

Enabling Electronic Commerce In Agribusiness: The Initial Stages Of A Diffusion Process

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Abstract

A case study is discussed which shows the steps a beef producer group is taking towards electronic commerce. The group intends to use electronic communication for group interaction, feedback in the supply chain, and marketing. The case study is interpreted in terms of Rogers' (1983, 1995) theory of diffusion of innovations. Electronic commerce is seen as an innovation which is perceived as having relative advantage, is compatible with the group's past experience, and is triable. Its adoption, however, is extremely complex, especially for people in rural areas and requires time which can be ill-afforded. The group is, however, progressing well in making use of electronic communication. This progress has been enabled by technical support on an individual basis and by attention to the communication process. The question remains as to whether the process followed can be generalized to other groups.

Introduction

The purpose of the paper is to discuss, with reference to a case study, how electronic commerce applications can be enabled in agribusiness. The authors are involved in a project funded by the Australian Meat Research Corporation which is investigating the use of networked information and electronic commerce in the Australian meat industry (the NIEC project). It appears that pressures for the adoption of electronic commerce in agribusiness will increase worldwide (Schware and Kimberley, 1995a, 1995b; Gregor, 1997; Gregor, Newman and Larner, 1997). Agribusiness, and the Australian meat industry in particular, would appear to be somewhat ill-prepared to respond to this pressure. As the red meat industry is important to the Australian and other economies, it is of practical significance to consider the problems and opportunities connected with the use of electronic commerce in this industry, and the means by which participation in electronic commerce can be enabled.

The term *electronic commerce* is used in this paper in a broad sense to mean “the sharing of business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks” (Zwass, 1996, p. 3).

The best known example of electronic commerce in the Australian meat industry in Australia is CALM (computer-aided livestock marketing). CALM offers a livestock trading system to around 6000 computer-connected users. The system had its beginnings in the late 1970s with a group of producers who wanted to get better prices for their cattle, as well as avoiding the costs associated with physically transporting beats to auction. The CALM system is considered to be less successful than initially envisaged (Smith, Tran and Ruello, 1995). Estimates show that only 1% of cattle in Australia are marketed through CALM (Heilbron and Roberts, 1995). Livestock trading through CALM has been operating at a loss since its inception. It appears that the introduction of a widely accepted product description system for the CALM system has also facilitated direct selling of cattle “over the hooks” to processors, which has allowed producers to gain many of the benefits of electronic marketing while avoiding the costs of the CALM system (Smith, Tran and Ruello, 1995). Constraints inhibiting the use of electronic communications, and thus of electronic commerce, in Australia’s rural communities have been identified as inadequate technical capability of the telecommunications infrastructure, high telecommunications prices, and restricted access to education, training and user-support services (Buckeridge, 1996).

Our case study shows how a group of beef producers in Queensland is adopting electronic communication and taking their initial steps towards electronic commerce. They intend to use electronic communication for group coordination, a benchmarking system, electronic feedback through the supply chain, facilitation of a quality assurance system and World Wide Web marketing. The adoption process began ten months ago. Already, however, a considerable amount of progress has been made. An attempt is made to determine the factors which are aiding progress and why, so that experiences here can assist similar ventures elsewhere.

The conceptual background to the paper is the theory of the diffusion of innovations (Rogers, 1983, 1995) which shows how new innovations are adopted over a period of time. Application to computer technology has been investigated by Brancheau and Wetherbe (1992) and Zmud (1982).

“*Diffusion* is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas. Communication is a process in which participants create and share information with one another in order to reach a mutual understanding”. (Rogers, 1995, p. 5).

Four important elements of the diffusion process are (i) the *innovation*, (ii), *communication* over *channels*, (iii) *time*, and (iv) the members of a *social system*.

Diffusion theory is complex and the theory is described and applied in a very general sense in this paper. In addition, it is recognized that other theory could be relevant to the work described here -- for example, the Technology Acceptance Model (Davis, Bagozzi and Warshaw, 1986) or social learning theory (Bandura, 1977). The theory of the diffusion of innovations has been chosen because it is well-established and has been widely used in other work with agricultural communities. In addition, diffusion theory includes consideration of the

process by which diffusion and change occurs and the **social context**. Both these factors are important in our project.

The study is considered to be *action research*, which seeks to add to knowledge, but seeks also to apply knowledge and become involved in the implementation of plans (Mansell, 1991). The problems to be solved were not defined by the researcher but by the producer group. The characteristics of action research should be acknowledged. The distinction between “researcher” and “researched” may be blurred and the participation of the researcher in the project is *reflexive* in that it is part of the subject to be researched (Checkland, 1981). Thus, the social system in this case study is taken to include the researchers.

