

THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA

REPORT BY MR TONY EYRES

2001 CHURCHILL FELLOW

‘Technology adoption in agriculture
and its impacts on rural communities’

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INTRODUCTION

My Churchill Fellowship took me to the United States for five weeks in November 2000 and the United Kingdom and Europe for three weeks in June 2001 to study technology adoption in agriculture and its impacts on rural communities. I ended up doing both parts on my own for family reasons and probably tried to do too much, having a hectic schedule on both occasions and no one to slow me down. However, this provided the opportunity to meet with so many amazing people, each with loads of ideas on precision agriculture, e-commerce and the convergence of these two technologies under consideration for my Fellowship.

I came away with a far better understanding of agriculture in these countries and a greater appreciation of agriculture here in Australia, which is well positioned by comparison. Key messages from my area of study included the need for agriculture and rural communities to embrace everything that these new technologies have to offer. Agriculture is going to become increasingly complex with further demands from consumers and the industry for accountability of agricultural production. Government and industry need to assist in developing further to capabilities of communities to adopt these new technologies and assist in managing the impacts. My studies have shown that impacts will have a net positive effect on rural communities and ensure they are able to meet the growing demands being placed on agricultural production.

ACKNOWLEDGEMENTS

I sincerely thank the Winston Churchill Memorial Trust of Australia who are to be congratulated on their ongoing commitment to funding overseas travel and study and to whom I will be forever indebted for the opportunity to be a Churchill Fellow. The flexibility shown to allow me to return to Australia half way through my travels to be home for the birth of my first child, was also greatly appreciated.

Ian McClelland, Chairman of the Birchip Cropping Group (BCG) provided initial encouragement for me to apply for the Fellowship and together with the Executive of the BCG, the support to complete the first part of my travels. I also acknowledge Ian's ideas and inspiration on all things agricultural and community.

Ron Greentree, Chairman of the Grain Growers Association recognised the value of the Churchill Fellowship and together with the Board, accommodated my completion of the Fellowship in June 2001, not soon after commencing in my new role with the Association.

My three initial application referees, Alex Black, Lui Marcelli and Broughton Boydell assisted in getting me to the initial interview stage and Mike Stephens from there to the final interview.

John Hill, AgSystems in Brisbane provided a large number of ideas and contacts to assist in organising my travels and he and his wife, Susan and their family looked after me while in Fresno, California.

Warren Clark provided a lot of contacts and ideas to think about while he kindly allowed me to stay with his family in Dundee, Illinois and share Thanksgiving with them which was a great experience.

Fiona Plant gave me the opportunity to enjoy some of the many things that London has to offer and put up with me on a number of separate occasions.

Rural Industries Research and Development Corporation (RIRDC) provided support to attend a conference in France which was invaluable in pulling together all my thoughts and experiences in three very full days towards the end of my travels.

There were so many very kind and generous people who helped me prepare for my travels, looked after me while I was away or just put up with me asking a million and one questions. I thank all of these people for assisting in a range of different ways including family and friends that accommodated either myself during my travels or my wife and daughter while I was away and work colleagues whom covered for me while I was away.

The person who needs to get the most thanks and acknowledgement is my wife Ingrid who was unable to accompany me on either part of my travels. Despite this, her support was fantastic and our daughter Sophie, the reason for Ingrid not being able to share so many experiences with me, is the best reason possible for the disruptions to our best made plans. Thank you for everything!

EXECUTIVE SUMMARY

CONTACT DETAILS

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PROJECT DESCRIPTION

‘To assess the role technology has played and will play in rural communities, focusing specifically on the use of satellite and Internet technology in agriculture’. This involved gaining an understanding of the technology, its applications and the possible benefits or challenges it may present to rural communities, specifically farmers.

HIGHLIGHTS (REFER TO PROGRAMME – TOO MANY TO LIST HERE!)

