

# Information technology in agriculture

Situation and perspectives

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**Information technology in agriculture offers promises which have not yet been generally accepted by the farming community. Experiences from many countries show similar applications' development paths which can be traced back to old established farm information and communication systems concepts. This suggests that developments are on the right track, but that the applications still lack sufficient user-orientation - a problem which requires the utilization of professional marketing approaches.**

## **Introductory overview**

The focus:

agriculture, farms and entrepreneurs

Agriculture is a business engaged in the production and marketing of basic food products. It relies on the decisions and management capabilities of individual farmers who have to deal with complex natural production processes and a complex economic and especially natural environment. The complexity of farmer's decision and management tasks has traditionally led to the engagement of many different institutions and groups who

- provide decision and management support through information, advice

or the initiation of cooperative activities;

- facilitate the decision and management processes through political and administrative regulations.

This paper deals with the first alternative which aims at supporting the farmer as an entrepreneur as compared to an administrator and focuses on an improvement of the farms decision and management skills through the utilization of information technology (IT) with its principal ability to deliver more and better information and to deliver it more efficiently.

## **Agriculture and IT: the promises and expectations**

In the late 70's and early 80's, the advent of microcomputer technologies (represented by pioneering manufacturers like Apple, Commodore and others) and of easy-to-use electronic communication services (exemplified by the British videotex system Prestel) initiated visions of a radical change in decision and management support practices for farms with a major improvement of their information situation. The new electronic information and communication technologies promised:

- higher speed in on and off farm communication processes;
- higher quantity in the processing and communication of information;
- higher degree of individualization of information in terms of problem-orientation, farm-orientation and user-orientation.

With these promises, a broad-based acceptance of the technologies by the farming community seemed only a question of some few years and predictions assumed impressive

adoption rates in the near future. In this pioneering phase many private and public organisations (including software companies, extension organisations, universities, farmers' organisations and others) started to develop 'applications', i.e., decision and management support routines which utilized the new technologies.

## **Agriculture and IT: success or disappointment?**

Ten years later, the promises are still there, many applications (and still more prototypes of applications) have been developed and offered but the adoption rate by farmers has been slow compared with the initial expectations. Worse still, most farmers are not yet keen to utilize the new technologies but need to be 'convinced' which contrasts sharply with the technologies' principal and still unchallenged promises. Not to be misunderstood, there are successes. If we take France and Germany as an example, current rough estimates of farmers using on-farm microcomputers or electronic communication services show figures in the range of tens of thousands:

No. of farmers in	France	Germany
Microcomputers	10,000	10,000
Communication services	50,000	10,000

These numbers mark success and disappointment. They are impressive but, on the other hand, represent only a few per cent of the farming community. The discrepancy between expected and experienced adoption rates requires us to critically analyze the current situation in the utilization of the new information and communication technologies in and for farms and to once again try a view on the development perspectives for the future.

## Agriculture and IT: a lesson on the difference between R&D and marketing

If we look back at the past development it becomes clear, that we were experiencing a typical pioneering phase: a new technology turns up, raises new ideas about its use, initiates many activities to try them out and leads eventually to some systems where the integration of the new technology seemingly improves existing system alternatives. Naturally, such a process takes time - something we seem to have forgotten.

With regard to the utilization of the new information and communication technologies in agriculture, we have reached a development stage which suggests that we have come to the end of the first major pioneering phase and need to concentrate on the fine-tuning and marketing of the applications that have emerged by now to arrive at mature decision and management support systems which 'speak for themselves' and do not require the farmer to compromise (at least not more than found acceptable by him or her) between improved decision or management support and other aspects like time requirement, intellectual capacity etc.

New products require marketing to become a success. We should look at other industries to understand this rule. The 'research and development' (R&D) divisions in industry do not create successes, they provide the basis on which marketing has to build.

### Marketing, an approach to customer-orientation

Marketing asks for a rigid streamlining of products to the needs of the customers. Everything has to be 'right'. With regard to IT-applications in agriculture this means a.o.

- it has to fit neatly into the decision and management behavior of farmers;
- it needs to have fitting links with communicating data sources and databases with its corresponding technical devices;
- it has to communicate with the farmer through an interface which fits his problem perception, his intellectual capacity, his informational and educational background and his preferences for input/output devices;
- it has to be embedded in a data collection and processing system which fits the data availability and the processing needs in terms of time, quantity and data format;

-if the application reaches beyond a farm boarder, it has to fit an existing organizational infrastructure and responsibility system or requires appropriate developments.

It is impossible to solve this marketing problem through theoretical elaborations. It requires a professional test system as has been designed by, e.g., the consumer industry. This includes an analysis of user needs, laboratory tests with user groups and field tests on various levels of intensity before an application can be advertised and sold on a larger scale.

Marketing is the key to success. In the past, farmers were not forced to market their products, they were used to deliver. We might have adopted a similar attitude - with the exception that nobody was forced to accept our deliveries.

