

Farmers online: drivers and impediments in adoption of internet in UK agricultural businesses

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Abstract

Farm businesses appear to have much to gain from the use of internet technology, particularly given their spatial dispersion and typically small scale (in terms of employment and turnover). And yet the available statistics show a lower rate of adoption than SME in general, with less than a third of UK farmers using the internet for business purposes. This article reports on an investigation by the University of Plymouth of internet adoption by farmers in two contrasting agricultural areas, with three iterations over six years. Longitudinal data is rare in this area of study, but more interesting than the quantitative results is the report on in-depth interviews with the farmers who were involved in the original experiment. Five years after they were 'put online', they have the opportunity to reflect on their use – or non-use – of the technology, their motivations, their thoughts on future developments. Such insights will be of value to anyone interested in the adoption of information and communication technology in microbusiness, and/or in the development of ecommerce in the farm sector. In this article, they are further used to identify research and policy issues outstanding in the field of internet adoption in agriculture, including the rollout of broadband infrastructure, the development of human capital, the key role of farm family members, and the understanding of the complexity underlying the adoption process.

Farms and the internet – the promise

Farming is an important part of the UK SME sector, although it rarely figures in discussions on small business development and entrepreneurship. In 2002 farm businesses employed 550,000 people (1.9% of the total workforce in employment) of whom 356,000 (65% of the total) were principals or members of their families. In 2002, agriculture's contribution to Gross Value Added was over £7bn (0.8% of that of the total economy), and gross fixed capital formation was £2.3bn (DEFRA 2003: 13,28). If businesses upstream and downstream in the food supply chain are taken into account, the impact of the farm sector is multiplied many times. It is thus worthy of specific consideration in this conference.

Comprised predominantly of micro-businesses (98% have fewer than 10 labour units), with a high degree of spatial dispersion, it would seem that farming is an obvious potential beneficiary of the internet as a medium for knowledge transfer and commerce. At the most basic, the swift transmission of information in electronic form has attractions in an industry which is highly dependent on external input, ranging from location-specific weather (and crop disease) forecasts through livestock movement regulations to current market prices. Looking beyond this to ecommerce gives the small farm business the opportunity to gain entrance to a global economy, and an opportunity to reduce input expenses by cutting transaction costs and/or by bypassing zonal supply monopolies. Given the extent of engagement of the agricultural industry with government, the push to get government online with all its

functions by 2005 offers opportunities to ease processes of making grant submissions and providing data for statistical returns, and allows government databases to be interrogated for information about the industry, impending legislation, and so on.

Increasingly, UK agriculture is having to come to terms with new conditions, most notably in the way that rural policy is moving away from supporting commodity production towards supporting the provision of public goods demanded by society. Thus on one hand there is pressure for farmers to become more all-round entrepreneurs, diversifying away from the production of crops and livestock as raw commodities for transformation further up the supply chain. Examples might include the production of speciality food products for niche markets; the provision of services (for instance haulage or fieldwork) to other farmers and rural businesses; the use of agricultural assets (the farmhouse, the farm animals) to attract paying visitors); and the employment of the farmer and/or members of the farm household in other occupations such as teaching or consultancy. On the other hand, society is increasingly looking towards agriculture to provide protection of the environment, opportunity for non-market recreation, and other benefits for the wider community. Within the European Union, at least, such activities are supported by funding, and so are becoming another part of the 'multi-function' of the industry.

The 'new' functions described above require new processes, which in turn demand new skills on the part of those engaged in the industry. In particular, diversification of production away from mainstream agricultural products usually brings the farmer into contact with a different kind of marketing activity, where markets have to be created in the face of strong competition, and where meeting the needs of the consumer applies much more directly to the producing unit. In such activity information and communication are key, in order to identify markets, source new types of input; inform and persuade potential customers, and establish price levels. Similarly, diversification into production of non-commodity goods needs ready access to information about appropriate environmental management techniques, non-market performance benchmarks, the availability of grant aid, and so on. Following the dismantling of the public-sector extension service, farmers are faced with increasing costs of private consultancy, or have to look for ways of accessing the knowledge directly. Because of the complexity and variety of the knowledge required, social and professional networks are likely to substitute for some of the more formal, hierarchical patterns of communication, and internet to substitute for more conventional methods of delivery.

Farms and the internet – the reality

Thus there are drivers aplenty for the adoption of internet in farming. But what is the reality?

Until recently it has been difficult to obtain a clear picture of farm-level ICT (information and communication technology) adoption in the UK. In June 2000 ADAS (Agricultural Development and Advisory Service) conducted a large-scale postal survey of 10,000 farmers in England, achieving a 20% response rate. The survey included questions on computer and internet use, and the results suggested that 71% farmers owned a computer, and that 53% had access to the internet (Brown, Anaman *et al.* 2000). Some doubt could be cast on the representativeness of these figures due to the respondents being significantly weighted towards the arable sector and to large farms: moreover the questions asked related to *ownership* or *access*, rather than *use* of the technologies as a management aid. Nevertheless,

they were taken by many as an indication that farm use of ICT would be universal before long.

