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# Communication technologies and knowledge building in agriculture

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*The concept of knowledge building communities has not traditionally been associated with agricultural extension, but is one which has the potential to increase the rate of adoption of best management practices by the industry. A potentially important mechanism to facilitate knowledge building is information and communication technology (ICT); however, very little research has been conducted on how effective it is in facilitating agricultural extension.*

*In this study, the potential for the use of ICT to facilitate knowledge building communities in agriculture was investigated in the dairy industry. Drawing on qualitative analysis using a case study, this research showed that ICT can enhance the gaining of technical knowledge (an important goal of extension); however, it was less successful in increasing collaborative learning. It was found that hierarchies within the dairy learning group were maintained despite*

*the use of ICT, and that this inhibited participation. The research concluded that ICT needs to be embedded in and supported by other forms of social interaction.*

## Introduction

Rural extension is defined by Baker (1987) as the transfer of information that supports the maintenance and development of people, organisations and communities, predominantly in rural areas, with an emphasis on agricultural information. Understanding adult learning principles is vital to extension in maximising adoption, whether the approach used is based on the traditional 'top-down' technology transfer method, or the more recent participatory 'bottom up' approach (Black 2000; Burrows and Boland 2002). The latter approach incorporates the concept of knowledge building communities, which are simply defined as "a group of people who investigate problems" and who are "engaged in progressive discourse in an iterative process of knowledge building" (Ferry, Figgins, Hoban & Lockyer 2000).

There is an emphasis in knowledge building communities on real world problems that are 'ill-structured', which refers to problems that need more information to understand the problem, where the definition of the problem changes as new information is added, where many perspectives can be used to interpret information and where there is no absolutely 'right' answer (Ferry *et al.* 2000). Water is one example of an ill-structured problem facing agriculture at present, where there is a high degree of complexity involved in achieving consensus on the most equitable and efficient way to allocate water.

Farmers are a particularly time-poor group who traditionally do not have a high rate of attendance at formal training and development opportunities (Fulton, Fulton, Tabart, Ball, Champion, Weatherley & Heinjus 2003). The challenge is, therefore, to find a format that fulfils their needs for flexibility. While many organisations offer formal training for which the Farmbis scheme (a federal subsidy for farmer training) offers generous subsidies, Fulton *et al.* report on a number of reasons why farmers do not avail themselves of these opportunities to any great extent. These include previous unsatisfactory experiences of education and training and attitudes that do not value education and training in rural life.



For this research, information and communication technologies (ICT) refer to the use of computer and Internet-related technology (Wilson 2002) for the transmission of information and the facilitation of communication. The rapid integration of ICT into all forms of education and training is of vital interest to extension practitioners and for knowledge building communities(Calvani, Sorzio & Varisco 1997). While much research has focused on the use of ICT for formal education, ICT is equally as valid for informal learning, which forms the focus of this paper. In turn, Schugurensky (2000) claims that informal learning is commonly neglected and under-researched, but is where most of the significant learning relevant to everyday life is learned.

Informal learning is defined as any learning which occurs externally to formal and non-formal educational institutions, and can be divided into three types (self-directed, incidental and socialisation) on the basis of intentionality and awareness (Schugurensky 2000). With regard to the use of ICT such as in an email list, since members intend to engage in learning when they join the list and they are aware when they have learned something, the learning can be classified as self-directed, informal learning.

In the area of informal learning, Scardamalia and Bereiter (1994) claim that the greatest potential of ICT is said to be in solving the logistical problems which occur in the construction of knowledge as a collective community goal. Further, they state that non-formal

or intentional learning requires social support, but that most social environments fail in this regard. Networks such as those facilitated by ICT have the potential to provide this support.

Email groups in particular have the potential to facilitate extension due to their networking capacity. Studies on extension have found that the most successful method of implementing change has occurred when the relevant information has emanated from a trusted source (Bell 2002). A strength of email groups is their ability to rapidly share information among peers, that is, among trusted 'colleagues'.

A common finding of the previous studies on education and ICT was that the use of ICT led to an increase in both technical knowledge and collaborative learning. The latter has been attributed partly to a greater equality of contributions within groups. However, there are conflicting reports on whether ICT can be egalitarian or whether it actually reinforces traditional language/power relationships. For instance, Sproull and Kiesler (1992) claim that, since it is more difficult to detect status cues in electronic messages than it is in other forms of communication, high status people do not dominate the discussion in electronic groups to the extent that they tend to in face-to-face groups.

Likewise, a number of research reports were cited by Blair and Monske (2003: 443) as agreeing that almost any networked activity will act to de-centre the formal educational space and decrease the power of authority figures. They further state that it is the responsibility of the authority figure (for example, teachers in classroom settings or moderators of email lists) to use computers to "facilitate an interactive, diverse, and collaborative writing community in which every student has a voice and can engage with each other and every other member of that community" (Blair & Monske: 443).