### On what to build and where to go

Till now, we (that means the people working in the area of IT integration) have developed much experience on the integration of different technologies in farm decision support routines and have tried out many ideas on the design of appropriate on and off farm support systems or 'applications'.

By comparing the developments in different countries in Europe, we can also see that most of the new ideas have been developed in a similar way in different countries and have led to similar farm support systems with similar reaction of users (for an overview see, a.o., Harkin, 1990, Houseman, 1989a, 1989b, Kuhlmann, 1990, Schiefer, 1988) By analyzing the developments it becomes apparent, that all of the new ideas and developments can be traced back to some few old established farm information and communication routines. This indicates a certain development stability which can serve as a good basis for the future development phases.

### Situation and perspectives

#### Information technology

The present information technology is primarily a data based technology, e.g. a technology which is able to collect, process and communicate information in form of alphanumeric characters. Its ability to deal with graphs is still very limited and primarily confined to collection and communication, not to processing. For use on and with farms the following technology components have become the prime choice:

#### For use on the farm:

- process control computers;
- general purpose farm computers.

#### For use outside the farm:

- data base (mainframe) computers.

#### For computer controlled communication between the farm and its data environment:

- telephone network (incl. telefax);
- videotex;
- videotex communication systems.

Videotex is a two-way communication systems which utilizes telephone networks, videotext a one-way communication system which utilizes the television broadcast technology. Videotex has recently gained some attractiveness through its possibility to communicate messages to specified groups where the information can be printed or recorded on videotapes etc. There are other technology components which might play a role depending on economic and technical considerations. An example is the packet-switched communication network, video conference facilities etc. However, those other possible components do not deliver a principally different usage alternative but represent alternatives to the components listed above and are, under present technological and economic conditions, less suitable for use in and by farms.

For a further discussion of the technologies we refer to the relevant technical literature published in various European countries.

#### Agriculture and IT: systems

The technology has been integrated into agricultural decision support routines through the design of information systems which provide an organizational framework for the collection, processing and communication of information to serve a specific task and which might include a combination of the technology components discussed above.

If we analyze the various developments reported so far from various countries we can conclude that all modern (i.e., computerbased) information systems are based on a few well established and proven traditional information systems concepts. That means on information systems which have been developed for farm decision and management support over a long period of time and which have been widely accepted by the farming community as principally supportive concepts.

If we take this result of more than a decade of development efforts as an indication that even with the advent of the new information technologies the principal information systems concepts with relevance for farm decision support remains unchanged, the integration of IT is reduced to the question of an optimal integration into established information systems concepts.

The established information systems concepts could be categorised according to the source of information delivery. The information could come from

- farm comparisons/activity control;
- advice from an advisory (expert) group;
- advice from an individual adviser;
- monitoring and file keeping;
- measurement and individual inquiry;
- trading negotiations.

All reported developments of computer-based information systems can be linked to one of these categories. As mentioned earlier, the developments that have been reported from various European countries show a similar structure and a similar utilization of information and communication technology.

#### Agriculture and IT: development examples

For each of the principal information systems concepts a number of broadly accepted applications have been developed, i.e., applications which are in use since a longer period of time and in different European countries.

*Farm comparison/activity control:* In this information system concept, information from different farms is brought together for an internal comparison with each other, with a reference information or with expert knowledge. It leads to information on the relative situation of the farm and might also be used to determine a representative information for use by others.

Application of this concept have been reported for price information systems (Christiansen, 1988), ordering systems, control systems in plant production (Christiansen, Graumann, 1988) and for rather complex herd management and control systems in pig and milk production (Petersen, 1989).

*Expert group advice:* This information system concept has led to some of the most attractive utilizations of IT in agriculture. Examples are

- off farm databases which store expert group advice for use when needed;

- the clinic concept (Harkin, 1989) which organizes a question and answer system through videotex and keeps any question and answer sequence in storage for use by others.

Most agricultural videotex information systems organized in Europe have these two IT applications included in their service. A third alternative which has been utilized in the US on a broader scale is the video conference technique. The concept of telecottages (Qvortrup, 1990) introduced in various European countries might serve as a basis for the introduction of similar services in Europe.

*Individual advice:* This information system concept assumes a situation where an advisor relates directly to an individual farm. It is assumed that the advisors advice capability is based on his or her experience and knowledge about possibilities which is used as a reference information for the problem brought forward by the farm. IT applications try to capture this reference information directly in form of data, mathematical models or expert systems and to relate it to the specific farm decision problem. It is in this category where most data processing applications have been developed.

*Monitoring and files:* The monitoring of farm activities and the storage of the results in books (bookkeeping) and other files has been and still is the basic IT usage (data base management applications) in farm management. IT helps to search for information and to analyze the contents of the files for possible ways to improve file management. However, up til now, the different files have not yet been integrated and are kept independently of each other.

Such developments can also be found for the remaining two concepts. For the trading negotiations concept a number of billboards and trading systems (notably for pigs) have been reported in videotex applications. These concepts have, however, not yet received similar attention with regard to the incorporation of IT technologies as the concepts discussed before.

