ICTs in Irish Agriculture: Can ICTs Improve Communication Between Agribusiness and Farmers?

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Abstract This paper critiques the level of adoption of ICTs among the farming community in Ireland and compares this with adoption by the general population. It was found that although computer access and internet use among Irish households have been increasing rapidly in recent years, farm households have been lagging behind in adoption of these technologies. Broadband access has been particularly problematic in rural areas, where farm households are located.

The development of a novel extranet service by a large agribusiness is evaluated in this paper; this service allows dairy farmer clients to access all information relevant to their accounts with this agribusiness through a secure website. A structured survey of clients was carried out and respondents were stratified on the basis of their usage of this extranet service. It was found that three factors are constraining adoption and use of ICTs among Irish farmers: low levels of computer skills; lack of awareness of the potential of ICTs to contribute to the farm business and thirdly access to Broadband in rural areas are fundamental problems that constrain adoption of ICT.

Keywords: ICT adoption; Online services; Broadband penetration; Extranet services

1 Introduction

Ireland is a small, trade-dependent economy in the extreme West of the European Union. It experienced rapid economic expansion from 1995 to 2007, when annual GDP growth averaged 6%, but economic activity dropped sharply in 2008 and Ireland entered into a recession for the first time in well over a decade with the onset of the world financial crisis and subsequent severe slowdown in property and construction markets. Agriculture, once the most important sector of the Irish economy, is now dwarfed by industry and services. Nonetheless, agriculture remains very important to the Irish economy; the agri-food sector is one of Ireland's most important indigenous industries and is particularly central to the economic and social vitality of rural communities.

There is increasing acceptance that information and knowledge are central to socio-economic development. However, there is a perception that rural areas, and farming families in particular, are lagging behind in adopting and using ICTs. The objectives of this paper are to critique the level of adoption of ICTs among the farming community in Ireland and compare this with adoption by the general

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population. It also reviews and evaluates the experience of one large agribusiness that has developed a novel extranet service. This is a dedicated secure site whose main purpose is to allow farmers have access to all information relevant to their business with this company. The objective of this research was to explore the effectiveness of the extranet project in providing information to its farmers and to determine how this could be improved.

2 Agriculture in the Irish Economy

The agri-food sector in Ireland accounts for over 6% of Gross Value Added, almost 8% of total employment, and 10% of exports (Department of Agriculture, Fisheries and Food, 2010a). While agriculture is of major importance to economic welfare and development in Ireland it is particularly central to the economic and social vitality of rural communities because of the dispersed nature and composition of the agri-food sector in Ireland.

The land area of Ireland is 6.9 million hectares of which 4.2 million hectares (60.9%) is used for agriculture and a further 737,000 hectares (10.7%) for forestry (Department of Agriculture, Fisheries and Food, 2010b). About 80% of the agricultural area in Ireland is devoted to grassland, 11% to rough grazing (mainly hill and mountain pastures) and 10% to crop production (ibid). Beef and milk production currently account for 66% of agricultural output at producer prices (CSO, 2010), both of these are grassland based farm enterprises. Data from CSO's Farm Structures Survey show that in 2007 (the most recent year for which data are available) there were 128,200 individual farm holdings, with an average farm size of 32.3 hectares (Department of Agriculture, Fisheries and Food, 2010a).

3 Information and Communication Technology Policy in Ireland

It is now recognised that information and knowledge are at the very heart of socio-economic development (O'Donnell et al, 2003). ICT and broadband are enabling tools and infrastructures for accessing, developing, using and sharing information and knowledge (ibid). A study conducted by Chambers Ireland (2007), involving Irish businesses, showed that Information and Communication Technology (ICT) tools and e-business solutions had become crucial for increasing efficiencies across all sectors of business in Ireland.

Both the EU and Irish Government policy has focused on promoting adoption and use of ICT in the home, in education and in the workplace. In March 2000, in Lisbon, the European Union (EU) set itself the ambitious target of becoming the world's "*most competitive and dynamic knowledge based economy"* within ten years (European Commission, 2007). It recognised that attaining this goal depended on making the best possible use of ICT. The Lisbon Strategy placed greater emphasis on the knowledge-based society within existing policy processes and launched the eEurope 2002 Action Plan as a roadmap to modernise the European economy (ibid). The i2010 strategy was launched by the European Commission in June 2005 and is in place until 2010. It builds on the eEurope initiative, which came to an end in 2005 (ibid).

Irish Government policy on ICT was built around two Action Plans. In January 1999, the Government launched the first plan for implementing the information society in Ireland. This set out a series of initiatives which included development of

telecommunications infrastructure which included national availability of broadband, new legislation and other measures to enable both public and private businesses to operate on-line and a range of eGovernment initiatives and projects (Government of Ireland, 1999).

