or some such title. Major TV advertisements during the Super Bowl heralded the arrival of computers for the family farm. Salesmen are stumbling over each other with hardware to sell; when discussions about the accompanying software necessary to make the hardware useful are opened, the salesmen quickly change the subject.

Yet, looking ahead over the next decade or two, the arrival of the computer on the farm -- with the vital software necessary -- will be a significant, perhaps the most significant, technological innovation on the family farm during that period of time. The magnitude of its potential is difficult to behold, certainly defies description, at this point in time. The major question remaining at the moment is: "When will the knowledge base of American agriculture -- the Land-Grant Universities and USDA -- turn their collective talents to building viable software to allow the computer to function on the American family farm?"

Robert C. Kramer, Program Director, W. K. Kellogg Foundation, makes the following predictions for 1990: 1/

"Three-fourths of all the mid-size farmers in the United States in 1990 will utilize computers or programmable calculators in helping make management decisions on their farms . . .

Many of the farming operations will be computerized and by electronic controls the operations will be automated . . .

There will be intelligent terminals in 90 percent of the county extension offices in the United States . . .

1/ FACTS Computer System -- An Update, September, 1980, pp. 135-57, Indiana Cooperative Extension Service, Purdue University.

*Presented at RARE meetings, Okemos Community,
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Virtually all of the departments of the Colleges of Agriculture and Home Economics will have intelligent terminals and/or small computers . . .

U. S. agriculture probably has the honor of being the top industry in the United States where the end-users (farmers) know more about computer programs . . . by 1990, the gap will widen . . .

Computer marketing or electronic marketing will be commonplace in 1990 . . .

Regional development and sharing of software, regional sharing of specialists and regional computer networking will be commonplace in 1990 . . .

For extension personnel who pioneered in the agricultural computer field during the past two decades, there were frustrations and dissappointments. It will take hard work and patience, but U.S. farmers and their families will benefit from computer programs developed by the land-grant system."

Extension's Delivery Systems

The demonstration technique innovated by Seaman Knapp ultimately catapulted into an institution called the Extension Service. This is still central to the institution although it continually undergoes modification with changing times and technology.

Other delivery systems -- though secondary to the demonstration -- are significant vehicles in the educational mission of the Extension Service. Among them, the following warrant separate comment:

1. The Extension bulletin (call it what you want). It was free; in the early decades of the century, it constituted the rural library of America. No longer free in many states, and no longer a monopoly as an information source, it remains an important delivery system for extension education.

2. Penalty mail -- often referred to as "free mail." This through the decades has been an important partner to the free publication. Since the early 1970's it is not free -- costs the same as regular mail. The only thing uniquely representing its importance in our history is the symbol -- the penalty mail eagle on the envelope. As we discuss this topic today, ECOP is considering allowing states to discard the symbol and move to stamps in the near future.
3. The "meeting" throughout the year -- but particularly throughout the winter months -- is and remains central to the extension educational program. Though the meeting technique ebbs and flows with the state of the economy -- high energy prices are momentarily of concern -- it, like the demonstration is central to the educational delivery system of Cooperative Extension.

The decade of the 1980's gives the Cooperative Extension Services an opportunity to establish a new, significant delivery system for its educational delivery system -- the computer. We dare not "pass"; further, we have an opportunity to re-establish our leadership in the mainstream of American agriculture. Thus, I have elected to concentrate my remarks on the Indiana Extension experiment with the computer for this purpose over the past five years.

The Story of FACTS

(Fast Agricultural Communications Terminal System)

The Background

The School of Agriculture at Purdue University, including the Cooperative Extension Service, initiated their original adaptation to computers in the 1950's and 60's. This involved the use of teletypes -- "dumb terminals" in scattered counties and area offices in the Cooperative Extension Service out in the state. Interaction was possible through long distance calls to the Control Data Computer (6500)

which served the entire university. This involved a long "learning process" basically on the part of our farm management staff in the field. Other agents essentially did not know the computer existed and had no hands on experience with it. There were many contention problems at the computing center at the university in terms of getting on the system. There were long waits with open long distance lines and obviously considerable costs involved before programs were run in many instances. Further, this system was not capable for out-of-state use like AGNET in Nebraska or TELEPLAN at Michigan State because of the way the system was programmed. From the standpoint of Extension, there were only two major departments in the School of Agriculture that made much use of it -- Agricultural Economics and Animal Sciences. Our faculty in the Agricultural Economics Department developed complex crop and financial models that could be run and interpreted by our specialists. One program, commonly referred to as the "Top Farmer" program, was widely acclaimed throughout the Midwest states. Animal Sciences essentially used the system for least cost ration formulation, judging results, carcass evaluation programs and the like.