#### Perspectives

Considering the stability in the principal information systems concepts in farm decision and management processes in the past, it is doubtful, that something 'really new' will develop in the future. What could change is the technology for their implementation.

Technological developments that might reach the user during the next decade could be

- improved sensor technology incl. the broad based utilization of satellite picture technology
- capability for image processing;
- new processing technologies derived from artificial intelligence.

These developments are certainly all important and will add to the potential of support IT can provide. It is, however, difficult to see, how the developments could substantially support the introduction of IT into the farms' decision and management processes. There is no way around the consolidation of the information systems concepts that have been developed so far. This is especially true as they cover the most basic information management and communication needs of the farming community.

#### Requirements for the future

##### What to do?

Irrespective of advances in the development of IT, the most pressing future activity for the broad-based successful integration of IT and the corresponding information and communication systems into farms remains marketing as discussed in the introduction.

The marketing approach is difficult to implement as it is a different type of people who are needed. It is no longer a development person whose main focus is the system to be developed but a person who looks at the user.

In our earlier discussion the key-word in this respect was to make the applications 'fit' the user, the problem, the institutional environment etc.

##### How to do?

This requires a professional engagement in experiments and the availability of appropriate equipment. We need laboratory tests and controlled field tests with potential users. We need to design and to establish management test labs which let us simulate reality.

#### Conclusion

The potential of information technology for substantial farm decision and management support asks for success. Developments in information systems concepts show that there is a stable core of applications which has been developed in different countries in a similar way. This shows that the systems are

approaching a technical maturity, a prerequisite for adoption. However, the systems are still not yet enough consumer oriented. This requires a professional marketing approach with a further development phase, a prerequisite for market success. This is a continuous process which requires the cooperation of many different people and research areas. But it is a challenging and fascinating interdisciplinary process which will have a major impact on the future of farm business activities.

## References

CHRISTIANSEN, M., 1988.  
Organization and focus of a farmer-oriented regional videotex service, in Schiefer, pp. 165 - 176.

CHRISTIANSEN, M., U. GRAUMANN, 1988.  
Closed user group plant-production, in Schiefer, pp. 173 - 176.

HARKIN, M., 1989A.  
Advice over the wire - answering farmers' queries via videotex, in Houseman, pp. 43 - 52.

HARKIN, M. (ED.) 1990.  
Information technology in agriculture, food and rural development, Commission of the European Community, Luxembourg.

HOUSEMAN, C.I. (ED.) 1989A.  
The impact of telematics on agricultural advisory work, Commission of the European Communities, Luxembourg.

HOUSEMAN, C.I. (ED.) 1989B.  
The green telematics challenge, Commission of the European Communities, Luxembourg.

UHLMANN, F. (ED.) 1990.  
Integrated and decision-oriented data processing in agriculture, Deutsche Landwirtschafts-Gesellschaft, Frankfurt.

PETERSEN, B.,  
Von der praktischen Herdenkontrolle zum Multifunktionalen Informationssystem. In: G. Schiefer (ed.), *Verbesserte Betriebsführung Durch Kommunikation Ber Bildschirmtext*, Vauk, Kiel, Pp. 223 - 233.

QVORTRUP, L., 1990.  
Telecottages: Scandinavian Information And Community Service Centres For Rural Communities, in Harkin, Pp. 152 - 162.

SCHIEFER, G. (ED.) 1988,  
Videotex, Information and Communication in European Agriculture, Vauk, Kiel.

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## Abstracts

The article describes the use of information technology for management purposes in Swedish agriculture. General trends in the historical development are described as a background to the present situation.

The information systems in agribusiness are completely computerized. The users operate the systems locally via terminals to main frame computers, and there is one terminal for every second employee. The systems are, among other things, used to produce management information for farmers. Examples are accounting service systems and production control systems. Advisors are using these systems or systems based on personal computers in their service to farmers.

Around 2.5 % of all Swedish farmers (or 7-8 % of full-time farmers) have invested in personal computers for management purposes. The on-farm computers are mainly used for accounting and to some extent for production control and planning. The farmers' organizations have developed the main part of the software, and they give service and support together with other actors. Research institutions produce the subject matter knowledge needed to develop the software.

## Aim

The aim of the article is to describe and explain the development, organization and use of information technology in the Swedish agricultural sector. The article deals mainly with information used for management.

## Development and use of Agro Informatics

### Agribusiness

Agribusiness is the biggest user of information technology in the agricultural sector. Turesson and Öhlmér (1988) have described the computerization of agribusiness in Sweden. A lot of data were collected already in the 1940's in milk production control systems for breeding purposes. In the beginning it was manual data processing, in 1951 a punch card system was introduced, and in 1961 the first computer, a Bull Gamma 30.

The computerization saved labour costs. Other advantages were less reporting, more accurate and complete information, new information, faster information and easier accounting.