However, in December 2001 the Department for Environment, Food and Rural Affairs (DEFRA) included questions on ICT use for the first time in its rigorous annual survey of 20,000 farms (DEFRA 2002). According to this, while 60% of farm businesses have access to a computer, only 35% use computers in their business, and 26% used internet for business purposes (see Table 1). This mirrors statistics produced by the United States Department for Agriculture (USDA), suggesting that in 2001 55% of American farms had access to computers, while only 29% used them in the business: 43% had access to internet facilities (see Table 2: note no figures on use available). Such figures confirm that we are still a long way from every farm business being able to rely on ICT for knowledge transfer, despite the rapid growth suggested by the trend data.

Table 1: UK farm computer use 2001 (DEFRA 2002)

	Have access to a computer	Use a computer for the farm business	Use internet for business purposes
All holdings	60	37	26
very small	53	22	16
medium	67	50	37
very large	94	88	66
General cropping	68	53	n.a.
Dairy	65	47	n.a.
Lowland cattle and :	53	27	n.a.
Mixed farms	66	47	n.a.

Table 2: US farm computer use 2001 (%) (NASS 2001)

	With computer access	Using computer for business	With internet access
US total	55	29	43
<\$10,000 sales	50	20	40
>100,000 sales	73	30	39
Crop farms	57	31	44
Livestock farms	55	27	42

Finding comparable, contemporary statistics for microbusinesses in general is not easy, but in 2000 an international benchmarking study arrived at a figure of 61% of UK microbusinesses (less than 10 employees) with email access: 49% where email was used daily by 20% or more employees (Department of Trade and Industry 2001: 12). This lends weight to a view that internet adoption in farm businesses is significantly below that of businesses of similar size in other sectors, despite the apparent advantages to businesses operating in rural locations

Some empirical evidence

In 1996 members of the University of Plymouth began an attempt to assess rates of adoption of personal computers and internet technology in farm businesses in two contrasting areas of the UK. Since that time, two further surveys have been undertaken at three-yearly intervals (1999/2000 and 2002/3), using the same sampling frame, thus giving a longitudinal view of adoption rates.

Methodology of the first two surveys has been described in detail elsewhere (Warren 2000: 11-13). In brief, 337 farm businesses were selected at random from the far South West of England (with high proportions of livestock farming and smaller farm sizes) and from the East of England (with high proportions of larger and arable farms). 277 responded to the first survey (72%); these were surveyed again in the second survey in 1999/2000, when 177 (64%) took part. These were in turn surveyed again in 2002/3, when valid responses were received from 115 (65% of the 1999/2000 respondents; 42% of those participating in 1996/7). Telephone surveys were used for their combination of speed and high response rate. Chi-squared tests were used to check that non-respondents were not biased to any particular type or size of farm. Eight farmers, all with a mixture of livestock production and arable production (including cash crops) were provided with modems for their computers in 1997, and given basic training and ongoing support in internet use (email and WWW). Each was interviewed during the summer of 1998 to check on progress, and to compare current perceptions of the internet with those expressed during focus groups at the start of the trial. All but one (with a long-term illness) were revisited during the autumn of 2002 to be asked similar questions to those of 1998, together with additional questions reflecting intervening events (including the outbreak of foot and mouth disease during 2001). Interviews were recorded, transcribed and subjected to textual analysis: in this paper they are used primarily as sources of illustrative quotations.

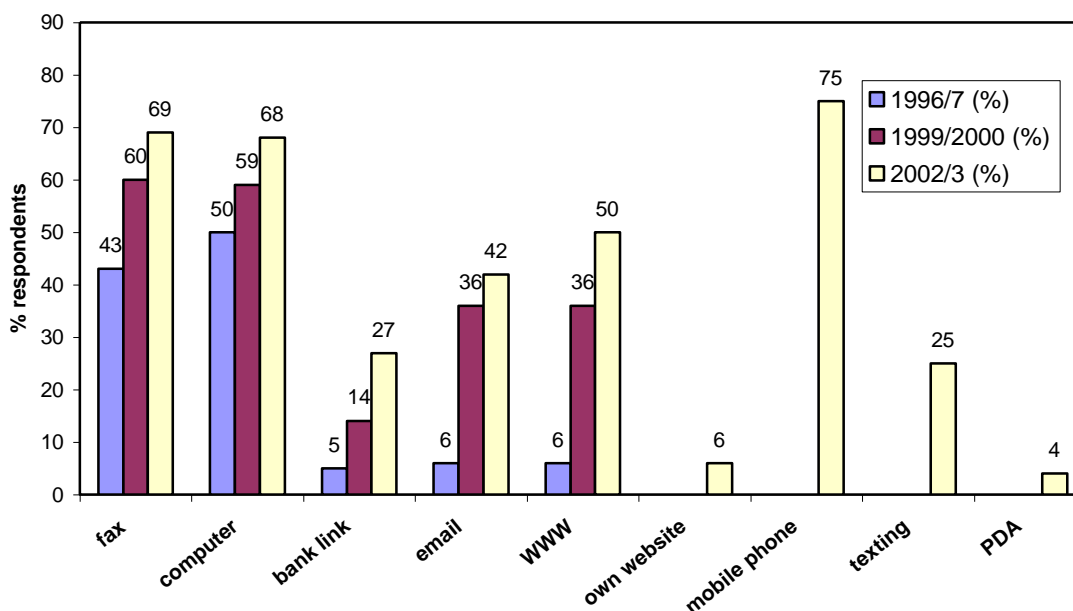
Identifying trends

The original survey was not designed with longitudinal analysis in mind, but in the event this has been a most valuable aspect. Figure 1 summarises the results of the three surveys, aggregated across both regions.