MAJOR LESSONS AND CONCLUSIONS

Satellite Technology = Precision Agriculture

- The key attraction of precision agriculture (PA) is the capture of information on various farming practices, including inputs such as fertilisers, chemicals and water. While offering commercial savings in reduced or more specific application, this information should also prove valuable as demand for specific information about farming practices, from both consumers of finished products and purchasers of properties, increases.
- Farm size, education levels, computer literacy and age are the key drivers of PA. In terms of farm size, economies of scale are currently critical in order to spread the cost of an investment which is presently not only expensive, but actually requires more work on the farmer’s part to obtain a benefit. As a result, developers of technology are faced with the challenge of producing a tool that is both easier to use and more cost effective.
- The remaining factors of education, computer literacy and age need to be recognised and addressed by governments, through upskilling of farmers at all levels, but targeting younger farmers in the first instance.
- The agricultural industry needs to be promoted as progressive and using the latest technology in order to attract higher quality people back into the industry. Universities will need to provide courses to fill the current void of people able to interpret data collected through the PA process. At the same time, existing industry participants need to be retrained and upskilled. Failure to do so will pose a major impediment to the future of this technology.
- More equitable access to infrastructure, such as cheaper and more dependable Internet services, will allow efficient exchange of information and analysis of data, thereby shoring up the future of this technology.
- Concerns about the loss of jobs due to replacement of labour with technology are arguably countered by a number of factors, including:
 - (a) the already existing lack of skilled staff in many rural areas;
 - (b) the need for staff such as engineers to support the technology;
 - (c) the opportunity to raise the industry’s profile as being progressive, thereby attracting higher calibre students into agriculture and related disciplines; and
 - (d) the opportunity for technology to replace a large part of the manual tasks required to produce a commodity, thereby creating more time for people to consider and interpret data and turn it into information that can then be used to create knowledge.

Internet Technology = E-Commerce

- The key benefits to be derived from the use of e-commerce lie in the transfer of information, and not necessarily the buying or selling of goods and services. There is a large potential for better information management by utilising the Internet, with all inputs and outputs captured. This will improve supply chain management and lift the integrity in the food chain that consumers are demanding. In addition, the use of the Internet allows farmers and other agribusinesses 24 hour access to the freshest data available.

- Using the Internet to overcome distance is another attraction for agriculture. On-line courses have much potential, and remote working is a real possibility, helping attract more people back into regional areas (provided infrastructure and services can be provided).
- As regards impediments to adoption, the technology still appears too complicated to potential users, many of whom will only adopt when they can see its benefits. Further, many potential users are still only willing to do business face-to-face.
- Controlling data is also going to be a major issue, that is who owns the information and what happens to any aggregated information that may be obtained?
- The current void of people who sufficiently understand agriculture as well as computers will need to be addressed by the agricultural sector. As is the case with PA, by working with universities and schools, an opportunity may exist to promote agriculture as a progressive industry, thereby attracting more people back into the industry.
- Technology will need to be as compatible with all operating environments as possible to ensure wide adoption. Limitations such as slow line speeds and expensive Internet access in many areas of Australia will have to be addressed, as will the need for standardisation of data being collected.
- Concerns regarding pressures put on local businesses in rural communities by competing e-commerce businesses may be allayed by the efficiencies gained from e-commerce including better access to the latest information and also opportunities created for local businesses to access a global market.

Convergence of Technology = Better Supply Chain Management

- The real value of these technologies is realised when they converge, combining e-commerce transactions and all the related information together with spatial information captured by precision agriculture. This will enable farmers to respond to increasing consumer demands for information on farm inputs and outputs and ensure the integrity of the value chain is maintained.

DISSEMINATION OF MAJOR CONCLUSIONS

The advantage of agriculture is that it has well established industry linkages and is a relatively small sector in terms of these networks. The most difficult aspect will be getting direct farmer contact but established farmer groups, whom I have worked with in previous roles, provide an excellent conduit. I have already addressed several farmer groups in Victoria and NSW and will continue to do so over the coming months and years.

My current employer has well-established links with a range of farmers groups and the major universities across southeastern Australia, several of the R&D corporations in agriculture as well as government and industry. All of these links will be utilised in communicating my findings and encouraging greater adoption of these technologies to ensure the full potential for agriculture is realised.

Specific representation to industry will also be made through conferences, meetings and other functions. Submitting articles to publications such as *Australian Grain* and *Farming Ahead* is another method of disseminating findings but the lack of statistical data to support many of my findings may preclude many of the more technical publications.

IMPLEMENTATION IN AUSTRALIA

Widespread adoption of any new technology requires a balance between commercial imperatives and sound support and promotion from industry and government.