This system involved the scientist with ideas, a programmer to implement his ideas within the capability of the machine and few other constraints. There was little compatibility from program to program and little transferability from scientist to scientist or agent without intensive training.

In the late 1960's and early 1970's the Purdue agricultural complex moved into a new phase of computer technology. This was the adaption of the intelligent terminal to agricultural research. Through a grant from the National Science Foundation we established PROJECT MIRACLE (Multi-disciplinary Integrated Research Activities in

Complex Laboratory Environments) to serve the Agricultural Experiment Station research and service laboratories throughout the Purdue agricultural complex. This System at the present time encompasses 20 laboratories, 50 terminals and more than 260 researchers. The research performed with MIRACLE support led to the development of information which has been incorporated in to the Extension Service teaching materials. It makes possible certain FACTS activities -- the collection of data from the National Weather Service which is in turn now sent out daily to the FACTS terminals throughout the state for example. More importantly, PROJECT MIRACLE developed and provided a wealth of experience to the personnel who would later become involved with the FACTS project. This project, which originated in the Animal Sciences Department, was quickly adapted by physical science departments (their first experience in many instances with the use of computers). This system involved new instrumentation -- the mini-computer at the source of the reeseach -- whether it be in the greenhouse, the weather station or at the lab equipment itself. In addition, it involved an intermediate intelligent terminal for data storage and processing along with an automatic link up with the university computer center. This removed much of the human error in complex program solving once the program was written and verified. It allowed what I call "machine to machine" research to begin to develop. Further, it led to complex interdisciplinary research undertakings with important Extension applications which have now followed.

MIRACLE gave us experience with intelligent, low-cost computers and it gave many scientists an opportunity to learn the technology of its use. Extension applications became apparent as it progressed. Networking was in its infancy throughout the country but the hardware requirements were now becoming available. Staff capabilities were

available to lead it at Purdue University with this kind of background. Thus, we were ready to move forward with a proposal to the Kellogg Foundation for the joint venture we now call FACTS. Compared to the typical university grant venture, I would have to classify this as a very "high risk" venture. Kellogg Foundation was not easily convinced that they should be jointly involved in such an undertaking in that they has pioneered computer work in the Cooperative Extension Service 15 years earlier with Michigan State University, in a program that led to TELFARM and TELEPLAN. With the advent of new computer technology -- the intelligent terminal -- a proposal was approved after lengthy discussions and an intensive site visit laying out the plans in some detail. Thus, in August 1976 the FACTS program of the Indiana Cooperative Extension Service was initiated under the sponsorship of the W. K. Kellogg Foundation.

General Mission

The objective of the FACTS system is basically to identify those circumstances in which the unique capabilities of the system enhance or improve the basic function of the Extension operation. In the initial phase for implementing FACTS, the following guidelines have been established:

- A. In information communication, FACTS will be used in those instances where speed and up-to-datedness are of primary importance in making information useful. It is not to be used to replace the printed word, mail or telephone for the general distribution of information.
- B. In memory applications, FACTS will be used for those operational management situations in which large quantities of repetitive material are used, such as mailing lists, program enrollments and instances where regular, periodic minor up-dating of technical bulletins, etc., is necessary.

C. In its problem-solving capacity, the potential use of the system far outreaches the resources available to FACTS. In the immediate future, development priorities will concentrate on:

1. Those instances in which individualized data of the client is helpful to his decision-making.
2. Those situations in which the limited specialty resources either on the campus or in the field preclude effective personal teaching relations; thus, FACTS can be a true extender of scarce resources to great numbers of clientele with specialized problems.
3. Those situations in which there is a reasonable time of operation and simplicity of user input. The programs should also have board and long-term use.
4. Those situations which are complex and require the interaction of several disciplines or specialities of campus staff, including with other computers.