This shows clearly the marked rise in use of all the technologies identified, with email and WWW showing the sharpest gains (probably due to having been further down the adoption curve at the inception of the survey). What in many businesses is regarded as an old-fashioned technology, the fax, has made significant gains, and is one of the most heavily-utilised communication media. This relates well to the comparison of email and WWW, which having shown identical adoption profiles in the first two surveys, now suggest that WWW is being used by a higher proportion of respondents than email. Until recently, many commentators regarded email as the 'killer application' which would attract farmers to use of the internet: the growing difference may reflect the growth of fax, (perhaps reflecting the latter's greater directness and ease of use), or alternatively maturity of the WWW giving rise to a greater probability of farmer users finding information of direct relevance to their businesses. More farmers are beginning to use electronic links with their bank, either direct or via WWW, giving them more sensitive control over their cash flow, but they are still a minority. Farmer-owned websites are beginning to emerge, used for advertising and/or selling of farm produce. Questions about mobile technologies were asked for the first time in 2002/3: the high usage of mobile telephony is perhaps not surprising, enabling worker/farmers to keep in touch with family and business contacts even while out in the field. More interesting is the high proportion (25%) admitting to using texting: when the author has asked farmers in meetings whether

they use texting, the usual reaction has been that this is something for the young, but not them. PDAs, or personal digital assistants (hand-held miniature computers) are not yet commonly used.

Figure 1: Use of ICT as aids to managing farm businesses



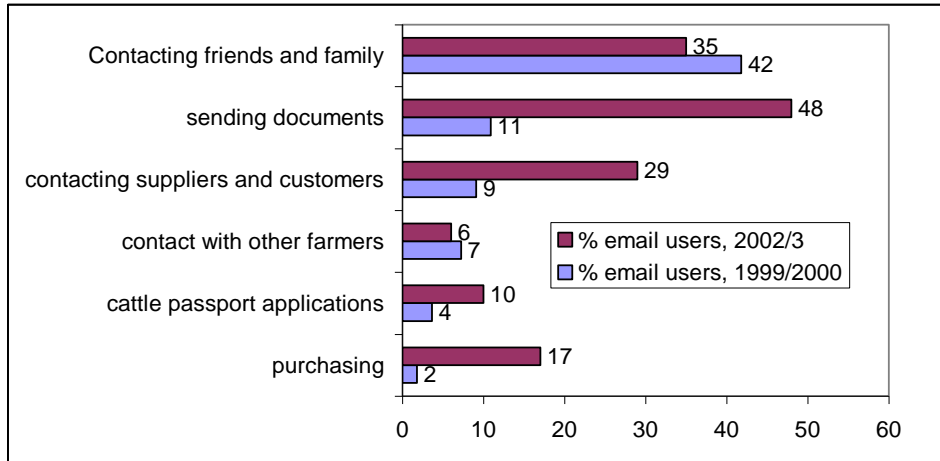
In the first two surveys, it was possible to break down this analysis by type and size of farm, and by education level and age of farmer. Size, age and education showed predictable patterns, with a clear positive association between increasing use of ICT and increasing farm size and farmer education, and a negative association with increasing farmer age (Warren 2000: 16-21). There was also a clear tendency for farms in the cattle and sheep sector to have lower levels of adoption than other sectors, both in respect of use of computers and of use of internet (for instance use of personal computer as a management aid was 33%, compared to the average of 59%; use of email/WWW 10% compared to 48% in mainly arable farms). This raises the question of whether a 'digital divide' has developed - an enduring and significant difference in adoption levels between cattle and sheep farmers on the one hand, and arable and dairy farmers on the other, and whether the consequences are potentially serious (Warren 2002).

Unfortunately, the size of the sample had become too small in the 2002/3 survey to allow confidence in repeating this depth of analysis. What *is* possible is to examine changes in the ways that email and WWW are used. Figure 2, for instance, shows how respondents have adapted their use of email over the last three years: social use continues to be an important aspect, but now overtaken by use as a carrier of documents as attachments. Use in commercial transactions has also grown, both in general contact with suppliers and customers, and as an active part of the purchasing process.

... yeah, email's quite good, cos like I said, you can hit a load of people with one hit. I know I had to do some for the group, I had to send out a tender for a product and I did that on the internet, on the email, cos I knew I could just write out one quote and just push a button and send it off to three or four

different [addresses], without having to go sending, writing out addresses and stamps [Interviewee 001].