The data concerning the project is taken from records of meetings, interviews, and surveys. It should be noted that the beef producer group involved, though not responsible for the form or arguments made in this paper, will be given the opportunity to read, verify and contribute to the paper before publication. Thus, the production of the paper in itself is part of a communication and learning process.

The paper proceeds by describing the case study in terms of the four elements of diffusion theory and the expectations drawn from the theory with respect to each of the elements. The paper concludes by discussing the implications of the findings to date in terms of both theory and practice.

Case Study Description

This section describes activities of the Blue Gum Beef producer group and the research project team from November 1996 to August 1997. Data has been gathered from records and notes made at the four meetings of the group which members of the research team have attended, and at a training session in Rockhampton. The project officer has kept a log of all telephone conversations, individual training sessions and other related activities. In addition, three in-depth interviews with members of the Blue Gum Beef group have been conducted. In these interviews, open-ended questions were asked about the use of the Internet in the beef industry, the obstacles to its use, how use could be assisted and whether perceptions of the Internet had changed. In the following discussion direct quotes from the interviewees are shown in italics with an identifying label (I1 to I3) to denote the particular interviewee.

The case study is described in terms of the four elements of diffusion theory: the social system, the innovation, time (the diffusion process) and communication and channels of communication. The interpretation and deductions from diffusion theory are those of Rogers (1995) unless otherwise noted.

Social System

The social system is defined as the set of interrelated units that are engaged in joint problem solving to accomplish a common goal (Rogers, 1995). Diffusion is affected by the nature of the social system, its norms, the role of opinion leaders and change agents, and types of innovation decisions. The consequences of innovation should also be considered.

The social system includes the Blue Gum Beef producer group and the research project team. A wider social system is also recognized which includes other components of the beef industry and our society as a whole. Space precludes a detailed analysis of this wider system but it is

important to acknowledge it exists. Ongoing experiences have shown that this context is extremely complex and knowledge of a number of industry bodies, initiatives, government policy and economic forces is needed.

The Blue Gum Beef group describe themselves as “a team of innovative and progressive cattlemen who joined forces in 1995” (Bluegum Beef, 1996).

When you're dealing with beef producers, you're dealing with people who have traditionally been fiercely independent, have been very conservative, have been reluctant in many cases traditionally as a group to work closely together. We're trying to get some of the more industrious and progressive people and mould them into a force that will produce a product and will work together to achieve some commercial gain. [11]

Currently the group has members representing 22 separate enterprises. The number involved varies as enterprises join and leave. The group has a formal structure with elected office-bearers.

There are members of the group who can be regarded as “innovators”. Two members of Blue Gum Beef were connected to the Internet before the NIEC project began. These innovators have been able to explain the benefits of using electronic communication at group meetings. The convenor of the group is probably the most influential *opinion leader*. The interview data suggests he is the individual who interacts the most with other members of the group. He was keen for the group to take advantage of electronic communication and is now connected to the Internet.

The authors of this paper are the members of the research project team who have been most involved in the adoption process. The authors had minimal knowledge of the beef industry before the project began. The first author is the project team leader and is currently an academic. She has prior experience in industry developing information systems and is aware of the importance of user requirements and the need to arrive at mutual understanding of these requirements. In her teaching role the project leader has been involved in several projects in which students used computer networks (Gregor and Cuskelly, 1994). The second author is the project officer employed on the project for the last two months. The project officer is a recent computing graduate. She has experience in training first-time users of computer systems and in working on a Helpdesk for first year computing students. The two other members of the NIEC project team are a geneticist and an information services officer/librarian. Both have considerable knowledge of the beef industry.

Thus, the authors have quite different backgrounds from the members of the producer group. According to Rogers (1995) the transfer of ideas in the diffusion process occurs more frequently when the individuals communicating are *homophilous*. That is, the individuals who interact are similar in attributes such as beliefs, education, social status and the like. The efforts the authors have made to compensate for the differences in background are discussed further under the heading of communication.

A further matter that should be considered with respect to the social system is the possibility of undesirable and unanticipated consequences. Rogers (1995) documents several cases where the effects of an introduced change have been deleterious to the social system. One effect that has been attributed to the move towards electronic communication is that some members left the group because they were uncomfortable with the emphasis placed on the use

of new technology. We are aware that care is needed so the technology is not used for purposes that are counter to the group's aims. A primary aim of the group is a co-operative approach to marketing. Any initiatives which encouraged individual marketing to a large extent (such as marketing the products of individual enterprises on the World Wide Web) could interfere with this aim.