The challenge is for industry to acknowledge the value of the information able to be captured by both precision agriculture and e-commerce and put steps in place to best realise its potential. This will require standardisation of much of the data being collected and a reduction in the cost of obtaining this information. For PA, this would mean of a cost reduction of an order of magnitude of two from \$100,000 to \$1000 for the technology. This is similar to the Chairman of Sony wanting people to have a Walkman to allow cassettes to be listened to while walking - he proved it could be achieved.

Government can assist by supporting research and setting such goals as a priority within the R&D objectives of its various institutions and corporations currently conducting agricultural research. A further role for government is to remove some of the key impediments to adoption, which include access to infrastructure and cheaper provision of services such as Internet in rural and regional Australia.

MAIN BODY

BACKGROUND TO PROJECT

This Churchill Fellowship evolved over several years from an idea of mine about the convergence of several emerging technologies, specifically precision agriculture and electronic commerce (e-commerce), being able to provide agriculture with solutions to challenges facing the industry, in particular integrity of supply chains. In particular, a belief that farmers could regain some ascendancy if they embraced everything these technologies have to offer.

This was tempered slightly by the fears held by some in the various rural communities where I had grown up or was living and working, that related to the negative impacts of adopting these new technologies. This included inequitable access, job losses as a result of adoption and pressure on the social fabric of smaller communities.

My Fellowship sought to gain a better understanding of these technologies, how they are being applied in the US and Europe, identify impediments to adoption and learn of any impacts adoption may have on rural communities back here in Australia. The UK and California appeared to have best recognised the potential impact of technology adoption on rural communities, working on maximising possible returns to regional communities from early adoption.

TECHNOLOGY ADOPTION

Any technology takes three to five years to be adopted with the 5-10% of early adopters leading the rest. As mentioned, farm size and education levels are the key drivers of adoption of many new technologies including precision agriculture and e-commerce. The real challenge is to identify the key steps needed to get farmers to adopt the technology with few caring about the technology, only the outcome.

It is important to remember that technology adoption will happen when it is profitable with no need for extension. A difficulty with precision agriculture is the cost of outlay to embrace the technology and this explains the low adoption alongside rapid uptake of other technologies such as seed biotechnology. The simplicity of this example where the technology is contained within a seed and the farmer only has to purchase the seed, follow agronomic advice and get results also explains the far greater adoption. In both cases, the benefits need to be considered more closely in terms of the return on the capital outlay.

The uptake of e-commerce may be quicker than adoption of other methods of doing business if it reflects the fast adoption of the Internet. Efficient product and money flow, accompanied by good information will ensure strong adoption. If you are also able to convince a farmer that the demand side wants particular things done using specific methods then you are far more likely to get adoption. Key drivers of Internet usage by business, including farmers, will be consumer pressures for information on foodstuffs, government compliance and the like.

IMPACT ON RURAL COMMUNITIES

Consideration needs to be given to the changes that have occurred in the past 100 years with agriculture virtually unrecognisable to the farmer of the early 20th Century. However, we all must but realise that change will continue. To quote a well known phrase, "it is far better to anticipate change than have it forced upon you". This is very much the case with new technology and some may argue that avoiding its existence may well put one's own at threat.

The positive aspects of embracing the two technologies considered in this study seem to be far greater than any of the negative aspects for rural communities. Two such negatives included loss of jobs due to replacement of labour with technology and pressure on local business through competition by e-commerce.

Job losses are best countered by the lack of skilled staff in many of these communities already and seasonal workers being particularly difficult to find. Further, using this technology would require a level of support staff, which would attract highly educated people into these communities such as engineers and communications specialists. It may also assist in promoting the industry as being progressive to prospective students and see higher calibre students taking vocations in agriculture and related disciplines.

The opportunities created for local businesses to access a global market reverses the second negative in relation to e-commerce and local businesses. Often this causes more problems due to an inability to supply or the receipt of orders from the far reaches of the globe that cannot be filled. There was an example of a Norfolk fertiliser merchant receiving an order for one bag of fertiliser from Cornwall in the UK and an order for several hundred tonnes from Japan, showing the diversity and potential of e-commerce, some would argue both useful and useless.

DATA ⇒ INFORMATION ⇒ KNOWLEDGE

The major challenge for any industry is to turn data into information and information into knowledge. This is particularly relevant for agriculture with declining numbers entering the industry and a lack of people to conduct many of the tasks required in producing a commodity. The opportunity exists for technology to replace a large part of the manual tasks required and making more time available for people to consider the data that is collected, interpret this and turn it into information that can then be used to create knowledge.