A study by O'Donnell et al (2003) showed there had been significant increases in levels of engagement with ICT in recent years. The dramatic increase in adoption of ICT was further supported by the second Action Plan of Government (New Connections, 2002**)** which accepted that it was timely to assess how we had progressed, to review our priorities, and to put in place a new strategic framework to take the country forward.

The Government Ministry of Agriculture and Food (Department of Agriculture and Food, 1999**)** recognised that the country was embracing ICT at a rapid rate and this had major implications for rural areas in particular. However it did caution that without the necessary infrastructural investment, rural areas could be disadvantaged**.** Since then much emphasis has been placed on engagement with business and the individual in relation to ICT. However it was recognised from an early stage that some groups were not engaging with ICT and as a result were being excluded from the benefits accruing. These included agricultural workers (O'Donnell et al, 2003). The application of eGovernment to agriculture had the potential to totally transform the way farmers engage with the Department of Agriculture. The Comptroller and Auditor General (2008) concluded that:

"There has been mixed progress in eGovernment projects that had a high transactional objective. There were a number of outstandingly successful projects including motor tax, ROS, On-line Area Aid, and animal disease eradication." (p.38)

However, the Department of Agriculture was held up as an example of how successful eGovernment could be. Today the Department of Agriculture and Food, together with Teagasc (Irish Agricultural Development Authority, responsible for research, extension and education) have a number of excellent projects operating under the eGovernment initiative. These initiatives indicate a very definite commitment on behalf of the Department of Agriculture and Teagasc to ICT and eGovernment initiatives.

4 Adoption of ICTs by the Population and by the Farming Community in Ireland

The adoption of ICT by the Irish population is a multifaceted area made up of a number of subsections which will be presented and discussed:

- The level of computer availability in Irish households;
- The level of access to the internet;
- The level of broadband penetration; and
- Adoption of ICTs by Irish farmers.

4.1 Level of Computer Availability

When computer access in households was measured during the last three months of 2009 it was found that 75% of Irish households had either a personal computer or a laptop (Millward Brown IMS, 2010a). However, further analysis revealed that only 53% of farming households had either a personal computer or a laptop indicating that

farmers are lagging behind in computer use (ibid). Only the retired and the unemployed socio-demographic groups lagged behind the farming households, 52% of these households (i.e. only 1% less than farming households) had either a personal computer or laptop.

4.2 Level of Access to the Internet

Internet use among the Irish population is increasing rapidly. By mid 2010 some 77% of the population used the internet on a regular basis and 95% of these did so from their own homes (Millward Brown IMS, 2010b); this had increased significantly from 58% just two years previously (Millward Brown IMS, 2008). Internet use among businesses was considerably higher; research (Millward Brown IMS, 2010c) indicated that internet access among Small and Medium size Enterprises (SMEs, defined as companies with less than 100 employees) has remained steady at 92%, while corporate access (i.e. companies employing 100 or more employees) was almost universal. Millward Brown IMS went on to report that smaller companies (i.e. employing less than 10 staff) were least likely to have internet access with 84% connected to the internet. However farming households were among the lowest internet users at 54% (Millward Brown IMS, 2010b). This was only surpassed by the oldest age category (52% of the over 65 age group did not have internet access). These figures indicate, once again, that farming households are not embracing ICT.

Comreg (2010a) reported that there were just under 1.6 million active internet subscriptions in Ireland at the end of June 2010. This represented a 0.2% increase on the previous three months and a very significant 8.1% increase on the same period the previous year. While the total number of subscribers is increasing rapidly the data in Table 1 show that dial-up internet access is declining rapidly while broadband is increasing.

Table 1. Total number of active Internet subscriptions in Ireland

Subscription Type	**Quarter (Q) 2, 2010 Subscriptions**	**Quarterly Growth Q 1 2010 - Q 2 2010**	**Year-on-Year Growth Q 2 2009 - Q 2 2010**
Total Narrowband	77,243	-26.5%	-56.5%
DSL Broadband	729,892	+0.8%	+6.1%
Mobile Broadband	508,620	+3.8%	+40.4%
Cable Broadband	173,146	+5.9%	+39.3%
Other Broadband	106,691	-4.2%	-15.1%
Total Internet Subscriptions	**1,595,592**	**+0.2**%	**+8.1**%

Source: Comreg, 2010a

According to Millward Brown IMS (2010a) the main uses for the internet included sending and receiving e-mail with nine out of every ten using this application. Research purposes were also considered important, together with transactional type activities (banking, shopping, booking tickets, etc). Social networking sites were also prominent driven by the younger age groups.