The Scorecard

The Indiana Cooperative Extension Service, through FACTS development the past five years, has intelligent terminals in 100 percent of its counties and 100 percent of its agricultural and home economics departments all tied into a networking system by private telephone line at the present time.

Compared to the typical university grant venture, FACTS would have to be classified as a very "high risk" undertaking. By the end of the fifth year, August 31, 1981, more than \$5.5 million will have been involved from three major sources -- Kellogg Foundation, \$1.9 million; Purdue University \$1.6 million and the County Cooperative Extension Services, \$2.1 million.

An undertaking of this magnitude impinged on all existing academic departments, the entire field staff and involved formation of a whole new

department -- Ag Data Network -- composed of nearly two dozen professionals to develop, implement and operate the system. Yet, without the simultaneous development of software systems by the extension specialists and departmental programmers there would be nothing to implement. Further, the user clientele -- county extension staffs -- enticed into purchasing the equipment had great risk with their support groups unless they had both sufficient number as well as quality software programs for their local machine.

We currently have more than fifty software programs available at the county level throughout the state. We are bringing approximately two new programs out each month and the quality of the software is now approaching our intended standards of excellence.

In summary, I have concluded, in my own mind, the dilemma we have faced putting this operation together. I describe it as follows:

"Integrating a complex highly structured component into a highly unstructured academic and field staff educational program -- the Cooperative Extension Service."

After several years of frustration -- near chaos at times -- it is nice to see "light at the end of the tunnel." Adding a subsidiary to the corporation is not easy. It if had been easy, it would have happened a long time ago somewhere in these United States. At this moment in time -- less than five years from inception -- a fully integrated, intelligent computer network is now in place and operational. Table 1. is a personal FACTS scorecard of the elements of the system development and the organizational cycle over the five year period.

Table 1. FACTS Scorecard

<u>FACTS System -- Software -- Etc.</u>	
<u>Grade</u>	<u>Program</u>
A	Hardware Purchased (DEC) - County Purchase; Human Engineering; Office Efficiency Programs
B	Communications - Weather, Special Reports, Messages Data Base Programs - Botany, Home Economics, Agronomy, etc.
C	Educational Problem Solving Programs (Stand Alone) (Actually range A to D)
D	Accessability to Programs on the Purdue mainframe Accessability to programs on other mainframe networks
F	Clientele (farmer, homemaker) oriented software
 <u>FACTS Organizational Cycle</u>	
<u>Year</u>	
1 & 2	"A passing fad." "It'll soon go away." "Let the other guy do it."
3	"Hardware rich - software poor."
4	Total chaos -- no visible organizational pattern or leadership. "It has failed -- pull the plug."
5	"Genuine enthusiasm." Field late adaptors have turned on their machines Campus late adaptors are ready to write programs "Genuine concern about funding situation."

Looking to the Future

With a computer in every county and area office and in our academic departments can we service the educational opportunities of our Extension clientele -- the citizens of Indiana? Obviously not -- these units just represent the "tip of the iceberg." To be effectively used the computer ultimately must be located at the site of the end user -- the farm, the home, etc. How do we move it from the Extension office to the end user and why?

First, let's examine the "why" element. Critical to successful agricultural computer programs is relevant software for problem solving. The knowledge generator for American agriculture is the Agriculture Experiment Station and the Cooperative Extension Service of each state in cooperation with the U. S. Department of Agriculture. Thus, these institutions must assume the responsibility of translating the research and information base into software packages applicable to family farms and related agricultural production and marketing institutions.

Second, let's examine the "how" element. By making our computer programs available to all our clientele -- through out Extension offices -- we are now able to provide the same programs to the individual to use on his own computer -- at his own expense of course. Under such an arrangement, we are not open to criticism for working with only a special sector of our agricultural clientele. Each state, and the nation, must face this major policy issue in a consistent manner through its Land Grant-USDA partnership arrangement.

