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On-farm computers for farm management in Sweden: potentials and problems

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ABSTRACT

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The potential uses of on-farm computers in management and the problems in these uses are analyzed. The analysis is based on a study of present uses of on-farm computers in Sweden. The results are compared with experiences from other countries.

On-farm computer owners use almost the same management methods as before the computer investment. The main difference is that they used to hire service organizations to do some of the management tasks and now they are doing it by themselves with the aid of the computer. Thus, the on-farm computer owners have to have the same knowledge level as the service agents and advisers.

The use of on-farm computers has so far affected the processing and storage of data for farm management purposes. A potential next step is communication of data from external computer systems at suppliers, customers, advisers and other farmers as well as automated data capture within the farm. One hindrance for this development is the lack of standardization of data and concept definitions. If this potential was realized the marginal costs of data and information would decrease. It would be profitable to use more information in the farm management, i.e. to develop the farm management functions. When farmers develop their management methods they will need still more knowledge. Service agents and advisers would have to change from doing management tasks for farmers to teaching farmers how to do these tasks and supporting farmers in the interpretation and analysis of information.

INTRODUCTION

Swedish farmers have had assistance in their accounting and performance control for many years. The service organizations began to use computers in the middle of the 1960s. The use of mainframe computers rationalized the work of the service organizations and they could offer the services cheaper than anyone else despite rising labour costs. It was possible to make more calculations and present more detailed and, to some extent, new informa-

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tion. Thus, e.g., the Swedish Association for Livestock Breeding and Production could offer feed-planning services as a complement to the milk-recording system in the early 1970s. The computerized accounting system and the computer systems at the enterprise level consist of mainly two parts:

- processing transactions, which will update a database
- processing data from the database to information, which will produce reports.

The reports are used in performance control. If the reports reveal differences from expected performance, more detailed reports can be produced as a basis for analysis of the reasons for the detected differences. The reports are also used as information for planning and decision-making about e.g. investments, financial actions, which cows should be inseminated, etc. The processing of data to information may include forecasts and more advanced calculations such as feed planning.

Farmers' management methods can be characterized by management services used. The most-developed management function is control. At the farm level, farmers used the accounting system for control purposes. Sixty percent of Swedish farmers buy accounting service from the market-leading service organization and there are other companies given accounting services too. At the enterprise level there are formal services for performance control in mainly milk, pig and beef production. Performance control services, including calculations of economic results, are used by 15–20% of the Swedish farmers (Statistiska Centralbyrån, 1988). The above-mentioned feed-planning system for dairy cows is used for 50% of all Swedish dairy cows (Svensk Husdjurssköts el, 1988). The rest of these farmers' planning and goal formulation is done in collaboration with service agents or advisers, or just as rough calculations on a sheet of paper or in the farmer's head.

One percent of Swedish farmers use on-farm computers in farm management (Öhlmér, 1989). On-farm computer systems are structured in the same way as the computer systems used by the service organizations. The purpose of this article is to analyse the potential uses of on-farm computers in farm management and problems in these uses. Present uses of on-farm computers in Sweden are studied and compared with experiences from other countries. Questionnaires have been sent to 127 Swedish computer owners in 1987, 70% of whom have answered (Öhlmér, 1987). Fifty computer owners were selected at random from the computer suppliers' lists of customers. All computer owners who had bought any milk, pig or arable systems were also selected if they were not already included in the randomized sample. The results from the two groups were compared in order to test for differences. There were no differences in the aspects discussed in this article. A similar study of 174 individual cases was conducted in 1984 on farms and horticultural holdings in England and Wales (MAFF, 1985). The development and

use of on-farm computer systems started some years earlier in the UK than in Sweden, so the two studies are comparable.

PRESENT USES OF ON-FARM COMPUTERS IN FARM MANAGEMENT

The on-farm computer owners in Sweden have bigger farms than other farmers and they are better educated (Table 1). MAFF (1985) reports the same situation in England and Wales, and Putler and Zilberman (1988) the same for computer owners in Tulare County, California. Farmers who have the biggest farms are first to adopt on-farm computers. Computer owners' education has the same high level in all three areas. Brink and Josephson (1986, p. B4) report the same for computer owners in Canada.