There is currently a lot of data being collected from precision agriculture and e-commerce but too few people are able to interpret this data and create knowledge to allow better decisions to be made. Too much time is spent collecting data and not enough time spent analysing this data to ultimately create knowledge on which decisions can be based.

The people in the best position to make most use out of so much of this data are the large multinationals that have stakes in many of these technologies. There is a concern about these companies already having too much control over the value chain and misuse of market power to the detriment to the consumer, in this case the farmers. Unfortunately, it is likely to be these companies that have access to sufficient data to create knowledge sense to allow decisions to be made on changing practices.

CONVERGENCE OF NEW TECHNOLOGIES

The real potential of technology for rural communities will occur when there is convergence between the two technologies under consideration, that is precision agriculture and e-commerce. This was a thought I had prior to my travels with many people believing the two technologies were two separate projects. The initial thought was to capture all the information about on-line purchases of inputs including batch numbers, place of manufacture and the like, then combine this with the spatial information of where those inputs were applied and ultimately where the commodity was produced through precision agriculture.

This would be a valuable tool in managing value chains and enable consumer demands for such information to be met. These demand seem to be increasing from consumers globally, foremost in Europe but more so now in the US and here in Australia. If a cost-effective method that does not require duplicating information capture or transfer could be developed, greater adoption would result and those 'first to market' would gain a competitive edge.

Push-pull marketing is a real possibility with this technology, if the one company manages the sale of all inputs to a farmer, which would enable the company to offer a price based on costs of production. If convergence of the two technologies occurs to the full extent and this company similarly managed the spatial production data either directly or through a related party, it reinforces control. While abhorred by many, there would be a percentage of farmers who would accept this means of doing business, reverting to an almost factory farming type model.

MANAGING ADOPTION

Technology adoption will have impacts on rural communities but acknowledging the positive aspects of that adoption and ensuring equitable access and awareness will avoid many of the associated problems. Information overload is often a big problem in regional development, so communities need to have two or three things to focus on at one time. Working with existing networks such as discussion groups and cooperatives, rather than competing, is most effective since these are already farmer owned and driven.

PRECISION AGRICULTURE

Key Attractions for Adoption

Precision agriculture (PA) captures environmental and economic information with a single entry but is still a largely nebulous concept combining soils, plants and water in one to better match inputs to specific needs. Water is critical in all aspects and addressing soil water holding capacity and climatic variability are important, as is the realisation that PA is more about identifying management zones and how soil, plant and water interacts within these zones.

The technology captures temporal (timing) and spatial information simultaneously, which is becoming critical in maintaining the integrity of agricultural value chains. This is in an environment where land management requirements are becoming increasingly stricter in Europe and to a lesser extent the US. Supply chain integrity and traceability are the key related applications, enabling farmers to meet customer and ultimately consumer demands for information on food products.

A lot of value of PA is the education aspect, despite often reaffirming things already largely known, with the information often as valuable as the data itself. That is, the data is most likely more valuable than any cost benefit of

reduced application, due to the ability to link to leases, sale of farm or subsidies to be received, especially as they become more environmentally focused in both the US and Europe. These environmental aspects and other advantages, such as historical data being collected, need to be considered in the economic analysis of the value of adoption of this technology.

Key Impediments to Adoption

At present, available technology is not only expensive but actually requires more work on the farmer's behalf to get benefit from its application, with adoption not likely to occur until PA makes life easier. Widespread adoption will not occur until a tool is developed which is easier to use and more cost effective, something not uncommon in adoption of any new technology. The technology needs to be made simple for everyone, including contractors so they can put a disk in and that's it!

PA is very different to the adoption of other agricultural technologies, such as biotechnology and new varieties, requiring large capital investment in machinery and actually requiring more knowledge, not simply buying and sowing a new variety. The products are still largely providing data management, not information or knowledge.

The technology is available to deliver precision agriculture but the expertise and skills to apply this technology are still lacking globally. There is only a small handful of people worldwide is currently able to do full interpretation and even then it is usually limited to specific crop types. Many people are trying to build an 'expert' system that allows decision support where you plug in data including yields and environmental factors and it tells you what to do next. The variables are too large and the scope of current models is limited. The technology, including software, hardware and services (eg. GPS satellite access) also seems ahead of the application with databases still not able to handle the data.