4.3 Level of Broadband Penetration

Broadband subscriptions are increasing at a rapid rate. Comreg (2010a) reported that by the end of June, 2010, there were 1,518,349 broadband subscriptions in Ireland. This represented an increase of 16.9% in the number of subscriptions since the previous year. Mobile broadband represents 33.4% of all broadband subscriptions in Ireland. Based on these data, the broadband per capita penetration rate at the end of June 2010 was 34.0% compared with 33.4% in the previous quarter and 29.4% the previous year. When mobile broadband is excluded, the penetration rate was 22.6%. The broadband household penetration rate was 63.1% at the end of June, 2010, up slightly from 62.4% in the previous quarter.

Comreg (2010b) compared broadband penetration rates in Ireland with other EU countries. It reported that Ireland's household broadband penetration rate ranked 14th among the EU 27 countries and was above the EU27 average of 56.7%. The Netherlands and Denmark had the highest household broadband penetration rates at 86% and 82% respectively. This situation was confirmed when fixed broadband per capita penetration rates for EU countries were compared. Comreg (2010b) reported that Ireland's broadband penetration at 22.6% placed Ireland below the EU average of 24.8% and again in 14th place in the EU 27.

Amarach Consulting (2007) surveyed subscribers' attitude to broadband. This study found that internet users outside of Dublin, the capital city, had far more problems with the poor service they were getting relative to Dublin both in terms of availability and competing choice. Meanwhile a national survey conducted by the Irish Farmers' Association (Smith, 2008) calculated that 75% of rural households did not have access to broadband in 2007. It was also stated that infrastructure to provide broadband to rural areas was totally inadequate (*ibid*).

4.4 Adoption of ICTs by the Farming Community in Ireland Compared with Other Countries

There has been a long-standing conviction in Ireland that farmers and farm families are among the slowest adopters of ICT. Morrow *et al* (2003) for instance reported that Irish farm families were falling behind other sectors of Irish society with regard to home internet access and cited evidence which showed that 21% of farmers had internet in their homes compared with the national average of 35% at that time. They also commented that this compared unfavourably with the farming communities of other developed economies. The author conducted research to measure the level of computer and internet usage among Irish farmers, to analyse the purpose to which these were put and to examine the factors which influenced the adoption of ICTs. The results were compared with the level of adoption among the general population in Ireland and with farm families in other comparable countries (Wims, 2007). It was found that a slightly higher proportion of farmers than the general population had home PCs and internet connections. However, when international comparisons were made it was found that the Scandinavian countries were forging ahead, with significantly higher proportions of farmers in Finland, Norway and Sweden having a home computer and internet access. Other countries with high levels of adoption were Switzerland, New Zealand, UK and USA (Ross and Waksman, 2004). From the figures of ICT adoption established in this study, it emerged that Irish farmers were approaching a level of adoption that was similar to the UK, USA and New Zealand.

It was found that Irish farmers who were married and with dependent children, particularly older dependent children, were much more likely to have adopted ICT within their homes; it is evident that these children have greater demand for ICT for educational purposes and for recreational purposes and are a considerable influence in encouraging adoption of ICT at household level. In addition, there were trends whereby farmers and/or their spouses who had off-farm employment were more likely to have adopted ICT than full-time farmers. This is likely to occur for two reasons, one being the increased level of disposable income available in these households and the other being exposure to sources of information about ICT external to their immediate social system. Farmers engaged in specialist enterprises were more likely to have adopted ICT; however, the proportions engaged in less profitable enterprises that have adopted ICT was surprisingly high but it is suggested that this can be attributed to the fact that these farmers or their spouses were more likely to have off-farm employment. Finally, it emerged that those with medium-sizes farms were most likely to have adopted ICT; *a priori* expectations were that those farming larger areas would have greater requirements for ICT within their farming systems, it was discovered that this latter category were least likely to have off-farm employment, thus reducing their disposable income and their exposure to ICT in the workplace. International comparisons from USA and European Union confirm that adoption and use of ICTs varies among different sectors of the farming community in those countries but in general has been found to be positively associated with farm size, type of production, gross income levels, age and education (Bardon et al, 2007; Burke and Sewake, 2008; Howell and Harbon, 2004, Warren, 2004)

5 Deployment of Extranet by Agribusinesses

In this section, a case study of an extranet website is presented. The term "extranet", according to Vlosky et al. (2000) is defined as a network that links business partners to one another over the internet. They explain that this linkage is usually accomplished by companies allowing their partners to access certain areas of their intranet. There has been considerable interest in researching the role of extranets in the business environment in recent years. Most of this research has focussed on exploring the benefits accruing to business from adopting extranets and also analysing the factors affecting their adoption. It has been found that the use of extranets can facilitate the sharing of information, decrease operating costs, save time and resources, improve customer service and generally improve business-to-business relationships (Anderson (1998), cited by Vlosky et al., 2000). In spite of these benefits, Windrum et al (2003) found that the adoption of extranets involved major organisational innovation and altered communication between the firm and its clients and suppliers.