Almost all on-farm computer owners in Sweden use the computer for accounting purposes (Table 2). Less than half of the computer owners having milk or pig production have bought a software item for its produc-

TABLE 1

Characteristics of on-farm computer owners

Characteristic	Average		
	Sweden	England and Wales	Tulare County, California
Farmer age (years)	46	–	around 46
Academic education (% of computer owners)	63	high	75
Gross income/year (US$)	543 000	–	1 510 000
Hectares of crops and grass	200	250	–
Number of full-time employees	3.6	5	–

Sources: Öhlmér, 1987; MAFF, 1985; Putler and Zilberman, 1988.

TABLE 2

Software items bought by on-farm computer owners

Software	% buyers of potential users	
	Sweden	England and Wales
Accounting systems	97	70
Milk production systems	40	83
Pig production systems	40	70
Crop production systems	11	27
Spreadsheet system	33	–
Word processing system	49	–

Sources: Öhlmér, 1987; MAFF, 1985.

tion. Eleven percent have bought crop-production software. Enterprise software is mainly used for performance control. Milk-production software is also used for feed planning, and the pig-production software for production forecasts. Spreadsheet software is used for budgeting and the rough calculations for planning purposes and decision support, which earlier were done on a piece of paper. Half of the computer owners use a word-processing system, which is used to increase the productivity of office work.

The same kind of software is available for farmers in England and Wales. MAFF (1985) reports a higher degree of use of enterprise software for performance control and less use of accounting systems.

The results show that farmers use the on-farm computers for doing the same management tasks as they previously hired the service organizations to do. The same data as before are used, but the data are processed and stored at the farm.

The on-farm computer owners in Sweden and in England and Wales indicate that they have quicker and easier access to the information than before the computer investment (MAFF, 1985; Öhlmér 1987). One development of farm management is that more detailed information is available than before the computer investment, according to the surveyed farmers. An explanation is that the service organization delivered summaries (and explanations), and now the on-farm computer owners have access to the whole farm data base. The Swedish farmers in the study also indicated that, after the computer investment, with the quicker and easier access to more detailed information, the farm management work becomes more interesting and more fun.

Computer owners register the transactions and produce the reports by themselves in the accounting system and the production systems at the enterprise level. This may lead to a better understanding of the information in the reports. Their own activity will also result in experiences which are an important part of the learning process (Kolb, 1971). The experiences will induce search of new knowledge, and use of the new knowledge will lead to new experiences, etc. The service agents or the advisers, who formerly delivered the reports, usually provided interpretation and evaluation of the information in the reports. On-farm computer owners are still buying the interpretation and evaluation services as for the accounting system but not for the enterprise systems. The computer owners are probably searching for the needed new knowledge about production processes from other sources.

POTENTIAL USES OF ON-FARM COMPUTERS IN FARM MANAGEMENT

From the present computer uses we can conclude that technological development and decreasing hardware prices have been important forces

driving on-farm computerization. The costs for data storage and processing data to information have decreased. The marginal costs have decreased even more because of the low variable costs for computer use.

Data gathering, and thus data costs, have not changed. Communication of data from external computer systems at the suppliers, customers, and advisers as well as automated data capture at the farm are technologically possible. The costs for utilizing this possibility would have a low portion of variable costs, so the marginal cost of information would decrease. Thus, it would be profitable to use more information in farm management, i.e. to develop the farm management functions. Examples of potential developments are:

- individual planning and control of each production unit to utilize the individual capacity;
- to consider risk in planning and decision-making;
- optimal use of intermediate products and resources common to two or more enterprises within the farm.

Optimization of the use of intermediate products and common resources will not only benefit from more information, but also from integrated software. Presently each enterprise software system and the accounting system are isolated from each other. Each system uses data bases of its own. Software for planning the production and use of intermediate products and common resources will need data from several of the other software systems in the on-farm computer. Integrated databases, or software giving access to the data in the various databases, will also be needed in budgeting and in other planning tasks common to two or more enterprises. Presently the use of budgeting software requires multiple data entry and risk of inconsistencies in the various databases. A necessary condition for integration of the databases is standardization of the data and concept definitions. This requires either agreement between the software suppliers, or a monopolistic situation with one market leader setting an industry standard.