In contrast to the ideal of egalitarianism, Grabill (2003b: 459) emphasises the issue of class in relation to the use of computers in society and the inevitability of disadvantage experienced by the "technopoor". Class is referred to as "the systematic products of a social hierarchy sustained by unequal access to resources" (Grabill 2003b: 456), for which the labour process is central. He also states that many of the interactions with ICT require significant written literacies, a lack of which may contribute to a substantial lack of productivity in most networked computing (Grabill 2003a, b). This lack of productivity or failure for email lists to fulfil their potential, it would seem, could be linked to the influence of class, one symptom of which is the presence of high numbers of "lurkers".

While Beaudoin found that members of online learning groups who do not actively contribute by posting messages ("lurkers") still gain in terms of learning outcomes, for instance by dedicating more time to reflection, Beaudoin (2002) and Preece, Nonnecke &Andrews (2004) found that many lurkers are not selfish free-riders, and the latter also found that lurkers' satisfaction with online groups was less than those who do participate. The conclusions of Preece *et al.* were that lurking may or may not be a problem, and that the causes are many and varied. One common reason found, however, was that many did not feel a need to contribute and gained the information they needed without posting. Cited as a less significant cause of lurking was the dynamics of the group, including power relationships.

Nevertheless, the potential for ICT to decrease hierarchies may increase participation by sections of the farming community such as women, who are often excluded in traditional farmer extension groups (Marsh & Pannell 2000). Another possible positive impact of the use of ICT in increasing technical knowledge and collaborative learning was an increase in critical reflection, as claimed by Comstock and Fox (1995).

A separate debate is the desirable versus the undesirable effects of technology on learning. For example, Luke (in Resnianskaia 2000) points out one powerful group of educational stakeholders in the provision of ICT are corporate experts, "who already play a significant role in determining how people will learn, what they learn and what constitutes literacy in the technologised society". The social and cultural implications of these trends are profound, but lie outside the scope of this present paper.

## Method

The research began with an analysis of the relevant literature, then the case study of Vicdairy-L, an email list used by the dairy industry, was analysed using qualitative methods. Qualitative research emphasises words in the collection and analysis of data, rather than quantification (Bryman 2001). Case study research was the specific methodology used, which has both advantages and disadvantages. The main advantage is that it is conducive to in-depth study. The disadvantage is that the findings may be difficult to apply to other cases, since the case study chosen for the research may be quite unrepresentative. However, as Bryman (2001) states,

> the findings of qualitative research are to generalize to theory, rather than populations ... it is the quality of the theoretical inferences that are made out of the qualitative data that are crucial to the assessment of generalization (p.283).

A strategy to decrease this problem is to describe as fully as possible all the details of the case study, and to allow others to judge how applicable the findings are to the general population.

The email list, Vicdairy-L, was originally set up in 1999 to help achieve one of the highest priorities for the Victorian dairy industry in Australia, that of accessing, understanding and using information. The listserver, which is a software program that sends messages



to multiple addresses (Layfield, Nti & Radhakrishna 1997), was hosted by the University of Melbourne. While use of the list began very slowly, there are now approximately 450 members, with four messages, on average, being posted every day. Membership of the list has spread from eastern Victoria to the remainder of Victoria, to South Australia, Queensland and New Zealand.

The researcher joined the list and immediately posted a message announcing her presence and that she was intending to observe the list for three months. Over this period, approximately 250 messages were posted to the list. Since contributors are encouraged and generally do include their personal details at the end of each message, the relative contributions of farmers and service providers were able to be monitored. In this context, service providers consisted of researchers, consultants, extension officers and sales representatives (for example, chemical and fertiliser). While service providers comprise about 25% of the membership of the list (DRDC 2002), it was observed that they contributed more than 25% of the messages posted. Messages of service providers, on average, also seemed to be longer than those of farmers.

A questionnaire was then used to explore perceptions of the usefulness of the list as a tool for extension. The questionnaire was emailed to all members of the Vicdairy-L list, a process that although skewing responses to those who actively monitor the list, was a very fast way of reaching all members. Questions covered a comparison of face-to-face extension versus Vicdairy-L, whether participating in Vicdairy-L had increased technical knowledge and then explored the relationship between the email list and networks and collaboration. The questions in the questionnaire were open-ended, to give participants the opportunity to express fully their experience relating to the issue behind the question. Thirty five responses were received, from a membership of approximately 450, of which it is estimated less than 30% contribute. Although this response rate is low, it was

considered satisfactory due to the nature of the Vicdairy-L group. Some of the same factors which restrain members from participating in online discussions, such as shyness (Preece *et al.* 2004), being time poor and a reticence to use written literacies, would also restrain them from responding to a questionnaire.