However, very little research has been conducted among agribusinesses and especially among farm businesses on their adoption of extranets. This present case study helps to address this information deficit by analysing the experience of one extranet service. The name of this extranet site is "AgriLink" and it was developed by Glanbia, an international cheese and nutrition company, whose headquarters are in Ireland. The group has 4,500 farmer milk suppliers and so is one of the larger milk processing companies in Ireland. Glanbia set up an extranet site (www.agrilink.ie) in 1999 on a pilot basis and launched it among its suppliers in 2000. It was established to

provide a link between the Milk Division and Agribusiness section of Glanbia and the farmer customers. It is a dedicated secure site whose purpose is to allow farmers have access to all information relevant to their business with Glanbia. Milk suppliers have access to a range of information regarding their milk account. This includes the latest milk test results, individual milk collection details and copies of milk statements. A superlevy statement is updated after every collection and help pages are provided with advice on non-conforming test results. Trading account holders can view the current balance on their accounts. Grain suppliers can select by grain type or intake branch to confirm the latest test results, weight, price paid and value of grain supplied. Copies of grain statements are also provided. AgriLink also provides a comprehensive news section. This includes updates on the Glanbia Superlevy position, technical information, links to other agri-websites and the latest Glanbia promotions. Thus, AgriLink has an important extension element. Registering for access to the AgriLink website has always been free to customers of Glanbia. In order to access AgriLink milk suppliers require a Glanbia account number and access to the internet. This extranet site is not unique in Ireland; in fact almost all of the large dairy cooperatives have established similar services in recent years.

The main benefits for clients of using AgriLink include:

1. 24 hour per day access to account information through AgriLink seven days a week.
2. AgriLink is updated daily, therefore the most current information regarding accounts is provided.
3. AgriLink also provides historical information since 1999; this allows the farmer to compare one month against the same month of another year.
4. Copy statements for milk, trading and grain accounts are provided.
5. Supplier's superlevy position updated after every milk collection.
6. Branch transactions updated daily after close of business.
7. Trading Statement download. This service allows a customer to select any month and a file containing a copy of the customer's trading or milk account statements will be forwarded by email to the customer. This file can then be downloaded into a farm management accounts package.

The features on the AgriLink website that were most accessed during 2007 are presented in Figure 1. Research was recently conducted by the author to evaluate the AgriLink website. The overall objective of this research was to explore the effectiveness of the AgriLink project in providing information to its farmers and to determine how this could be improved. The specific objectives included, *inter alia*, to describe the history and evolution of the website; to describe the present content and how it is presented; to determine how many of the target users were actually using it; to analyse/measure the success of the website; and to examine what constraints were impeding farmers from using it.

5.1 Research Methodology

Data were obtained from the Glanbia website development team, Agribusiness Division and Farm Development Section and from dairy farmers who supplied milk to Glanbia Co-Op who provided primary data. The quantitative research took the form of a postal questionnaire to a sample of Glanbia dairy farmers in order to establish farmer views on their adoption and use of ICT and AgriLink. As the questionnaire

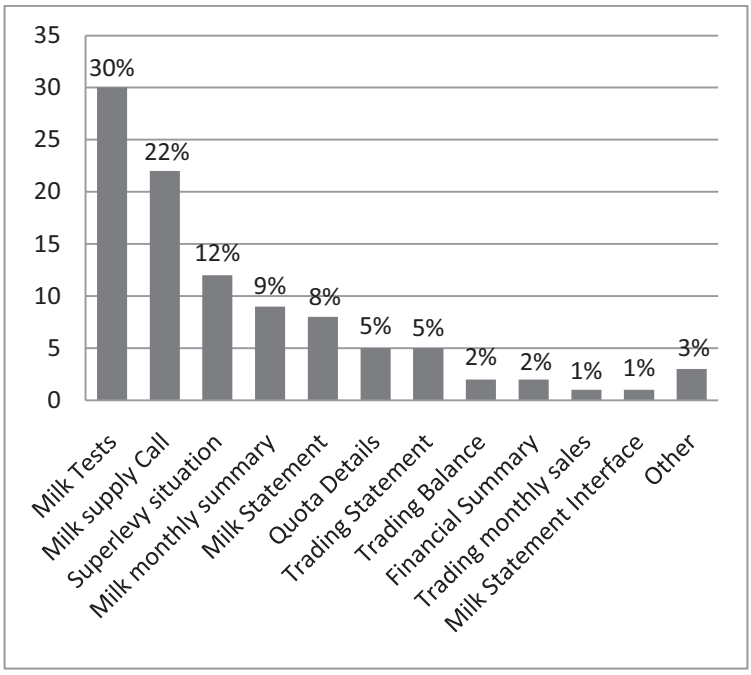

Figure 1. Hits on AgriLink during 2007 (N=857 suppliers who used AgriLink)
Source: AgriLink Development Team (personal communication)

was being posted to farmers, care was taken to ensure that all questions were clear and unambiguous. The questionnaire was presented in A5 format in booklet form. The questionnaire was initially piloted with a sample of five dairy farmers and final adjustments were made to the questionnaire arising from this exercise. A letter was prepared explaining the purpose of the research and Glanbia also provided a cover letter of support.

