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ALTERNATIVE APPROACHES OF APPLYING COMPUTER TECHNOLOGY TO AGRICULTURAL PROBLEMS*

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The world of computer technology is rapidly changing. This change in the computer industry has been brought about by a revolution in the electronics field. This revolution has been accomplished by the wide spread use of large scale integration (LSI) technology. Today's computers use chips for processing and storage that are extremely small, exceedingly fast and relatively low in cost. Likewise, other aspects of the computer industry keeps changing. New storage devices such as the bubble memory and the Winchester disk drive have also had a major impact on the computer industry. The new processor chips emerging (e.g., the new 32 bit processor) will have a major impact in the years ahead.

Correlated with these developments, is a greater desire on the part of the public to utilize this technology. This desire to use computer technology has been increased by the availability of small computer systems. These systems, which cost only a few hundred dollars, place computer technology within the reach of nearly everyone. Similarly, micro-processors are everywhere--in our kitchen appliances, electronic games and emission control systems of automobiles. The electronic age is here. The concern before us is how do we apply this technology to the problems of agriculture.

MICHIGAN EXPERIENCES

The discussion that follows examines the applications of computer technology by the complexity of the computer system. The discussion does not follow the chronological development of computer systems discussed. Indeed the maxi computer which is used in some of our first applications is discussed last. Likewise, the programmable calculator, a relatively new development is one of the first to be discussed. In discussing computer technology an analogy is made between computer technology and alternative methods of tilling the soil. Different amounts of "computer horsepower" is needed to tackle some data processing tasks just as different amounts of tractor horsepower is necessary to tackle different tillage problems. When tilling the soil it is important to use the right sized machine for the task to be accomplished. A rototiller is fine for a small garden but not for a section of land. Vise versa can be stated for the large 4-wheel drive tractor. The same concept holds true for data processing.

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Programmable Calculators

On scale of different sized computer technology, the first I want to address is the programmable calculators. Programmable calculators range in price from $200 to nearly $600. In terms of memory size, they range between 2 1/2 to 4 1/2 K bytes of memory. The programmable calculator is contrasted to the garden tractor.

There are two major manufacturers of programmable calculators--Hewitt Packard and Texas Instruments. There are advantages and disadvantages to each of these units. Most of the software written in the agricultural area is for the Texas Instrument Model 59 calculator. The programmable calculator is well received because of its low cost, portability and user control. Also some argue that it is easier to program.

In Michigan we have a package of programs (TELCAL) for programmable calculators. Most of the programs have been written for the TI59. There are approximately 40 programs in the library. Most of these programs are for routine problem solving (e.g., ration formulation, how much rent can I pay for a piece of land, calculating the repayment of a loan, and so forth. These programs are published in a loose leaf notebook and the purchase price is $35.00. Notebook updates are automatically sent to the purchaser for a modest length of time. It is anticipated that most of these programs will be used directly by the farmers themselves as opposed to working in conjunction with an extension agent. There are some very distinct limitations to the programmable calculator. One is it is not very capable of solving large complex problems (e.g. linear programming problems) or can they be used as a storage device--a capacity needed in a farm accounting system.

Micro and Mini (Small) Computers

Moving up the scale, the next systems I would like to discuss is the micro and mini computers. Micro computers range in memory size from two to sixty-four K and range in price from $200 to $8,000. Mini computers are larger and more sophisticated in their capacity to handle data processing. These type of systems range in price from $1,200 up to $150,000 and memory size from 4 to 256 K size. In terms of the above discussed analogy, I contrast these systems with the two and four plow tractor.

The small computer market has active in it a large number of equipment manufacturers. There are hundreds of makes and models of small computers and in terms of peripheral devices there are literally thousands of manufacturers in this market. Furthermore, this is a very dynamic market. Because of the variety and the changing nature of it, it is complex for a person to decide which system should be purchased.

The current best selling micro computer on the market is the Radio Shack TRS80. There are three different models of this computer. Apple, Commodore and Digital Equipment Corporation make other popular selling small computers. Recently, IBM and Zerox have introduced small computers. Some of them such as the Apple have capabilities to do color graphics. In the mini computer market, one of the most popular brands

is built by Digital Equipment Corporation.

