INTRODUCTION - COMPUTERS AND FARMING: VISION AND REALITY?

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About this Book

If there is one thing which characterises ICT development in all sectors, the world over, it is that vision and expectation are always way ahead of reality. In this regard agriculture is no different. The advent of the PC in the late '70s led to a proliferation of systems with promises of simplified accounting, paperless offices, automated process control and even systems that could think – so called expert systems. Prof. Harsh quotes Mr Akerman detailing of these visions in 1963. Much of this promise has not been delivered. There have been many attempts to identify reasons and suggest solutions – including efforts supported by a series of ICT Adoption questionnaires – reviewed in this book. The development and adoption of ICT in agriculture provides an illuminating case study of technological innovation with many lessons which are applicable beyond agricultural production and this sector.

The following chapters provide a fascinating overview of the introduction and adoption of ICT into a diverse industry which ranges from small, part time business which are relatively under developed to large agri-businesses which are competing in world markets. This very diversity is a challenge in itself. The lessons learned regarding understanding the value that the development can bring *as perceived by the eventual user* are crucial for anyone working in ICT today. The authors of the chapters share their perspectives and wealth of experience regarding ICT introduction and adoption over time. They can be reached through the list of e-mail contacts provided for reader's convenience. Author Bio Sketches appear at the end of their chapters.

I am honoured to be associated with this project and to be asked to write an introduction. As President of EFITA I am proud to be able to publish this e-Book under the EFITA banner. Thanks go to all chapter authors and of course to Ehud Gelb for his tireless editing and gentle cajoling to achieve dissemination deadlines.

Some History

Developments in the UK for example typify these ICT expectations - where in 1984 there were sixty three companies claiming to provide specialist agricultural software to farmers and growers. Even IBM decided to move into the apparently huge market of 100,000 British farmers.

The reality of course was somewhat different, most of those companies operating in 1984 soon realised that there were no fast bucks to be made and numbers fell back quite quickly to four or five specialist operators who understood clearly the nature of the business they were in. A review of agricultural software availability and use at the time, titled FARMSOFT, was prepared in 1997 by an international team and is summarized in one of the book's chapters.

Arguably, the UK was different than the rest of Europe in that much of our development was through commercial software houses whereas most other countries relied more heavily on the education and research sector to provide software and systems. This may be one reason why farmers in mainland Europe seem to be more willing to try new systems and embrace new technologies like decision support tools than their contemporaries in the UK.

Mechanising the 'Back Office'

Computing in the eighties was about mechanising existing processes. Farm accounting packages allowed easier tracking of performance, less of a scramble at the year end to provide data for the accountant and, most important of all, the ability to claim back VAT easily and quickly. Dairy cow programs also provided valuable analysis of individual animal performance data. Gelb, Kislev and Voet measure the benefit from the use of such programs.

However, improved number crunching and tidy farm records are all very well but they are hardly inspiring; many farmers found the effort involved in consigning their data to a computer system was greater than benefit they obtained and user numbers grew slowly to around 15% of farm businesses by the early '90s.

New opportunities were needed to encourage a more general uptake of the technology where the benefits clearly outweighed the effort involved. The paper by S Harsh provides an interesting review of the history, methodology and developments of these Management Information Systems.

Increasing Statutory Paperwork

One of the biggest drivers to encourage greater use of computers in the last few years in the UK and beyond has been the increasing emphasis on recording for statutory purposes, quality assurance and traceability. IACS spawned a rapid growth in the use of arable crop recording systems and associated mapping programs. The more complex beef subsidy arrangements and the advent of cattle movement recording encouraged the uptake of beef recording programs to ensure compliance with statutory regulations and to make sure all subsidy claims are submitted on time. With the advent of the SFP it remains to be seen how less specific statutory demands will alter the need for these systems.

What is clear is that demand for information of the provenance of food is increasing dramatically as the various buyers' assurance schemes come on stream and will certainly mean that everyone producing food even on a modest scale will need computerised recording systems to enable them to cope. Professor Berman considers some of these issues from the dairy farming perspective.

The Communication Revolution

Email, more than any other, is the feature which will get computing technology onto every holding in Europe. Everyone has a need to communicate and the disparate nature of our industry makes electronic communication a godsend. It is actually easier to communicate in this way than via the 'phone' and those without Email connections are already finding themselves isolated.

The commercial use of the Internet to deliver information is still in its infancy and the growth of specialist agricultural information providers is now providing some focus to what is a very ill-defined and undisciplined activity. People have spent years trying to work out exactly what information farmers need, and there is now clear evidence that most benefits come from frequently updated, rapidly changing information on prices, market reports and of course, the weather! Farmers do not want reference material pushed at them down a wire and there is scope to use the emerging decision support tools to be a little more intelligent about how we present this type of information.