The responses were then collated and coded.

## Results

The following are the main results of the survey (Figure 1).

*Figure 1: Results of survey of Vicdairy-L*

| Parameter | Percentage |
|---|---|
| Increased knowledge as a result of being a member of Vicdairy-L | 91 |
| Face-to-face extension more effective than Vicdairy-L | 64[1] |
| Vicdairy-L has one or more advantages over face-to-face extension | 66[2] |
| Have increased networks/contacts since joining Vicdairy-L | 53 |
| Have increased participation/collaboration due to Vicdairy-L | 29 |
| Have used the archives of Vicdairy-L | 29 |
| Vicdairy-L could be improved | 44 |

[1] Expressed as a percentage of the respondents who indicated they were familiar with extension

[2] Expressed as a percentage of those who indicated that face-to-face extension is more effective

### Face-to-face versus computer-mediated extension

A significant finding of the survey was that the majority of respondents felt that face-to-face extension is more effective than ICT



(in the form of Vicdairy-L). Many of the respondents stated that ICT will never fully replace face-to-face communication in extension. One reason given for this is the much documented problem of the 'digital divide' – that people who do not have access to a computer, or the knowledge to use one, miss out on fora such as Vicdairy-L. Another reason expressed was that, with agricultural extension, many of the concepts require hands-on experience, which can only occur in a face-to-face situation such as during a field day.

However, of those who claimed ICT is less effective than face-to-face extension, 66% felt that ICT also had one or more advantages over face-to-face. The following quotations are examples of these advantages expressed in the survey:

> ... the list is no-work learning, no need to find the time, get organised – no need to listen to a whole-day forum when you only want a little bit of what's said.
>
> Expert knowledge and discussion has been much better than face-to-face.
>
> ... members can access the information they need, and others need but don't know it, and they can get the information when they require it and in their own time. The group is a great idea ...

### Increase of knowledge and self-directed learning

The highest number of positive responses was received for the question on whether belonging to Vicdiary-L had increased knowledge for respondents to the survey. Respondents stated that, through Vicdairy-L, they had increased their knowledge of a range of issues facing the dairy industry such as cow nutrition, grazing management and business management. One comment was that the information from Vicdairy-L, while not always providing the whole picture, enabled crystallisation of information from other sources. Thus, the hypothesis that ICT can be a useful tool for extension was supported by the survey.

The results also lent weight to the claim that participating in the list enhances self-directed learning. Since farmers reported that they had increased their level of knowledge through participation in the list, it is proposed this knowledge has arisen through self-directed learning. This conclusion is reached since use of the list gives farmers full control over what they learn and, to a lesser extent, how they learn it; that is, they are fully responsible for their own learning. For example, it is the individual's choice how much he/she participates, and the nature of that participation in Vicdairy-L. Use of the list in this respect is in contrast to participating in a traditional face-to-face extension group, where there is much less control over the means and the objectives of learning.

However, the result that two-thirds do not access the archives (a searchable, web-based, historical list of all messages) detracts somewhat from the vision of the list providing a repository of knowledge. The low rate of accessing of the archives indicates that, with regard to referring to the messages at a later date, the information is either being accessed from the original emails or not at all by the majority of respondents. Thus, while members may find the information useful at the time of the message being sent, there was no evidence of the information providing a longer term store of knowledge.

### Power differentials

The issue of the participation of service providers was mentioned in response to a number of the questions, with both negative and positive views being expressed. Certainly the efforts of service providers contribute significantly in one respect to the level of activity of the email list in terms of technical expertise. The following is an example of the positive point of view expressed by a relatively small number of respondents on the contributions of service providers to Vicdairy-L:



> ... some of the more technically and professionally adept have been good enough to explain their thinking and performed calculations to support a particular point of view.

However, while there are these advantages of the expertise of the service providers adding to the quality of the discussion, it also had a suppressing effect on farmer contributions. Perhaps particular personalities are an issue as well, as from observing the list there was one particular service provider who regularly posted long messages which were sometimes not related to local issues. The relevant quotes on this issue included:

> I think there are a lot of people on the list who read the replies/comments who are apprehensive of jumping in with their comments. Particularly with some of the high powered comments from a number of regular contributors.

> ... the discussion can often be completely stopped once certain "know-it-all" types put their 2 [sic] cents worth in. The list does tend to be very top heavy with too many gov't employees/ consultants putting in responses which tend to stiffle [sic] discussion, often a good dicussion [sic] gets going, then some "have-to-have-my-say-types" stop it by being very over the top with almost agressive [sic] tones in their emails. I've seen several good discussions finished by one email from these types just as it was getting interesting.