Figure 2: Uses of email

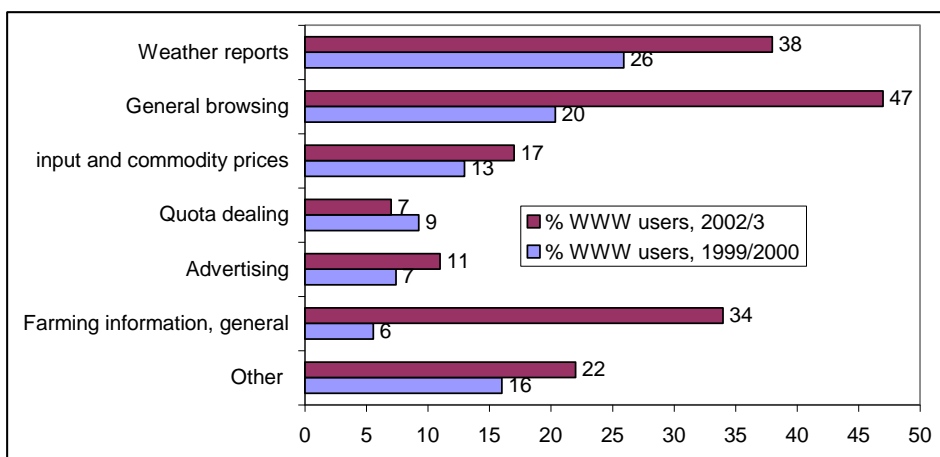


Use in applying for cattle passports is low at 10%, though this will reflect the lower number of beef producers who are email users. There is little use in communication between farmers .

Within [the marketing group] we don't, well, I'm not involved in any emailing between members. I mean, the furthest it goes there is we get minutes and agendas of meetings emailed to us, but that's about it really. [Interviewee 006]

The principal change in the way WWW is used is a greater readiness to browse the web both for general and for specific agricultural information (possibly reflecting an increase of content, and of utility of that content), and for access to the all-important weather forecast (Figure 3). Those computer owners not yet using email and WWW generally cite lack of familiarity, lack of real need, or lack of convenience in the medium as the main reasons.

Figure 3: Uses of World-Wide Web (WWW)



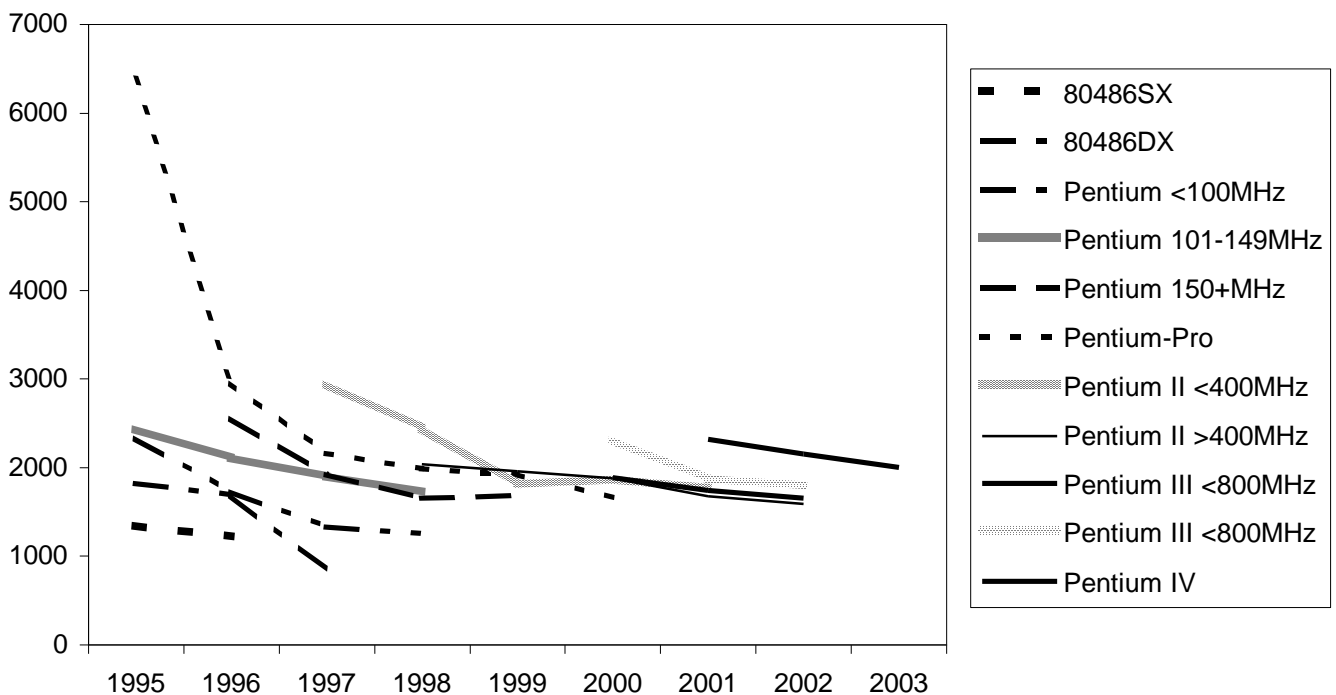
Impediments to adoption

Technological factors

One of the reasons for low internet connectivity is, as we have seen above, the lack of suitable on-farm hardware. Even in relatively advanced countries such as the US and UK a significant proportion of farms still do not have a PC (still the default base technology), and in many of the others the computer is old and too slow to allow effective use. In poorer countries, and particularly in the developing world, the initial investment required is prohibitive, unless the use of the PC can be shared amongst many activities in the same business, or between many users in the same community (through, for instance a local 'drop-in' telecentre, or internet café).