Sample selection was on the basis of stratified random sample, stratified on the basis of milk supplier usage of the AgriLink service. Of the 4,500 milk suppliers to Glanbia some 2,200 were registered to use AgriLink but only 857 of these used the site during 2007 (Source: Glanbia IT section, personal communication). Glanbia staff compiled a list of all suppliers with their corresponding usage of AgriLink, where usage was measured by the number of times each milk supplier logged on to the site. Hits on the website were recorded each time milk suppliers logged on and sought information regarding their accounts. The range of hits on the website varied from 1 to 2,500 during 2007. For this research, a sample of 165 dairy farmers in three categories was selected: these consisted of 55 frequent users of AgriLink, 55 occasional users and 55 non users of the website. The most frequent 55 users for the research were all those farmers who recorded hits on the AgriLink site of more than 460 times during the year. All 55 milk suppliers in this group (top 6% of users) were

selected to participate in this study. This group was designated as the frequent users group.

The middle user group were identified as those who had between 192 to 460 hits during 2007. Some 101 milk suppliers (12% of all users) were in this category and 55 were randomly selected to participate in the study and were designated as the occasional users group.

In order to derive a non user group the complete Glanbia supplier database was accessed and all AgriLink registered users were removed. It was observed that none of those suppliers already selected had less than 21,997 gallons (100,000 litres) of milk quota. In order to maintain a comparable sample in terms of enterprise scale, all suppliers in this category were also removed and then 55 suppliers were selected by random sample. This group was designated as the non-user group.

Questionnaires and cover letters were posted to all three groups. A stamped self addressed envelope and a return date were also included with the questionnaires. Eight days later a text message reminder was sent to all non respondents. Some 113 fully completed questionnaires were returned. This represented an excellent response rate of 68% (113 out of 165). The breakdown of the three groups represented 43 frequent users (78% of sample), 41 occasional users (75% of sample), and 29 non users (53% of sample).

The data were entered into the Statistical Package for the Social Sciences (SPSS 11.0® for Windows) and analysed using this data manipulation programme. Descriptive statistics (frequency distribution, percentages, measures of central tendency and variability) were used to describe the data. Crosstabulations were used to examine relationships between variables. This methodology is typical in research of this nature which analyses adoption and use of ICTs (see, for instance, articles in well recognised peer-reviewed journals by Alam and Noor (2009), Bayo-Moriones and Lera-Lopez (2007) and Fabiani et al. (2005)).

5.2 Research Findings

Analysis of the data revealed that the profile of the typical AgriLink user was male, engaged in full time farming, either young or middle aged (i.e. 35-50 years of age), married with dependent children, and owner or joint owner of the farm business. He was likely to be a Teagasc client, well educated and with a good level of agricultural education. Non users of AgriLink were also likely to be male, full-time farmers but were older (in age range 35 to 65 years), less likely to be a Teagasc client and also had a lower level of education, including agricultural education.

When home PC ownership was examined it was found that 94% of respondents had a home PC; this was expected as all AgriLink users had a home PC. However 76% of respondents who did not use AgriLink also had a home PC. This was considerably higher than the national average of 53%. Connectivity to the internet was examined and it was established that 49% of respondents used broadband, 2% used ISDN and the remaining 48% used dial up. This half and half split between broadband and dial up was poorer than the rate of broadband penetration nationally. The distribution of respondents by their means of accessing the internet is presented in Table 2.

Table 2. Type of Internet connection among Respondents by AgriLink User group (n = 113)

Internet connection type	Frequent Users (n=43)		Occasional Users (n=41)		Non Users (n=29)		Total
	No	%	No	%	No	%	No
Dial-up	16	37%	22	54%	12	41%	**50**
Broadband	25	58%	18	44%	7	24%	**50**
ISDN	2	5%	1	2%	0	0	**3**
None	0	0	0	0	10	35%	**10**
Total	**43**	**100%**	**41**	**100%**	**29**	**100%**	**113**

When the three user groups were examined, the level of internet access was 100% among users while access was at 65% among non users. The use of broadband was also much lower among non users at 24% whereas over half of the frequent users had broadband.