Because farming systems are so complex, more layers of data are required. There is a clear need to also capture what is in farmer's heads since their knowledge of the farm, its variables and nuances is likely to be far greater than any simulation model. A farmer knows that a particular paddock gets too boggy to drive on after 20mm of rain and knows that a hail storm came through when a paddock was only half harvested which could not be explained by a yield map. That is, there is a need to use people's brains to refine initial sorting by the technology but this cost of interpretation is often not realised by technology developers.

Precision agriculture will always only be as good as the data being gathered with "garbage in, garbage out!" being very poignant. There also appears an urgent need for standardisation like that seen globally for other engineering aspects of agriculture, like PTO shafts on tractors. There is an ISO standard being developed (ISO11783) but major industry players are trying to be the accepted standard, much like VHS versus Beta videos, which is hampering efforts. The ability to "plug and play" between implements from different manufacturers appears essential to the wider adoption of the technology with users, primarily farmers, not wanting to be locked in to one system.

Lessons and Possible Solutions for Australia

Precision agriculture offers large opportunities for Australian agriculture due to broadacre nature of many of the farming operations and the growing input costs of major inputs, including fertilisers, chemicals and water. The information captured through PA should prove very valuable over time as demands for specific information about farming practices, either from consumers of commodities produced or potential purchasers of properties, increases.

Farm scale is seen as critical for adoption to allow the full potential of the technology to be realised and economies of scale to spread the cost of investment. This offers a further challenge for developers to arrive at simpler, cheaper PA options while maintaining accuracy. A major challenge is to get costs down by a magnitude of two ie \$100,000 (\$10²k) down to \$1,000 (\$10⁰k) and then adoption will flow. Many new users of PA technology are choosing to lease equipment or use a contractor in the initial instance, which appears the best approach.

There is no harm in encouraging farmers with access to the technology, either through contractors or on their own machines, to start collecting the data now. This is in anticipation of using this data in the future, when better applications and interpretation become available, since there appears a need for at least 3-4 years of data.

A large focus of precision agriculture has been on variable rate technology (VRT) and much of the economic analysis on PA has been done on this aspect, often in isolation to other components to its adoption. These need to be considered when looking at the value of adoption such technologies.

There is a lack of highly skilled people entering agriculture with IT and commerce jobs attracting leading students for promise of greater salaries, and due to a perception of agriculture as not being a progressive industry. Promoting the industry as being progressive and utilising the latest technology may provide a means of attracting higher quality people

back into agriculture. However, if this fails, supporting this technology with staff with the required expertise may also pose a problem.

There is a real need for university courses to attract people into the area of PA and fill the void of people able to interpret the data currently. These people are needed to provide independent evaluation of the outcomes of the technology. However, there is a similar need to retrain and up-skill existing people in the industry such as resellers who are an important interface for adoption and of course the farmers themselves.

Critical aspects specific to the adoption of PA but also common amongst adoption of similar technologies include computer literacy, education level and age. These need to be recognised and addressed by governments in a broader overall manner for lifting the skill set of farmers, but targeting younger farmers in the first instance.

Other aspects include equitable access to infrastructure such as relay stations and other related services such as cheap and dependable Internet access to allow efficient exchange of information between users and those with the ability to interpret the information. Greater access to satellite technology and expenditure on this sort of infrastructure will sure up the future of this technology.

E-COMMERCE IN AGRICULTURE

Key Attractions for Adoption

The key benefits from the use of the Internet for business (e-commerce) are in the transfer of information, not necessarily goods and services. It may be the sharing of information between farmers within a virtual cooperative, independent of commercial interests, or it may simply be information between a farmer and his bank or between suppliers. Examples of cost savings are shown with some cooperatives having stopped poll faxing their database since e-mail offers a far cheaper option. However, posting information on a web site has seen almost no inquiry but is a good exercise to go through to understand the clientele.

Large volumes of information can be provided via the Internet provided it is properly managed to avoid overload. By way of example, foot and mouth disease (FMD) gave UK farmers a compelling reason to get on-line because they were often barred from leaving their farms or at least the district. Either the Ministry of Agriculture, Forestry and Fisheries (MAFF) or National Farmers Union (NFU) site (which was often more up to date with member feedback) was the most effective way of getting the latest information. On-line or "virtual" presentations were also done very effectively at local distributors stores across the UK to overcome travel restrictions. The Mad Cow Disease (BSE) outbreak in 1995 used phone, letter and fax while the FMD outbreak in 2001 saw very little paper leave the offices of the NFU, with the use of e-mail and posting information on the web proving very timely and effective.