It is true that the price per unit of computer processing is constantly falling, but this is not reflected in the price per discrete computer unit. Figure 4, for instance, shows how the European price per PC unit has hovered around the €2,000 point for some years. This is due to a steady increase in the demands for processing power and storage capacity of new-generation software. The development away from text-based web pages to those carrying multiple, dynamic photographic images is just one example. In contrast, telephone charges and running costs of services supplied by internet service providers (ISP) have generally fallen in real terms, though in the EU they are still not as cheap as in the United States (European Commission 2002:6-7).

Figure 4: Evolution of average selling prices for PCs, Europe, €, 1995-2003 (EITO 2002: 449)



Further, in most countries, poor rural telecommunications infrastructure is a major barrier. High capital costs of infrastructure, combined with low density of potential subscribers, limit the incentive for existing providers to operate in rural areas, and thus new initiatives tend to be in metropolitan/urban areas. This affects the quality even of conventional telephone lines, but in particular limits rural access to

broadband (high speed and 'always-on') communication links. From being a luxury that could be afforded only by firms with specialist needs and deep pockets, broadband is rapidly becoming regarded as an essential – at least in urban areas. Firms that need to host a website which will react quickly to enquiries, or need to transmit large files (such as photographs, architectural drawings, digital video, computer software) need broadband connectivity. The rural graphic designer or software developer who is supplying, competing against, or collaborating with urban businesses will find it difficult and increasingly impossible to do so without broadband. Here there are significant problems. Affordable delivery by landline relies on commercial cable providers or asymmetrical digital subscriber line (ADSL). Cable is currently available only in selected urban areas, and uptake of cable services has been slower (and thus less profitable) than anticipated, so there is very little prospect of rollout to small towns, let alone more remote rural areas. ADSL is provided through conventional telephone lines, not all of which are suitable, and can currently service only subscribers within 6km line-length from a specially-adapted telephone exchange. Moreover the 'asymmetrical' tag means that uploads are slower than downloads. The primary provider, BT Openworld, has been accused in the past of dragging its feet over the conversion of small-town exchanges: it has since accelerated the process, but it will be some years before a majority of the population outside towns and larger villages is supplied.

Attention for remoter areas is now focussed on various forms of wire-less delivery. Satellite transmissions are not limited by population density, but are again asymmetrical, requiring terrestrial lines for uploads (European Commission 2001:29-31). The next generation of mobile telephone networks (3G) will allow a laptop computer coupled with a suitable cellphone, or a PDA (Personal Digital Assistants – palm-sized miniature computers) to transmit and receive data at far greater rates than have been possible so far. However they will still be relatively slow, and will be expensive (in order to allow the companies which own the 3G licences to recover the huge investment (around €110bn) they made in them). Some of the most interesting experiments have been with Fixed Wireless Access (FWA), using localised wireless transmissions to connect suitably adapted personal computers (e.g. in different buildings in a town, or across a stretch of countryside) with a leased-line broadband 'feed'.

Human capital

It is not enough, however, to focus on technological factors without considering the relationship between the technology and people: those who make the investment decisions, and those who are required to operate the equipment. One issue is simple lack of awareness of information and communication technology (ICT) and its capabilities. Unlike many agricultural innovations (for instance an improved version of a crop harvester), the first-time adoption of a business computer represents a quantum leap. Innovation theory (Rogers 1995:204-249) suggests five characteristics of an innovation which may affect its rate of adoption: *relative advantage* (e.g. economic, comfort, time and effort); *compatibility* (with existing practices, values and beliefs, etc); *complexity* (a negative relationship); *trialability* (the opportunity to test the technology before adoption, or during a phased introduction); and of *observability* (producing visible evidence of advantage). On all these counts the initial adoption of ICT in a business meets difficulties. This has led one commentator to propose a 'chasm' in high-technology adoption between early adopters and the majority, risking a fatal stalling of the adoption process (Moore 1995). In farm businesses, potential adopters face additional problems. Geographical factors can imply considerable journey times in order to test and

observe. The status of many farmers as craftsman/manager/owner makes it difficult to spare time unless the relative advantage is already clear.

Typically, the average farmer's level of educational attainment is lower in farming communities than that of the urban-based business manager (Gasson 1997:19-20). Most adoption studies show a pronounced positive relationship between education and propensity to adopt, this being a combination of lack of the necessary skills to operate the technology, and a lack of confidence in the abilities that he or she does possess. In most countries, training programmes exist to help those in rural areas to overcome these problems, but there has been a tendency to locate such training in centres such as regional agricultural colleges, requiring some trainees to travel long distances and to be away from their work for long periods.

Even those who are able to overcome the above difficulties may find the incentive for them to use email and the WWW limited by its poor utility and convenience relative to other communication technologies (including magazines and journals, TV, books, fax, telephone). This is partly due to characteristics of the hardware (for instance the need to interact through a keyboard; the ease of reading and organising information on paper rather than via a computer screen; the slow speed of reaction of most on-farm computers; the ease of reading paper-based communication at the kitchen table or in the living room).