Mick Harkin's paper provides a useful and interesting review of the development of on-line information systems from the early days of Videotex to the present day, Abraham Lebowitz describes the enormous challenges of creating and maintaining a trans national agricultural information system (AGRIS).

Trading on the Internet?

If ever there was an example of expectation in IT being ahead of reality, then e-Commerce must be it. Fortunes were lost in most sectors, very few succeeded and much damage was done to the credibility of ICT in the eyes of the sceptics. In agriculture there was great enthusiasm for on-line trading of inputs and outputs and several multi-national projects were established to exploit this perceived opportunity. In the UK there were four companies initially involved – all of whom have either ceased trading or reverted to on-line services and information provision. The story has been similar throughout Europe.

Some evidence of a more optimistic future is provided by a fifth UK company, First4Farming, which is still trading successfully by focussing heavily on providing services to manufacturers and distributors and limiting it's farmer facing activity to providing a portal to provide access to supplier's and distributor's own sites. Perhaps the lesson here is that facilitating and enabling existing trading processes is likely to be more successful than re-engineering the way a whole industry does business!

Although the focus has been on the large scale failures of the 'dot.com' era we should remember that there are a large number of smaller internet based output trading sites in agriculture and horticulture which are trading very successfully. Much of this activity is focussed on niche products often in the organic or 'green' sector where the demographics of internet users tend to favour this type of trading. Typically these businesses already operate mail order delivery which means that fulfilment, the other major obstacle to successful e-trading, is already in place.

There is undoubtedly a place for e-trading in agriculture, its fragmented structure, relatively dispersed trading community and consequently inefficient supply chains mean that this is ample scope to reduce costs and improve service levels. The increasing acceptance of the internet as a business tool by the rural community and by the supply trade will also drive progress in this direction. The over-hyped claims of the original 'dot.coms' have been replaced by a more pragmatic and reasoned approach by existing businesses who recognise the opportunity but are disinclined to move too quickly until they understand fully the implications and costs.

With the substantial re-focussing which has occurred in the larger scale input trading community it is probably now the case that simple, small scale sites marketing to consumers may have a greater impact on the industry, at least in the short term.

E-Trading will happen in agriculture in the UK – perhaps not as quickly as first thought and perhaps smaller, consumer led businesses will lead the way but those who watch carefully and invest wisely will still be able to derive benefits.

Geographic Information Systems, Precision Farming and Mapping

Being able to identify the position of any farm machine to a resolution of a few metres anywhere on the planet has intriguing potential but as usual, vision has moved way ahead of reality. There is undoubtedly scope to adjust inputs either to take account of existing levels of say phosphate or potash or to modify nitrogen or spray regimes to reflect the yield potential. The problem is that many of the yield variations within a field are far from repeatable year on year because there are complex interactions between a host of variables like soil type, aspect, temperature, disease pressure, variety and sowing date. This means that the original predictions of being able to control automatically, the application of inputs using yield map data and clever agronomic software are some way off at present.

Fountas, Blackmore and Pedersen have produced a valuable chapter looking at the uptake of Precision Farming in the US, UK and Denmark and describe the issues involved. They suggest that farmers will not save time from the use of GPS driven variable rate applications – in fact they must commit time to learn the new techniques and that the complexity of the subject and the wealth of data which must be interpreted is a significant factor limiting uptake at present.

Improving Decision Making

Using computer systems to assimilate information and provide advice is perhaps the most exciting opportunity for the future. These systems can apply the information in a consistent and logical manner and can cope with far more information than any human. The computer models within them can incorporate knowledge and expertise from many different specialists and can sift and apply a huge range of relevant information in seconds to arrive at suggested courses of action. Typical applications to date have included pest management in grain stores, arable crop disease control and grass seed mixture formulation.

Decision support systems have their limitations of course; they have to have their zone of operation (domain) limited to make the amount of information to be handled manageable and they cannot apply common sense. We are a long way down the road of developing the models and the technology but we are some way off understanding exactly how farmers actually make decisions. Hence the term ‘decision support’ - the technology can provide the options, some measure of reliability and even a preferred option based on the information available but the decision itself rests with the farmer.

Prof. Friedrich Kuhlmann describes the ‘paradise lost’ of decision making under uncertainty in a thorough review of modelling optimal nutritional strategies for wheat.

Jerry Lambert asks the intriguing question, "Tell me crop, how are you" in his chapter and describes the development, application and eventual demise of the Cotton management model, GOSSYM-COMAX – one of the best known crop models in the world. Professors Goldschmidt and Lakso go a step further and review in detail the set of models relevant to fruit trees and some specific aspects of fruit production. Taragula and Gelb try to describe the adoption of these models – in Horticulture in general and in relation to the EFITA questionnaire baseline formulated since 1997.