Small computers are very powerful devices for their cost. Because of this unique characteristic they have a strong appeal among potential users of computer technology. Some of the advantages of owning your own small computer system is that there are no telephone costs involved in executing programs and the processing costs are low once you have purchased the machine. Also, they have the capability to communicate with larger computers through communications packages. Some see the small computer being a very important part of a distributed computer network which will be used by small businesses including farmers.

These small computers have the capability to do a lot of local processing. Examples of possible applications include the maintaining of financial and production and health records on individual animals. They could all so be used for routine problem solving of the nature discussed earlier.

One of the major problems with small computers is the limited amount of computer software. This is particular true in the field of agriculture. Although there is a lot of activity nation wide in developing software for these small computers, much of it remains untested as to its usefulness. Indeed, one of the major problems with these small systems is the cost of acquiring software. It is highly likely, unless an integrated approach for the development and distribution of software for small computers is adopted, the software costs will exceed the investment in hardware.

There is general purpose software that some farmers are finding useful in the management of their businesses. Examples include electronic spread sheets and data base management systems. In a recent survey conducted by Purdue University, farmers that already owned small computers ranked software addressing financial records and their analysis as being the most important. Crop production records and marketing programs were also highly ranked.

Maxi Computers

Maxi computers is the technology that has been with us the longest. It is also the technology for which we have developed the most applications software as it relates to agriculture. When comparing maxi computers are compared to tilling the soil, it is like a four-wheel drive large tractor. Maxi computers can cost from a half million dollars on up to several million dollars, likewise memory size ranges from about half a megabyte to substantially larger sizes with the use of virtual memory operating systems.

Substantial software has also been developed for farmer use. Examples of the following reflect some of the applications of maxi computers to problems of Michigan farmers.

TELFARM

In the early 1960's, MSU, with the assistance of a Kellogg

Foundation grant, pioneered the development and implementation of a computerized accounting system for farm businesses. This system (TELFARM) greatly expanded our ability to use farm records in the management of a farm business.

Today, TELFARM serves 1,500 Michigan farms and farm-related businesses. It is financed on a self-sustaining basis, with users paying a fee for services received. Efforts are currently underway to find ways in which small computer systems can compliment the TELFARM system.

DHIA

Michigan has a strong history in being an innovator in the processing of dairy herd improvement records. DHIA was established in Michigan in 1905. In 1953, they started using computers to process the records. Today the farmer controlled cooperative has 2,490 farms using the DHIA system. This represents over 177,000 cows.

The success of the program is commendable. An analysis of herds on the system, as opposed to those not on the system, indicated a milk production increase of over 4,000 pounds per cow.

TELPLAN

With the advancement of computer technology (e.g., time sharing computers and remote terminals) the Kellogg Foundation assisted MSU in establishing the TELPLAN project. Using a modest core of software a limited number of terminals were placed in Michigan extension offices in 1969.

TELPLAN has grown and expanded in both concept and usage since its beginning. It is now considered one of the major computer networks, with users in nearly 40 states. There are over 90 programs in the TELPLAN library.

PMEX

Pest management is the development, coordination and use of practical strategies to reduce pest populations below economic injury levels under a variety of ecological, economical and sociological constraints. Specialists in pest-related disciplines at Michigan State University recognized that timely information and decisions regarding pest management could be delivered via computer. This was termed on-line pest management since information could be rapidly communicated between users with access to a computer via a terminal.

COMMUNICATIONS NETWORKS

With the advent of various types of computers systems (small to maxi computers) there is increasing interest in being able to communicate between the various systems. Likewise, many see the advantages of using the appropriate size of system to do processing at the desired location. Therefore, we believe all systems will have a place and purpose. Realizing this, Michigan State University has embarked upon a

project in which communication between systems can be accomplished. This project is called COMNET (COMmunication NETwork).

The establishment of COMNET has been accomplished by a redirection of financial and human resources within the College of Agriculture and Natural Resources, the Cooperative Extension Service, and the Agricultural Experiment Station. The computer, DEC 11/70, has been purchased and recently installed. Software which will fill some of our objectives has been purchased. A staff has been assembled to address the development of software which cannot be purchased (e.g., intelligent networking).

Nearly all counties have purchased the required equipment which will interface with COMNET. There are 80 campus terminals on site which are currently being installed. COMNET is our foundation for computerized information delivery to the agricultural community for the 1980's.