In the 2002/3 University of Plymouth survey, respondents were asked a series of questions relating to influences on their use of ICT. 54% of all respondents had children who use the internet, and 25% of spouses were internet users. The computer they were most likely to use for this was the business computer in more than half the cases, and otherwise a computer dedicated to family use (38%). 34% of those with internet users in the family said that this had had an effect on their own attitudes to using the internet, mostly in making them more receptive to the potential of the internet, and keeping them up to date with developments:

Children act as teaching aids and give enthusiasm; wouldn't have used computers without their input. [survey respondent]

Guidance from son has been very helpful when having a problem. [survey respondent]

... yes, my nine year old granddaughter would run rings round me, as in most places, you know, 'Oh, come on, Granddad, do it this way.' You know, if I ask her to do a particular thing. But yes, sons and son in law have got me out of trouble... [Interviewee 003]

Some of the respondents, of course, are themselves representatives of a younger generation:

My sister and her husband, they're all emailing photos of the baby to all their relatives, so he's quite into it that, he [respondent's father] gets these sort of photos of the grandson comes to him, singing and dancing birthday cards, so he will use it for that as well. ... And my sister and that, they email their Christmas list and you've got to email back what you want for Christmas and all that, so they [parents] do do that sort of thing. It normally means she has to come up and show them how to pull it out but they do do it. (laughter) [Interviewee 004]

This raises questions as to whether efforts to develop human capital should focus on children and spouses rather than, or as well as, the business principal. It also points up the importance of non-business use, in the form of a social or entertainment activity, as a spur to learning how to use the technology, which can in turn act as a springboard to business use.

Impact of business change

Respondents were asked whether their businesses had changed, and whether that had had any influence on their use of the internet. 43% of the businesses had changed in some way, mostly by changes in the ownership/management structure, and by adjustments in their farming enterprises, rather than significant non-agricultural diversifications. Of these respondents, 22% felt that the change had influenced their use of internet, but not in any dramatic way: most cited an increase in their use of WWW as a source of information to help them in the change. A specific question related to the impact of the foot and mouth outbreak in the UK during 2001. Anecdotal evidence had suggested that use of email and WWW had increased during that time, not only on farms directly affected by the disease, but also those affected by movement restrictions and in danger of future infection. 24% of internet users said that they had increased their use during that time, mostly for keeping up to date with the spread of the disease and with changes in livestock movement restrictions. Only in one case, that of a farm business which diversified into bed and breakfast as a consequence of the disease, was there any suggestion of a lasting impact.

Overcoming the impediments

The seven farmers interviewed in person were asked additional questions about the difficulties of using ICT, and on their thoughts concerning ways of increasing rates of adoption in agriculture generally. One issue was trust – to some extent related to security of purchasing transactions, but more to interactions with government over subsidy claims where a small mistake can cost a great deal:

I was a bit cautious about the first time I used a credit card over it ... and still am, I suppose. I haven't used it that many times, but on occasions it is handy to do it, booking tickets or whatever. But .. that, I think that was one of my biggest concerns really, first time I used that. Just how secure it all was [Interviewee 006].

When you're buying something for the farm rather than for yourself, it's usually sort of four figures rather than three, and it's nice to see somebody or at least talk to them over the phone, and with the internet I know you press a button and it's sent, and it tells you you're sent a receipt, blah, blah, blah, but even if it's on the phone, you're talking to somebody and you can write down their name, and it's more personal, therefore more accountable, you'd think [Interviewee 002].

Q: What about [subsidy claims], do you do that? A:... there's a bit too much money involved ... We're not that confident yet, we'll let somebody else, let them sort it out first. ... I think it was last year some people were using, trying to do the [claims] over email and it didn't work and they're very wary about doing it again [Interviewee 001].

Personal skill also featured as a problem, particularly with older interviewees:

I can do what I know I can do, but as soon as I stray off the beaten track I get lost very quickly ... in the process of using computer. I mean, I'm more with it now than I used to be, by playing around, but my granddaughter comes down and she plays with it, 'Can I have the computer granddad?' 'Yeah. that's fine.' Then she goes and I find she's altered the .. desk or whatever it is you call it and I can't get it back to what I had before, you know, I can't go behind the scenes and do very much [Interviewee 003].

Those more conversant with computers saw slow network speed as a major issue:

It's always speed. The faster it is, the easier it is, because you can whip round the pages without worrying. It takes you an age, I mean, it happens in banking, it takes ages to bring the pages up, it's all related to speed [Interviewee 005].

I mean, I am fast on the computer, I'm very quick. But it drives me nuts, I think it's so slow. Whereas other people perhaps don't work at the speed I work at, don't find it as frustrating. But oh, I find it a nightmare. ... I mean, the other day it must have took me an hour to get one invoice through, and I thought there is no way this (...), in the end I was doing it combined with housework, I was keying in the text or product code, going off and doing something, by the time I'd finished Hoovering the kitchen or something it'd pulled up the product code [Interviewee 004].