Adoption and Use of PC and Internet among Respondents When PC usage was examined it was found that everybody in the respondents' households could operate the computer in 55% of cases while the respondent alone operated the computer in 34% of households. The remaining 11% of respondents indicated that their spouses (4%) or their children (7%) could operate the PC. When the results were analysed by AgriLink user groups a different picture emerges and the results are presented in Table 3.

Table 3. Distribution of Respondent by who in household is capable of operating PC (n = 106)

	Frequent Users (n=43)		Occasional Users (n=41)		Non Users (n=22)		Total
PC operator	**No**	**%**	**No**	**%**	**No**	**%**	**No**
Respondent	19	44%	13	32%	4	18%	**36**
Respondent's spouse	1	2%	2	5%	2	9%	**5**
Respondent's children	0	0%	0	0%	7	32%	**7**
Everyone	23	54%	26	63%	9	41%	**58**
Total	**43**	**100%**	**41**	**100%**	**22**	**100%**	**106**

The data in Table 3 indicate that respondents themselves were operating home PCs in almost all cases where they used AgriLink whereas in non-users' households only 60% of respondents could use a computer. Computer use by respondents was examined to ascertain for what purposes the PC was used. It emerged that respondents who used computers applied them to farm business use. The four options selected most often were use of AgriLink (by 79% of respondents), maintaining herd records

(75% of respondents), maintaining miscellaneous farm records (68% of respondents), and Entertainment (by 60% of respondents).

AgriLink usage among Respondents Respondents who used AgriLink were asked how often they did so and their replies are summarised in Figure 2.

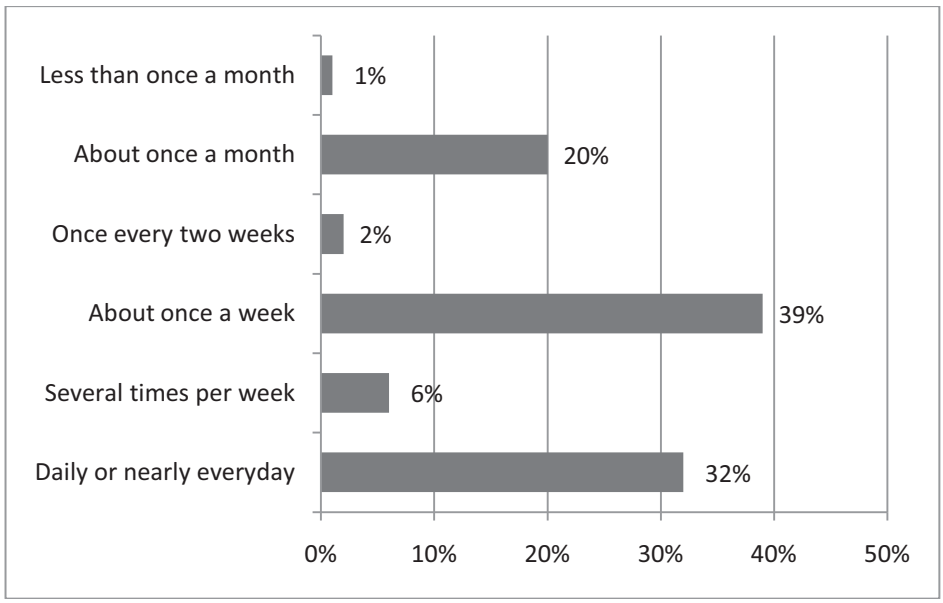

Figure 2. Distribution of Respondents according to Frequency of Use of AgriLink (n=88)

From Figure 2 it emerged that the majority of respondents used AgriLink regularly; a significant proportion (32%) used the facility daily and 77% of respondents used it at least weekly. Respondents were also asked for what purpose they used AgriLink and their replies are summarised in Figure 3.

Respondents were asked to rate eleven features on AgriLink. Each feature was evaluated on the basis of being very useful, of some use or of no use to the respondents. All eleven features were easily accessed on AgriLink and were strongly promoted by the website developers. The distribution of respondents by their responses to these features is presented in Table 4. From Table 4 it is clear that respondents who used AgriLink were very familiar with all milk related features on the website. However Milk Statements and Annual Summaries were not as popular as all other milk related features; despite this most respondents still found them useful or of some use. On the other hand all agribusiness and online business features were much less popular. The bulk feed ordering feature was used by 26 respondents but only nine of these reported it to be of any use (i.e. very useful or of some use). The General News section was also regarded as poor with only ten respondents finding it very useful. The Statement Download facility was only useful to those who had a farm software package to utilize it. While some 60% of respondents did indicate that