So where have we got to?

A paper published in The Journal of Extension in 1990 by R Keith Iddings and Jerold W Apps identifies factors affecting computer use which are still applicable today, 15 years later. They include the degree of external support, network of other users, attitude and approach to management. Does this mean we have not progressed or is adoption an on-going process and we are merely looking at uptake of more complex systems than were around 15 years ago? The role of Extension in all this is reviewed in general by Richardson who suggests that there is a "change in agricultural extension from a process of technology transfer (research-institution to farmer) to a process of facilitating a wide range of communication, information, and advocacy services". Extension in relation to Internet as an example is reviewed by Bonati and Gelb.

Ehud Gelb and his colleague's summary of their work on ICT adoption in agriculture between 1999 and 2004 suggests that there is inconsistency in the reasons people give for the slow uptake of ICT in agriculture. There is some agreement that lack of training is an issue and general concerns over ease of use, 'friendliness' and lack of perceived benefit would support this. This is based on a series of questionnaires surveyed in EFITA conferences, with farmers in Germany and respondents elsewhere.

My perception is that there is still a fundamental issue with ICT adoption in agriculture – and it applies in most other industries as well – and this is the lack of perceived benefit to the user. I have described the 'Benefit vs. Effort' rule on many occasions but as promoters and suppliers of this technology, we still tend to ignore this simple truism

This simple rule states that if the effort required to use a piece of software is less than the benefit derived adoption will occur – if it isn't then it won't! Effort may be defined as time, intellectual input and cost while benefit tends to be monetary. A refinement of the rule is to define Benefit as 'Value' and crucially this is value to the user rather than our scientific or theoretical value which may be difficult to realise. We should also bear in mind that the developers' perception of value (environmental benefits for example) may not be shared by the end user.

The best example of 'Benefit vs. Effort' in action is e-mail – it is actually easier to make contact with people via email than by telephone and this coupled with the low 'cost' (actual and time cost to learn) made adoption a near certainty. Using mobile phones to send text is about as crazy a technical development as it is possible to devise and gives us a valuable lesson on the relative unimportance of 'friendliness' compared to benefit and cost. In this case teenagers (and us adults as well these days) will use an unbelievably difficult technology to send messages because it is very, very

cheap and they perceive they get great benefit (probably by conversing in a language unintelligible to their parents!).

So we need to get better and devising systems which deliver real value to those whom we expect to use them – value they can understand in their terms. We need to communicate that value through training and workshops and provide ongoing support (at least in the early days) to ensure that the value gets delivered and the costs are minimised.

If email and text messaging are examples of the Benefit vs. Effort rule delivering adoption, then the very limited uptake of decision support tools by farmers shows the rule working the other way. Complex models require a huge investment in time and intellectual effort which dwarfs any other 'cost' of acquisition, to understand the value which might be delivered and furthermore our ability to communicate that value in terms that the user recognises and understands has been limited.

Understanding the components of 'Benefit' or Value and 'Effort' requires considerable depth of knowledge and experience and even 'vision' which is normally beyond typical users. Our approach to ICT development in ADAS over the years has been to shift from the standard 'user group' approach which tends to satisfy only those who are in the group and alienate everyone else, to a more centralised approach. Sometimes termed the 'benevolent dictatorship' this approach uses highly knowledgeable designers who understand the business and who develop systems which demonstrate what is possible and what is likely to be required. This initial system can then be refined by allowing an increasing number of real users to access to it. This type of iterative development is much easier nowadays with modern web based technologies and the collaborative opportunities provided by the internet technologies described above make communication between collaborators that much easier.

The advantage of this approach is that systems can be put in place very quickly and refined 'in situ' by users who can express their needs in terms of modifications or extras to an existing system and peer pressure tends to improve uptake and buy-in. The risk of course is that you choose the wrong expert designer in the first place and this has to be managed by experienced individuals with sufficient experience to judge.

Scientists and extension workers may be able to undertake these 'proxy user' roles where they have sufficient expertise and understanding and they clearly have a crucial role in identifying the benefit opportunities – that is the problems which if resolved will deliver sufficient value to trigger adoption. EFITA can provide a channel for this activity and aid collaboration between the participants and I suggest that identifying priorities based on industry need rather than scientific interest should be a major objective of the Federation in the future. An example of the potential of ICT Adoption Spillovers is reviewed by Gelb, Getz and Oberman.

In summary I suggest a key future role for EFITA to encourage developers and researchers to think about the value their systems might deliver and how this is to be communicated before the systems are developed and funded. Only in this way will we be able to show the funders that their investment is delivering the outcomes we

have promised. For this reason I have during my Presidency of EFITA, inaugurated the 'EFITA prize' which will be awarded to the research project which 'makes a difference' by delivering real value rather to users and to the industry we claim to support.

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