Increasing adoption in general was seen as a mixture of push and pull influences:

Some cheery news perhaps about prices. (laughter) If suddenly it said 'Potatoes are a hundred pounds a ton rather than fifty.' Well, that'd be ideal. ... I think farmers, like I say, are slow to change. ... initially we couldn't see how we were going to use it very much; we do now, not tremendously but more so than we did when you were last here, and I think if you come back in another three or four years I think you'll hear us say we're using it more again. ...once you get something 'oh, that's interesting', be it weather or prices or whatever, then you log on more. Once they know they're getting more hits then I suppose there'll be even more interesting sites come up, you see, I don't know, it's chicken and egg sort of thing. But I think farmers will want to know; if they buy Farmers' Weekly, [they] will know what the price was last week, [but] certainly it's interesting to find out what the price is now, usually it's that hour, or certainly it's close of business that day, so that's interesting [Interviewee 002].

No, I don't think there's anything that can be done to (pause) no, I think it's just the case of as the generations come through it's just going to get pushed on us that we've got to make the effort to do it. I don't think you can, I don't think there's anything could be changed to help farmers get onto it [Interviewee 001].

...they [a government agency] said 'Well, why don't you email [the documents] to us.' And Dad said '... I don't know how to use the bloomin' email.' And they said 'Well, I suggest you learn to use email, Mr X, and then you won't have any problems, will you.' You know, that was their attitude, so it is gonna have, you know ... a drive from outside that's coming in that's making us [Interviewee 001].

I think the industry needs to settle down again, because I think it's gone through such a rough time that people are just watching the pennies and you know, just trying to get on their feet again, a lot of these people. I think perhaps education, that people need not be scared of it, realise it is a tool that they can use and could save them time, money, energy. And open up a lot of information to them. But I think the more older school farmers you'll never change, but as the younger generations come on I think you've got more of a change. I think age does play [a part], old school tie people run a lot of these things: 'Well, we've managed all these years without it, we've managed to do it.' [Interviewee 004]

Emerging questions

So what? Why be concerned with farm rather than non-agricultural business, with rural rather than urban? Am I not describing something which is common to all innovation? Which affects both urban and rural alike? Which will pass, as these things always do? Whose resolution is properly left to 'the market'?

The answer to each of these questions is a qualified 'yes', but the devil is in the qualification. Yes, many of the issues are relevant to diffusion and adoption of innovations in general. But there are qualities of ICT adoption that make it particularly interesting, such as the complexity arising from the 'nested' nature of the decision (e.g. adoption of ecommerce by a business requires first adoption of computer, then internet, then website, then appropriate business systems); and such as its importance, with the cost of exclusion, voluntary or involuntary, rising steadily as internet becomes the communication of choice.

Yes, there are still urban digital divides. Stephen Graham, among others, makes a convincing case in a landmark article, where many of the features and factors described have parallels in the rural milieu (Graham 2002). Indeed such divides can be more obvious in an urban than a rural setting, given the geographical concentration of deprived urban social groups, while the poor and underprivileged in rural society tend to be more scattered (and thus do not show up well in area-based statistics). However there is some evidence from America that such income-based urban divides are narrowing as the technology becomes cheaper and the rewards become higher (NTIA 2000; 2002). Meanwhile urban businesses are much less likely to be limited by infrastructure-based divides: the higher density of population gives higher incentive to commercial providers to install infrastructure such as cable, ADSL, wireless 'hotspots', and creates a (more) competitive environment with consequent lowering of cost to the user. There is better provision of public facilities (e.g. public libraries with internet, cyber-cafes, etc) and a higher density of training opportunities, often within easy reach by foot or public transport (and however bad urban trains and buses may be, they are a million times better than those in the English countryside).

Yes, the disparities will diminish over time, to be sure. But how long will this take, and what inefficiencies and inequities will be perpetuated in the meantime? The answer to this is partly bound up with the answer to the fourth question: yes, this is something the market *could* be left to sort out, and an equilibrium of sorts would surely be found. But what is the nature of that market? Is it working efficiently to allocate resources, or is there still, despite deregulation, an element of market failure arising from continued market dominance of huge telecommunications providers, coupled with high barriers to entry in infrastructure provision? Even if the markets are working efficiently in narrow economic terms, will they meet society's

requirements for equity of treatment, as expressed in multiple declarations of intent by national governments and the European Union (for instance the third priority of the EU's eEurope 2005 programme: ...“we have to pursue digital inclusiveness for all Europeans” (Liikanen 2002))? And is society prepared to live with the practical consequences of inadequate rural provision, such as the migration of small firms to urban areas, and the consequent pressure on urban facilities and damage to the rural economy (in desperate need of an influx, not a drain, of economic activity to compensate for the rapidly diminishing agricultural economy)?

Policy implications

Although the above discussion raises more questions than answers, it nevertheless makes the case, I hope, for the importance of considering rural businesses, and even farm businesses, as having particular difficulties and particular needs when it comes to adoption and use of ICT. On more pragmatic level, it also implies the general question of ‘what can be done’?