Government departments in both the US and Europe are looking to put subsidy request forms and loan and grant information on-line which will give another compelling reason for farmers to use the Internet.

A further application by government is to create expert Q&A sites where agronomic or other agriculturally related inquiries can be answered on-line. This can be very useful for targeted information to meet the time of season such as what varieties can be sown late if conditions are to wet or too dry for sowing and grain storage tips at harvest.

Private sector providers are already offering such services where paddock type, soil type, location can be entered in by subscribers and broad recommendations can be made, based on templates. This sustains grower dependence on consultants for information but provides this information in a novel and ever changing way. This is inevitable, as farmers will no longer being able to afford the fortnightly crop walks they receive in parts of the UK, with better use of the Internet seeing crop walks reduced to 8-10 per year.

The use of the Internet to deliver and manage information enables 24 hour access by growers and the freshest data possible with the real time capability of the Internet, not one or two day old price reports which are often simply based on calls to people in the industry anyway!

Other benefits include it largely being point and click technology, requiring little training and the Internet allows data to be accessed simultaneously at several locations eg: for discussion between a group of farmers.. There is also no need for software updates, and server computers hosting the information and are bigger and faster, not relying on farmers' own PC's. Farm data can be safely stored at a remote location, off the farm so house/office can burn down and no data lost!

E-commerce has the potential to allow farmers to monitor all inputs including factory of manufacture and even batch numbers for every chemical, which will help differentiate produce, until everyone starts doing it. Provision of good quality information up and down the supply chain is a key benefit of e-commerce, adding value to the flow of the

product along the chain. Real time traceability for foodstuffs for the duration of their life would be a big thing for agriculture

Point of sale ID is now feeding into stock control and in turn into purchase orders for suppliers. Several consecutive good spraying days in the UK saw a lack of chemical product available since manufacturers are moving towards a "just in time" method rather than storing or warehousing. Large databases tracking global or at least national stocks would assist in anticipating demand and avoiding such problems. Real time production of chemicals is possible just as computers are assembled "on demand" now. The ultimate would be just in time delivery of produce as per the car tyres in a Ford factory in Brazil arriving on a truck only hours before being fitted, removing the need to unload, store on a shelf then fit, simply going straight onto the production line.

Supermarkets want this integration but it is difficult for foodstuffs, due to quality issues and requires a greater dependence on suppliers by supermarkets to make this work, which supermarkets want to avoid. Logistics is the key and while many supermarkets have very well developed systems, based around hubs, shelf life is a major issue. Fax orders will essentially be replaced by on-line orders between supermarkets and large cooperatives.

So many records are being kept to comply with regulations and customer requirements but few are in an electronic form. There are many government and industry (supermarket) administered certification standards now being imposed on growers with a great opportunity for a one-stop-shop to be set up, enabling farmers to record data then deposit only once and receive all the certificates. This can be done manually with paper forms but best done on-line. Government can subsidise some of the cost of data warehousing but farmers must pay to use the service and supermarkets pay to retrieve data that is stored.

Growing a diversity of crops brings with it diversity of marketing decisions, with the Internet offering another dimension in information to assist in decision making. Farmers have been largely price takers, focussing on the production side to increase margin but e-commerce gives the opportunity on the supply side. Aggregated selling is just as possible as aggregated buying with web sites already developed to bring a number of producers together at a virtual market place.

Using the Internet to overcome distance is another attraction for agriculture. On-line courses have a lot of potential due to regional location and relative isolation to institutions, especially things like chemical accreditation, which is a legal requirement. Remote working is a real possibility and may help attract more people back into regional areas, provided infrastructure and services can be provided. There are examples of recently retrenched people placing their resume on-line and having almost instant responses from hours to days, with most offering flexible work hours and locations, in particular the ability to work from home. This shows a growing preparedness for employers to use technology to make work easier.