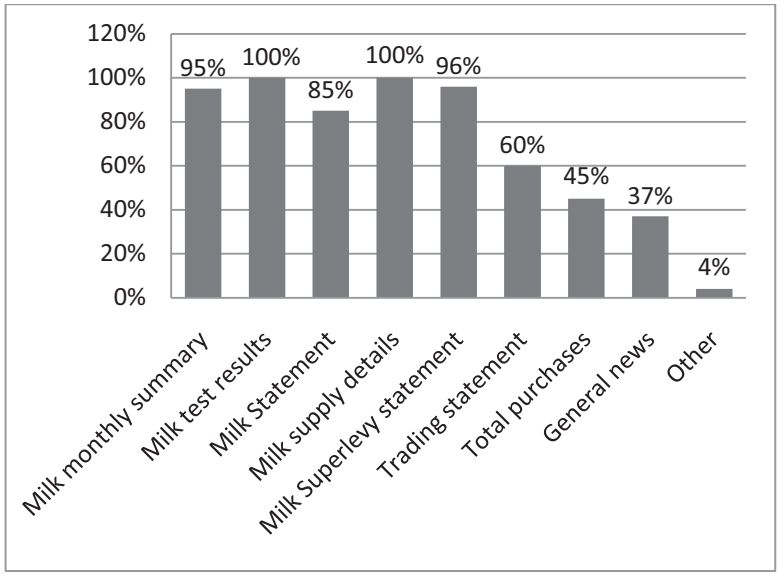

Figure 3. Distribution of Respondents according to purpose of AgriLink use (n=84); Multiple responses allowed

they had a farm management software package it is clear that not all of them were incorporating AgriLink into it and obtaining the full benefits of it.

Table 4. Distribution of Respondents by how useful they rated AgriLink features (n=88)

AgriLink Feature	Very Useful	Of some Use	Of no Use	Have not tried it	Total Responses
Milk Monthly Summary	68	13	3	0	**84**
Milk Supply Details	77	6	1	0	**84**
Milk Test Results	79	4	1	0	**84**
Milk Statement	54	26	4	0	**84**
Super Levy Statement	73	6	3	2	**84**
Annual Summary	37	31	6	6	**80**
Trading Statement	39	22	8	12	**81**
Total Purchases	28	26	9	13	**76**
General News	10	29	26	13	**78**
Bulk Feed Ordering	5	4	17	47	**73**
Statement Download	19	16	10	30	**75**

Factors which influenced PC and Internet Adoption In this study PC and internet adoption were found to be universal for users of AgriLink. For non users it was necessary to examine the reasons for slower uptake of ICT. While 76% of

respondents who did not use AgriLink had access to computers at home, it was considered unusual that they had not engaged with this resource and other factors, other than access to a home PC, were clearly preventing them from realising the benefits of AgriLink. It was found that non users of AgriLink were much less likely to have completed computer training than either frequent users or occasional users. The distribution of respondents by their level of computer training is presented in Table 5.

Table 5. Level of computer training completed according to AgriLink user group (n=110)

Computer training	Frequent Users (n=42)		Occasional Users (n=41)		Non Users (n=27)		Total
	No	%	No	%	No	%	No
Beginners course	16	38%	18	44%	9	33%	**43**
Advanced course (ECDL)	8	19%	5	12%	0	0	**13**
No Training	18	43%	18	44%	18	67%	**54**
Total	**42**	**100%**	**41**	**100%**	**27**	**100%**	**110**

From Table 5 it is notable that 56% of AgriLink users had engaged with computer training whereas only 33% of non users had taken computer training. It may be concluded that this low level of training among non users has influenced the adoption of ICT and the use of AgriLink. Analysis revealed that 75% of non AgriLink users had a home PC and 66% were connected to the internet. Figure 4 indicates what would encourage Non User Respondents to use AgriLink.