Where provision of technology is concerned, the specifically rural elements turn mainly on the availability of broadband internet. Some commentators argue that telecommunications companies with large market share should be charged with universal service obligations to ensure that they do not simply concentrate on the more profitable urban populations, leaving rural populations without access (Graham 2002: 48). Many feel that broadband facilities should be treated as an essential element of infrastructure, like roads, electricity and water, and provided as a right by government agency (at national, regional or municipal level) to the whole population (Skerratt 2003: 42).

While such arguments carry weight in principle, they fit poorly with the pro-market stance and constrained resources of governments such as that of the UK, where limiting tax burdens is a political necessity. Government will be persuaded to intervene only if there is evidence of market failure or a clear redistributive justification. The former may be difficult to prove, however vociferous the criticism of the role of BT as benefiting from its transformation from a public monopoly to a private near-monopoly, at least in the landline arena. On the other hand, if the case for universal broadband is made sufficiently forcibly, the government may be persuaded that intervention is justified on grounds of redistribution. It is unlikely to have the funds or the will to intervene systematically, however, and the most likely scenario is of small-scale help to facilitate small-scale self-help development, particularly in the FWA/satellite area. An example is the launch in 2001 by the UK government of a £30m (€47m) programme of pilot projects in 2001 to boost the roll-out of broadband services. Most of the projects funded are located in urban areas, though some of the results will be transferable to rural settings (Department of Trade and Industry 2002). One, named the Buckfastleigh Broadband Community Network, is located in a small rural town 10km in South West England, and is currently the subject of intensive investigation by the University of Plymouth and the University of Newcastle (Skerratt and Warren 2003).

Meanwhile, the rapidly declining cost of entry into the FWA market is allowing creation of wireless ‘hotspots’ in small towns and in rural areas of the UK by partnerships between small firms and community groups. The latter still rely on leased-line feed controlled (and priced) by major telecommunications providers, however: the resulting development is tentative and will be patchy for many years into the future without some policy oversight.

Other policy measures can include incentives to businesses to acquire necessary modern hardware (such as tax allowances in the UK for small and medium enterprises investing in information technology). Another option is to invest in 'telecottages' or 'telecentres' in villages and small towns, allowing local people access to modern equipment and assistance with its use. Reliable evidence about the success of telecentres is sparse. Some notable examples exist, particularly in Scandinavia, but doubts persist about their ability elsewhere to contribute to a sustained development of ICT in rural areas (Cornford, Gillespie *et al.* 1999:33-34), particularly if not developed with and by the community, rather than imposed by a well-meaning donor (Koutsouris 2002)

Where farmers are concerned, the major limitations are not currently the quality of the telecommunications infrastructure, but at a more local level – whether they have, and can operate, the equipment which enables them to interface even at a rudimentary level with the online world. This in turn is profoundly influenced by the development of human capital: most farmers *could* afford a tax-deductible computer with modem, even in these straitened times, if they understood and were convinced of its potential to the business, and had the confidence and skill to use it. A determined effort is needed to provide rural people with the same opportunity to learn and to understand as their urban fellows. Development programmes should be flexible and user-centred, going to where the people are, providing training in the specific context of the trainees' work, using group processes and peer support wherever possible (Errington and Nolan 1998:641-645; Warren 2000:49-54). They should also concentrate on those who are most likely to use the technology and/or act as a catalyst for others: farming women, for instance, who can be more likely than their farmer husbands to use the internet (Singh 2001:403-407). There are many examples of good practice, often supported by EU Structural Funds or the LEADER II initiative (see, for example, the nine case studies described in the LEADER Observatory Dossier 4 (Anon 2000)). A recent review of rural ICT learning classifies such approaches thus:

- Community resource centres [telecentres] providing opportunities for 'tasting' ICT;
- Personal and entertainment activities [e.g. internet cafés and video games] as tools for removing 'entry barriers';
- Service delivery beyond fixed locations [e.g. by use of mobile workshops or laptop kits];
- Use of ICT capabilities in the delivery of general services [i.e. creating a utility in the use of internet that goes beyond specific business purposes] (Huggins and Izushi 2002:114).

Conclusions

Certain key points arise from the above discussion:

- Despite significant growth in use of internet by farmers in the UK, it is still far from universal, and likely to stay so for some considerable time.
- The adoption of internet by farm businesses lags behind UK SMEs in general.
- This is not in itself a problem, but will be so if the internet becomes a default medium for knowledge transfer, commerce, etc – and if not all farmers have equal opportunity/ability to take up the new medium.

- Developing human capital is crucial to increasing speed and coverage of adoption, though technical limitations still have an influence (especially speed of rural telecommunications links).
- Family members have a key influence on ICT adoption which is under-acknowledged. Family members can act as 'information intermediaries' for those without access to ICT or skill and/or desire to use it.

Most of all, I hope, it shines a little light on the 'forgotten sector' of the small business world, the agricultural industry, and its difficulties in adoption of ICT. Although many of these difficulties are specifically related to rurality and farming, others are conditioned by the dominance of very small businesses, often operated solely by the principal and his/her family. If this causes us to examine more closely the barriers to *any* microbusiness in adoption of ICT, and to challenge assumptions of an all-pervasive business technology, so much the better.

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