PROBLEMS IN THE POTENTIAL USES OF ON-FARM COMPUTERS

Software has to be developed in order to realize any of the potential uses. Software development is expensive and it is difficult to cover the costs for it because of the low user number, i.e. the slow adoption rate. According to the biggest supplier in Sweden, a sales volume of 500–1 000 systems is needed to cover the development costs of a system if 30% of the product price can be used for this purpose (Lantbruksdata, 1987). The accounting system is sold in this volume but the enterprise systems are far from it. The technological development will result in improved development tools which will decrease the development costs. Standardization of data and concept definitions may

have the effect that each supplier will specialize in a few software items with higher demand on each, which will make it easier to cover the development costs. Another possibility is that the development costs will partly be covered by other benefits in the suppliers' business. The on-farm computer software and service may, e.g., be a competition means in selling farm inputs and buying farm products. This kind of supplier may fight against standardization.

An effect of on-farm computerization is that farm data are stored at the farm. Farm data are also needed for breeding purposes, to produce statistics for comparisons between farms, and for agricultural policy-making at the national level. Specific actions may have to be taken to get data from these farms to the centralized databases. It is not a problem today because of the low number of on-farm computers, but it might be in the future, especially as the biggest farms are the first adopters of on-farm computers. As for the cost problem, each data use should cover the costs caused by this use. It is also a question of personal integrity versus joint responsibility for breeding work and similar activities for common benefits.

The on-farm computer owners need computer knowledge, i.e. knowledge about how to operate the computer system. Experience from teaching computer knowledge to farmers shows that this knowledge is easy to acquire. One to two days per application program are required to get the users started, and the same for the systems software (Öhlmér, 1989). The increasing private uses of personal computers will make it even more easy to learn the needed computer knowledge.

On-farm computer owners used to hire service organizations for accounting, performance control and some planning tasks. Now they are doing these management tasks by themselves. Thus, they had to have the same knowledge level in farm management as the formerly hired service agents and advisers. Empirical evidence for this conclusion is that more than 60% of the Swedish on-farm computer owners have the same level higher education as the service agents and advisers.

As mentioned earlier, the same tendency is shown in a survey of 52 Canadian farmers using on-farm computers, where 74% were educated to college or university level (Brink and Josephson, 1986, p. B4). This tendency is also reported from the US. Putler and Zilberman (1988) have shown that the education level of farm operators is an important factor (together with farm size) explaining the adoption of computer technology in Tulare County, California. Seventy-five percent of the 115 on-farm computer owners studied had a bachelor's degree or post-graduate degree. In other studies it is reported that additional education increases the capacity to use computer-provided information (Welch, 1970; Schultz, 1975; Huffman, 1977).

In the next step of on-farm computerization, farmers will use more

information and develop their management functions further. Farmers will then need still more knowledge to be able to analyse and use the new information and management methods.

The service organizations and advisers will have to change from doing management tasks for the farmers to teaching farmers how to do the management and support them in doing it themselves. The need for assistance will probably be the same as before measured in hours, but it will have a totally different content and the service agents and advisers may need additional knowledge to be able to meet this new demand.

CONCLUSIONS

Present uses of on-farm computers:

- use of on-farm computers has decreased the costs of data processing and storage, especially the marginal costs;
- farmers use on-farm computers for doing the same management tasks as they previously hired the service organizations to do;
- farm management methods have not been further developed to any large extent in the computer software;
- farmers need the same amount of management knowledge as the formerly hired service agents and advisers to be able to do the management tasks by themselves.

Potential uses of on-farm computers:

- one possibility is to decrease data costs, especially marginal costs, with the aid of communication of data from external computer systems and automated data-gathering within the farm;
- another possibility is to integrate the various farm databases in order to decrease the cost of data entry and risk for inconsistencies in the databases;
- decreased marginal costs of data and information will lead to use of more information and development of the management methods;
- some potential uses of on-farm computers are: individual planning and control of each production unit, considering risk in planning and decision-making, and optimal use of intermediate products and common resources within the farm.

Problems in the potential uses of on-farm computers:

- high costs for software development in combination with slow adoption rates makes it difficult to cover the development costs;
- data may be withdrawn from centralized databases for breeding purposes and similar, which will be a problem when the number of on-farm computers increases;

- the service organizations and advisers will have to change from doing management tasks for farmers to teach them how to do these tasks by themselves, and they will meet a growing demand of knowledge needed to use the information from the computer systems;
- service agents and advisers need more management knowledge to be able to teach about and support further developments in farm management methods;
- farmers need more management knowledge to be able to use the further-developed farm management methods.

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