> I think that if the interlectuals [sic] toned down their language a little (some of them tend to be a bit condesending [sic] when giving an answer to a question asked by one of us poor dumb farmers) some of us dumb farmers would be less shy about asking ...

### Lack of confidence

Farmer confidence in actively participating in Vicdairy-L appears to be a significant factor in use of the list, as illustrated by the following quotes. While the frequency and length of service provider contributions appeared to have a negative affect on farmer

confidence, many other factors appeared also to contribute to a lack of confidence in communicating via ICT.

> ... lots of listeners and not many talkers; perhaps some are unsure of contributing as you may not be as good as the experts.
>
> ... has intensified debate, but only by the confident.
>
> ... the discussion does not have enough genuine farmer input and farmer self-confidence is not high enough.

There are some contributors to the list who seem to have a lot of time and much to offer. Interestingly, few are farmers, and those farmers who do make a post, usually keep it short. It is important that all make some statements, provided there is no derision and sensible dialogue prevails.

### Collaboration

While just over half reported they had increased their networks and/or contacts as a result of belonging to Vicdairy-L, only 29% reported there was increased participation and collaboration. Perhaps individuals have increased acquaintances by belonging to the list, but this has not necessarily translated to closer relationships resulting in collaboration. In fact, the list did seem to engender weak or bridging ties, between people who normally may not come into contact with each other, rather than strong or bonding ties.

Since social capital refers to the existence of networks and the resulting coordination of actions necessitating both weak and strong ties (Putnam 1993), it would appear that Vicdairy-L may not be effective in building social capital at this stage. However, with the result that over half did claim Vicdairy-L has increased their networks, it may simply be a matter of time until this translates to increased collaboration and social capital. One respondent did claim that the list had not been operating for long enough for collaboration



to occur. The following quote indicates the potential of the list to perform the function of increasing collaboration:

> ... speaking to people thru [sic] this system makes you feel like you get to know them a bit and they treat you kindly when you contact them – probably would do anyhow, but it's a nicer feeling. You also learn which areas of expertise belong to which people.

Although not directly surveyed, it may be surmised that there are some participants in Vicdairy-L who do not regularly avail themselves of other, more traditional learning or training opportunities. Since 82% of respondents said they are or have been involved in extension, theoretically 18% of Vicdairy-L respondents have not or are not involved in extension. This forum, therefore, may be reaching many members of the farming community who are not being reached by other methods. To the extent that this may be borne out by further research, this would be a very important advantage of electronic groups.

## Conclusion

The case study of Vicdairy-L provided some insight into electronic groups and posed some questions about how to engage farmers in the process. Vicdairy-L showed that ICT in the form of an email list has the potential to be a useful tool for extension, particularly in terms of increasing knowledge. Over 90% of respondents to the survey stated that being a member of Vicdairy-L had increased their knowledge, implying that self-directed learning has also been enhanced.

However, the research was inconclusive on whether ICT engenders cooperative learning and increases social capital. Barely more than half said they had increased their networks via Vicdairy-L, and less than one-third felt there was increased participation and collaboration amongst members due to Vicdairy-L. It appears ICT does increase weak ties but is less successful in building strong ties.

In the longer term, it is possible that weak or loose ties may become strong ties facilitated by email lists, as trust builds between members. A factor which may have impacted on the formation of social capital via ICT is the issue of the presence of service providers, and the resulting power differentials. Many respondents to the survey flagged the detrimental effect service providers can have in contributing academic messages on global issues rather than using language more familiar to farmers on local issues. Survey responses demonstrate there is a significant inhibiting effect of these messages from service providers. It appears that, while email groups have the potential to provide the 'trusted sources' cited as being successful in implementing change, there is a danger that the nature of some of the members may act against this. The intervention of a skilful moderator may be necessary to lessen the effect of some groups dominating fora such as Vicdairy-L.

This of course mirrors a basic premise of traditional extension, that language should be appropriate for the audience. While this knowledge has been incorporated into traditional extension, the findings of this research are that it needs to be revisited in the context of ICT. In addition, the study highlighted the need for training in the use of ICT; this would enable not only more farmers to participate, but would increase the confidence of those who are current members of Vicdairy-L.

There are possible technical solutions to the problem of domination of service providers, such as limiting the list to farmers only, with an intermediary seeking input from service providers as required. Another option involves the use of bulletin boards which allow the dividing of discussions into topics, therefore one topic could be devoted to 'intellectual' discussions, while the other could focus on day-to-day farming issues.

As expressed by many respondents to the Vicdairy-L survey, ICT will never (at least in the foreseeable future) replace face-to-face



extension. It is also recognised that dangers exist in relying on technology in general. While ICT can assist farmers and growers to increase their knowledge, it should not be used in isolation. As stated by Garson (1995), communication technologies are characterised both by powerful opportunities **and** significant problems.

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