The Innovation

The innovation is the use of electronic communication for electronic commerce. In diffusion theory (Rogers, 1995) the characteristics of innovation and the way in which they are considered to influence its rate of adoption are:

- 1) *Relative advantage* - the degree to which an innovation is perceived as better than the idea it supersedes. The greater the perceived relative advantage of an innovation the more rapid will be its rate of adoption
- 2) *Compatibility* - the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. Innovations that are more compatible with prevalent values and norms of a social system will be adopted more rapidly than an innovation that is incompatible.
- 3) *Complexity* - the degree to which an innovation is perceived as difficult to understand and use. New ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understandings.
- 4) *Trialability* - the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on a partial basis will generally be adopted more quickly than innovations that are not divisible.
- 5) *Observability* - the degree to which the results of an innovation are visible to others. More observable innovations are more likely to be adopted.

A **relative advantage** is perceived by the group in the use of electronic communications, in terms of cost, flexibility and a marketing edge.

A great advantage ... if you're out in the lead and the rest are trying to catch up. [I3]

It [e-mail] is a great way of doing it compared to the fax machine. [I3]

The telephone, 2-way radios, fax machines and now the Internet, it's really shrinking the world and bringing us much more in touch with the people we deal with, with markets and consumers. I think the potential is unlimited for educating use, selling our products, educating our families and generally informing about what's happening around the world. [I3]

Some drawbacks are also perceived. All interviewees mentioned the lack of time for learning and using electronic communication systems.

Linespeed is a big obstacle, typing skills hold you back if you're not very fast. [I3]

A practical obstacle is not having enough men to run the property while you're in the office. [I3]

Using electronic communication is **not incompatible** with current practices of the group. They are used to using fax and had a relatively high proportion of computer ownership when the project began (90%).

Adopting electronic communication is a **very complex** process for members of the group. They have to upgrade their computer in some cases, obtain a modem and connect it up, establish if they have a suitable telephone line, find an Internet Service Provider (ISP), and then learn to use electronic mail and how to access the Internet. Each individual step is non-trivial. Obtaining a suitable telephone line can be a major difficulty. For example, an upgrade to the telephone exchange at Springsure meant two members had no access to the Internet while the exchange was being fine-tuned. One of these people had then to go through a long process of reinstalling software before getting back online. Difficulties are compounded by the fact that many members live in isolated areas and assistance may not be readily available.

The move towards electronic commerce is **trialable** in that it is being carried out in stages. The first author discussed with the group at the second meeting attended how they needed a phased approach. The first step is to get everybody online and using email for sending simple messages. The next step is to begin transferring data files. It will then be possible to move on to the development of a World Wide Web site for marketing and the more sophisticated feedback and quality assurance systems.

Electronic commerce, like other software systems, is **not readily observable**. At the Barcaldine meeting in March, 1997 of Blue Gum Beef there were demonstrations of electronic mail and the World Wide Web, making the software more observable to the group. It was at the conclusion of this meeting that the group made the commitment to proceeding with the adoption of electronic commerce.

That Barcaldine meeting where we had a cross-section of input from people in various areas of the industry who are associated with information technology somehow or other. That gave us a broad picture and I think that was the turning point where a lot of our members saw that these are the benefits we can get, let's get in and help develop them. [I1]

Time And The Innovation Diffusion Process

Time is seen as an important dimension in the diffusion process, encompassing the process that occurs over time, the time that an individual takes to adopt and the time taken for adoption in a system. Rogers (1995) sees the process in which an organization or group adopts an innovation as being more complex than the process by which an individual adopts an innovation. In the current study, there was a collective innovation decision -- the choice to adopt or reject the innovation was made by consensus among members of the group.

Two stages in the innovation process for a group are seen (Rogers, 1995). The first stage is *Initiation* -- all of the information gathering, conceptualizing and planning for the adoption, leading up to the decision to adopt. Sub-stages are (1) Agenda-setting and (2) Matching. The second stage is *Implementation* - all of the events, actions, and decisions involved in putting an innovation into use.

The history of the project is now described as far as possible in terms of these stages.

I (1) Initiation - Agenda-setting

The NIEC project began with the awarding of a grant by the Australian Meat Research Corporation. Participants in the meat industry attended a launch of the research program on 7 November, 1996. One participant was the convenor of the Blue Gum Beef group. The group was encouraged to consider being involved in the project at their next meeting by one of the members of the research team. As a result, the convenor wrote a letter (Shannon, 1996) expressing interest in the program and stated six areas where it was believed that assistance could be given. These areas were: (i) benchmarking, (ii) commercial trading, (iii) electronic feedback through the supply chain, (iv) quality management system, (v) internal communications, and (vi) use of the Internet for marketing and information.