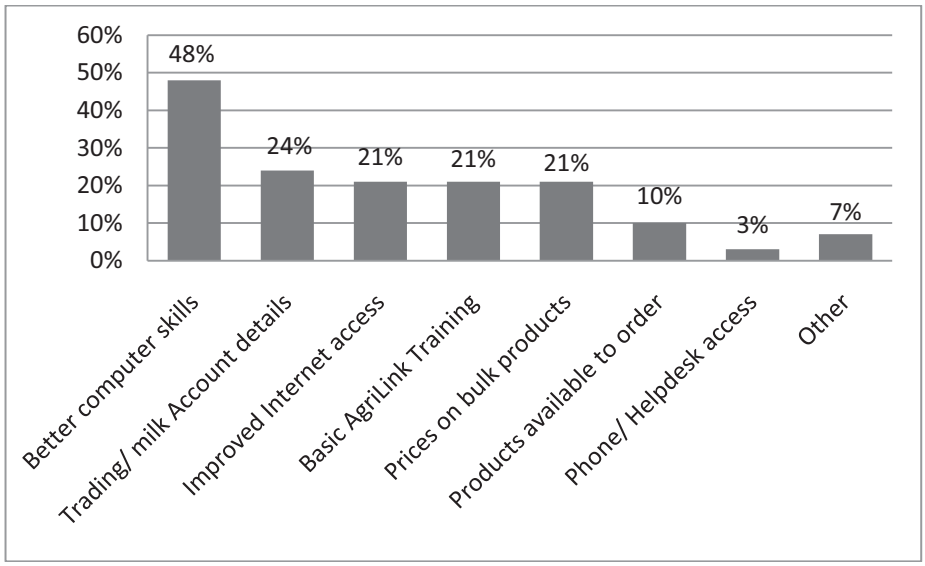

Figure 4: Distribution of non-using Respondents by Main Factor that would Encourage them to use AgriLink (n=29); Multiple responses allowed

It is clear that a lack of computer training was a major impediment to increased computer use and increased AgriLink use. Infrastructure was also an issue as more than 20% of respondents felt that improved internet access would encourage them. A number of respondents also were totally unaware that an AgriLink type service was available as they felt that access to Trading and Milk Account details would encourage them to use AgriLink. This indicates that an awareness campaign by Glanbia, the service provider, might encourage increased use.

5.3 Conclusions from AgriLink Study

This study examined the Glanbia AgriLink extranet site and the respondents to the survey could not be taken as representative of how Irish farmers are adopting ICT on their farms. However the study did discover a number of issues which may be slowing the rate of adoption of ICT. The sample of farmers who did not use AgriLink have also embraced ICT but not to its full potential. Some 75% of those farmers have a home PC and 60% of them can operate it. Therefore there is a huge onus on IT support teams both in Glanbia and in training bodies such as Teagasc to provide bespoke training to help those farmers in the years ahead to embrace ICT more fully and so reap the benefits accruing.

6 Conclusions

This paper has analysed the penetration of ICTs among the general population and among farmers in Ireland. It is apparent that considerable strides have been made in ICT and eGovernment initiatives in Ireland in recent years. Unfortunately, however, without the necessary infrastructural developments which include broadband, Irish farmers could continue to be marginalised when it comes to ICT adoption.

6.1 Constraints that Impede Farmers from using ICT

It emerged throughout this paper that older farmers are less likely to use ICTs than farmers under 50 years of age. Older farmers have less understanding of the benefits of ICT adoption. This is partly due to their lower education levels. According to ISITA (2003) computer training is an issue for farmers in the adoption of ICT and research findings presented in this paper also found that the lack of computer skills is an issue. Less than one third of non users of AgriLink, for instance, had completed any formal computer training while none had completed more advanced ECDL training compared with 57% of users who had training. This lack of training will continue to be a barrier to increased uptake of ICT among non users.

While the skills necessary to engage with ICT continue to limit uptake, the lack of infrastructure necessary to use ICT to its full potential continues to be a barrier. The lack of availability of broadband in rural areas is limiting the impact of ICT among Irish farmers. While rates of broadband use among AgriLink users, for example, was high at 51%, it was much lower among non users at 24% indicating that lack of availability and lack of awareness of the potential of broadband was evident among non users. It may be recalled that recent research by Smith (2008) indicates that 75% of rural areas in Ireland do not have an adequate broadband supply. This is significant since 20% of non users of AgriLink did indicate that improved internet access would encourage them to use it.

6.2 Recommendations which Emerge

The adoption of computer technology to enhance the flow of information to farmers is seen as a vital tool to allow farmers remain competitive on a global stage. What is clear from this paper is that a core group of farmers have embraced ICT and are benefiting from its adoption. However, it is essential that barriers to the adoption of ICT by farmers who are not using it are overcome. Efforts must be made to focus all players within the agricultural industry to make ICTs more relevant to farmers.

The transformation which has taken place in Irish agriculture due to eGovernment has been remarkable with the facilities to interact with the Ministry of Agriculture on a number of schemes for farmers. This development is welcome and must continue. However, one area where Government has not been so successful is in broadband provision to rural areas, where the farming community are concentrated. Today, there is a major imbalance in the provision of broadband to urban and rural areas with many rural areas trailing in ICT penetration. The commitment given by Government to extend the benefits of the Information Society to all parts of the country including farming communities and the rural population must be delivered. Broadband is now accepted as vital to rural sustainable development and without it farmers cannot make full use of ICT.

Finally, it is evident that there is a desire among farmers to embrace ICT but without the necessary skills to do so, this will not happen. If farmers are to adopt ICT on a grand scale it will only happen if they are taught the skills which they can implement immediately in relation to their farming businesses. While agribusinesses themselves may not want to get involved directly in training, it is important that they are supportive of organisations such as Teagasc or other local organisations in delivering the type of training required by farmers.

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