Looking ahead, in Indiana, a possible second step is to make our software information and programs available to vocational agricultural departments that are financially able and ready to purchase compatible equipment in their high schools. This would serve both an educational function -- giving high school students hands-on experience with computers -- and problem solving opportunities for their home farm where applicable.

The third major step involves getting the computer on the farm itself -- in the hands of the end user. This becomes possible when our software packages are of sufficient economic value to justify the purchase of such farm computers. An agricultural computer association, similar to farm accounting and farm management associations common in the Corn Belt currently, is one form such an end user group might adopt. The members would own their own equipment, including the central switching and computing center serving their association, and they would purchase their software packages from the Land Grant Institution servicing their state as one major supplier. Many other related services would be purchased from other suppliers as well. Further, some would develop capacity to write some of their own software programs over time.

By making all programs available to everyone through our Extension offices, we can subsequently work with those who can afford their own without public antagonism and add a new dimension to the competitive effectiveness of American agriculture. We look forward to a pilot effort -- putting the computer on the farm -- in the not too distant future in Indiana.

Policy Issues Involved

Policy issues facing the adaptation of the computer to American agriculture are many and varied. A few that have surfaced as we struggled with FACTS over the past five years include:

1. Do we all need to "re-invent the wheel" in order to get started?

Our grant with Kellogg Foundation involved developing a prototype Extension networking system with intelligent mini-computers. The networking system necessarily was developed from the ground up to make the system functional. The cost for developing the networking system alone will total close to \$2 million before it is completed. More important than the money-

tary cost, it took more than four years to accomplish. Does every state need to start from ground zero and invest this kind of time and money to put a system in operation?

States interested in establishing a network with compatible or near compatible equipment to Indiana's can save two to three years start-up time and much of the \$2 million network development cost we incurred. As a prototype system, we stand ready to transfer our present technology to any Extension Service compatible system at very nominal costs by comparison.

2. Don't we have a right, perhaps an obligation, to share software?

Software packages are expensive in the development stages. Whether or not to copyright our software was another major policy issue in Indiana. There are as many copyright policies in existence currently as there are universities -- so it would seem. We have decided to copyright our programs and are currently in the process of carrying this out. We are doing it for the following reasons: (1) to carry the university name and reputation with the programs developed; (2) to give further credit to the "creators" or "developers" of the programs in the university review system; and (3) to allow franchising in the commercial or private sector if the program has widespread appeal and proprietary value that should be protected by the university and inventor. The protection per se of a computer program through the copyright policy is really of minimal value.

Our copyrights signed by the creators and department heads and agreed to by the university carry the following exclusion for each copyrighted program:

"Permission is given to Purdue University for use of said Materials in any non-commercial or educational activity including but not limited to the University relationship to

and function in the cooperative Extension Service which would include cooperation with any other state cooperative Extension Service for non-commercial or educational purposes."

Thus, our programs are available for other Cooperative Extension Services to adapt to their computer system on the above terms at very nominal costs. This remains true even where a private franchising agreement has been consummated.

3. Can we establish and carry out documentation standards that allow program interchange at minimal cost?

We have established standards and procedures for documentation of each program that are unique before the program will be used in our FACTS system. The documentation is such that the program can be adapted to any computer system (of sufficient size of course) or language with very minimal effort. Such standards are not now present in our Land Grant Universities or Cooperative Extension Services.

4. Can we arrange multi-state programming in areas of similar agriculture -- the Corn Belt or Great Plains for example?

Large land areas in the United States have common types of agriculture over several states -- e.g., the Corn Belt, the Lake States and the Great Plains. The real scarcity in agricultural computer development is the number of scientists and specialists available to create relevant programs to make a system viable. If groups of states with common types of agriculture could develop compatible systems, each of us could have the best scientists' programs from all the states available to our clientele in each state. If we could implement the Midwest Plan Service or Swine Industry Handbook concept to computer programming, what a magnificent breakthrough this would be for our Extension Services, and more importantly our farm clientele across the nation

We need this sharing of development resources in Indiana today and stand ready to assist in any such undertaking.

In conclusion, the development of regional centers, such as the North Central Computer Institute, will allow us to address issues similar to these and hammer out agreements mutually beneficial to our ultimate clientele -- the farmer, homemaker and the like.