I (2) Initiation - Matching

The next major step was the attendance of members of the research team at a producer group meeting at Emerald in February, 1997. It appeared at this meeting that the attitude towards participation in electronic commerce was fairly negative. At this point there were two members of the group who were online.

At the following group meeting in March, 1997 at Barcaldine, the group convenor had arranged for a number of people associated with the use of technology in the beef industry to give demonstrations. The demonstrations included the use of electronic mail and the World Wide Web. The NIEC project leader also gave an overview of how the move towards electronic commerce could be approached in a number of stages, with an objective at the end of the year of having all members online and using electronic communication to support profit-driven strategies. The group committed to adopting electronic communication and associated systems at the conclusion of this meeting.

The way in which the group decision to adopt occurred matches Rogers' (1995) description of the adoption of innovations by organizations. The convenor was "scanning" for promising innovations that matched a problem faced by the organization. This awareness of the innovation led to planning and design of the fit between the innovation and the problems faced.

II (1) Implementation - Redefining/Restructuring

After the initiation stage comes the implementation stage which is seen as involving redefining and restructuring, clarifying and routinizing (Rogers, 1983).

The implementation stage in the NIEC project to date has involved the provision of a considerable amount of training and support for members of the Blue Gum group.

We have continued to attend all meetings of the group -- at Dalby in June, 1997 and in Brisbane in August, 1997. The researchers have made brief presentations at each meeting but most benefit to members appears to result from informal discussions in breaks and at social activities.

A workshop was held in April 1997 during the Beef97 week in Rockhampton. The workshop provided hands-on experience with using email and browsing the World Wide Web. A home page was created for the workshop participants with relevant links to beef related sites,

weather, media, tourist information, searching, education and fun. Four members attended the workshop, with family members.

In the two months since June, 1997, the project officer has spent approximately 75% of her time assisting members of the group. She has established contact with each enterprise by phone and gathered specification on members' computers to aid in support. She has acted as a go-between with members and Big Pond (the favoured ISP) where necessary. Members regularly ring up to ask questions about how to use the Internet software, and with technical problems with the telecommunications, connection, ISP and software. She has downloaded and tested software such as mIRC, virus software, and typing tutors so as to be able to make recommendations to members. She has assisted in running the group's mailing list and written guides on mailing lists, mIRC and email.

The Project Officer has visited two properties for problem solving and individual training sessions. The first visit, to a property near Duaringa on 10 July 1997, involved removing conflicting ISP software and making changes to the configuration of the computer. The software conflicts had prevented the member from getting on the Internet and required an experienced computer user to correct. The ISP software was then installed and configured, and the email and World Wide Web software demonstrated to the member and family.

The second visit, to a property near Barcaldine on 18 July 1997, was to a member who had connected to the Internet a week beforehand, and consisted of training and practice in using the email and web software.

I didn't have a clue really what e-mail was and I think the scary thing about e-mail for a start is the e-mail address which looks double Dutch and has funny terms like Big Pond and .com.au and after a while you realize that it's quite logical and it's just an abbreviation and it becomes much more normal once you get into it. [I3]

Members of the group believe hands-on learning is important:

I probably learn better on my own, making mistakes and seeking assistance from somebody like yourself for technical help. [I3]

You learn by doing it yourself and seeing what happens. [I2]

Group members are also insistent that one-to-one support is very important.

I think in terms of getting acceptance for various electronic communication type systems across the industry, the need is for someone like Kylie, a project officer type person, to actually communicate on a one-to-one basis with people. It's a relatively costly manner of doing things but there are certain times with computers and computer-type systems where you really need some one-to-one assistance to get into an area or overcome a problem. [I1]

Other observations support the need for individual assistance. One couple had attempted to join the Farmwide trial, which has involved 1000 farmers across Australia (Anon, 1997). They were told their linespeed was too slow. The project leader travelled with this couple to one meeting and stopped at their property with her own computer to check the connection to the Internet. A connection was obtained immediately and this couple have since been found to have one of the highest linespeeds in the group.

Another producer is still not online. He has been waiting for Telstra to install a second telephone line to his home, which could take some time. In conversation it became clear that he had not realized that the email system did not have to be online all day, like a fax, and that he could begin with the one line he already has.

The technical support provided by the ISP Big Pond is also appreciated.

They are just brilliant those people. They can solve just about any problem as long as you have two phones. [I3]

To conclude, one-on-one and hands-on training appear the best ways for each member to learn. The group dynamic is essential in their acceptance of the ideas, but the only contribution to learning it has is to encourage the members to try to get moving more quickly.

Of the 22 enterprises currently members of the Blue Gum Beef group, 16 now have Internet access. Of the six enterprises without Internet access, two are at the stage of seeking a second-hand computer. One of these has no power connected to the property and also needs hardware to regulate the power from a generator. Of the remaining four, one has Internet access but no email access, and three have computers but are yet to join an ISP. The fundamental contributing factor to these members not being connected is a lack of time to devote to buying and setting up a computer, installing the ISP software, and registering with the ISP. While the amount of time involved for each member in their remaining steps to getting online may seem trivial, it is still time away from the work that earns the money.

Communication And Channels Of Communication

The essence of the diffusion process is that information is communicated with respect to a new idea. The communication channel may be mass media or interpersonal. Most people, however, evaluate a new idea based on the subjective evaluation of someone who is like them who has previously adopted the idea. It is believed that the transfer of ideas occurs most frequently between two individuals who are alike, similar, or homophilous. *Homophily* is the degree to which individuals who interact are alike in terms of beliefs, education, social status and similar attributes. More effective communication occurs when two individuals share common meanings, a mutual subculture language and are alike in personal and social characteristics. Individuals who are not homophilous may still communicate effectively if one individual has empathy with the other, and is able to project themselves into the role of the other.

In this study the communication channels have been almost exclusively interpersonal. We are conscious of the fact that we have different backgrounds from members of the group and have made clear that we feel we need to learn about the beef industry so we can better understand what they are doing. We have made a point of attending all meetings for their full duration, including social activities. Where possible we have also travelled to the meetings with group members. The project officer believes that going to the meetings, talking to members over the phone and helping them out has been instrumental in being accepted and trusted by the group.

Many group members do not ask questions in formal presentations, but prefer to ask them privately in coffee breaks and during social activities -

I think most of the people didn't want to ask a question that might have displayed their own ignorance. Whereas they're quite happy to go up to her later on their own and quietly say to

her ' Look what about this or that?'. I think it's getting back to the change of culture, that mentality. None of us like to make a fool of ourselves. [I1]

The four factors identified by Rogers' as leading to change agent success can be distinguished in the communication process in the case study. First, the project officer (a change agent) has put considerable effort into contacting clients, by phone and by being available at meetings. Second, we have a client orientation. We are focusing on what the clients want, rather than the technology in itself. The members of the group are sensitive in this respect -- the technology in a different project was referred to as "toys" by one interviewee, who could not see the relevance of the "toys". Third, the innovation is compatible with clients needs. Fourth, we are attempting to empathize with clients and explain the innovation in a way that has meaning to them. A number of comments have revealed the importance of this aspect of the communication process. At one meeting a degree of negative feeling was associated with one speaker, not a member of the NIEC project team, whose presentation was "above their heads" and "not direct enough".

Conclusions

Our case study shows a group who have exhibited success in the first stages of adopting electronic commerce. The group is comprised of 22 enterprises. Sixteen enterprises are now using electronic communication for group communication and transfer of commercial data compared with only 2 enterprises six months ago.

Analysis shows experiences in this case study are largely congruent with Rogers' (1983, 1995) theory of diffusion of innovations. The social system includes a group who see themselves as innovative. There is at least one strong opinion leader and several especially innovative individuals. The process is being assisted by change agents who are client-focused, put effort into contacting group members and endeavour to empathize with group members, despite differences in backgrounds. The innovation, electronic communication and electronic commerce, is perceived as having relative advantage, is not incompatible with the groups' current practices, and is trialable. It is, however, relatively complex. A considerable amount of training and support has been needed to counter this complexity. The process conforms to Rogers' idea that organizations scan continuously for innovations, and match a promising innovation with one of their own problems. The group decided to adopt the innovation by consensus among the members -- there is now some pressure on all members to conform to this decision.

Some additional observations are drawn from the case study. The beef producers exhibited a strong preference for hands-on learning and one-to-one support. One of the biggest obstacles to the adoption and regular use of electronic communication is the lack of time for learning and setting up a system.

The question remains as to whether the process followed here can be generalized and lead to similar results with other groups. The congruence between our observations and Rogers' diffusion theory suggests that this generalization may be possible. Again, we should look for groups who can perceive relative advantage in some form of electronic commerce and be prepared to offer a considerable amount of training and support. This training and support is relatively expensive. A challenge is to identify means of support which are not so expensive and time-intensive.

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