The biggest potential is business to business (eg: manufacturer to supplier) which has been really successful, unlike business to consumer which has failed despite lots of hype. There are very few agricultural companies in the US or Europe currently offering e-commerce to farmers. Many people are still using the Internet for price discovery, but not actually purchasing on-line. Many farmers see little benefit in on-line purchasing of agricultural inputs but happily buy their groceries on-line (eg: Tesco's in the UK), enjoying the convenience, ability to use previous orders and home delivery and are prepared to pay five pounds extra.

There are now stickers on bananas in the supermarket asking, "Where do you find a recipe for banana muffins? – Ask.com" which is no longer using the Internet to sell bananas but using bananas to sell the Internet! This highlights how the Internet is growing and changing.

Key Impediments to Adoption

The technology still appears too complicated to many potential users with "techno speak" scaring people and not being able to see the technology actually working, similar to the problem with laser leveling where people could not see the laser beam. People will adopt when they can see the benefit of the technology.

Many have a broad view that e-commerce will simply become commerce, but are not too keen due to loss of the personal touch. The majority of people still want to do business face-to-face, so e-commerce is struggling a little. Consumables like food and clothing cannot all be done on-line due to the "try before you buy" approach of many consumers.

People are comfortable with normal credit card transactions but not so on-line. Consumers have concerns over follow up to purchases made on-line, with an example of a new kitchen being available on-line for 2000 pounds cheaper than local tradesman but the purchaser decided to go with the local person. Therefore, if there are any problems, one can get them back to fix it, making it the tradesman's responsibility not the home owner!

Access to the Internet is still a major impasse in many places, despite the density of population and the impression of being advanced countries. Many US farmers are still paying long distance rates and Internet access is quite expensive on the European continent, largely controlled by governments. This has seen far slower adoption than in the UK and the US, but it may also be due in part to everything being so close and accessible without any sense of isolation.

There are still limitations to the current technology, in particular doing some of the more difficult business activities like spread trading of commodities on exchanges such as the Chicago Board of Trade. The room for error and time efficiency are the major problems to be ironed out before widespread adoption of this technology occurs. However, the financial sector is a major user of these tools and adoption will occur in time.

Patents, copyright and ownership of information is to become a bigger issue for the Internet but still very grey at the moment.

Lessons and Possible Solutions for Australia

The Internet is the key to providing information to farmers, either real-time like weather or marketing, or on demand. There is large potential for better information management by utilising the Internet with all inputs and outputs captured. This will improve supply chain management and lift the integrity in the food chain that consumers are demanding. However, controlling data is going to be the major issue to address. That is, who owns this information and also what happens to any aggregated information that may be obtained through queries or transactions?

There are real voids of people that sufficiently understand agriculture as well as computers but this needs to change. The next generation can use technology far easier than the current generation so to get adoption, the agricultural sector needs to work with universities and schools. It may provide an opportunity to promote agriculture as a progressive industry using the latest technology, which may attract young people back into the industry. Many promoters of e-commerce are targeting the younger generation of farmers either directly or through young farmer associations. These farmers are already banking and managing share portfolios on-line so are comfortable storing financials on-line.

Farmers need to start using the Internet through e-mails, printing out messages and downloading files so they can see an output. If growers start with purchasing on the Internet, selling will eventually follow. The need for the provision of personal information on registering with a site should be kept to a minimum and, if requested, an explanation provided as to why this information is needed.

Technology needs to be as compatible with all operating environments as possible to ensure wide adoption. The Internet is an ideal tool in this regard, since upgrades are easy, however there is a need to be mindful of limitations such as line speeds and expensive access in many areas of Australia. There is also a need for standardisation of data being collected to ensure links between farmers and their suppliers. A move towards spatial systems of standardising data rather than a financial or accounting type standard would be beneficial, however previous attempts appear to have failed.

Information is the key aspect being delivered at present, not products or services. Many successful e-commerce ventures are using the approach of building a community first by providing lots of information at no cost then introducing e-commerce aspects later. Content is important to build trust and once established, people will keep coming back. However, a successful site must always give farmers a compelling reason to come back, preferably because all the information is in one spot or one platform. The Foot and Mouth Disease outbreak in the UK provided a great example of a compelling reason for farmers to use the Internet, kicking their kids off and using it themselves.

PROGRAMME

UNITED STATES, NOVEMBER 2000

Date	Activity
Saturday 4 th November	Flew from Melbourne, Victoria to Los Angeles, California arriving two hours before I left! Hired a car and drove north, visiting Santa Barbara and San Luis Obispo before staying overnight in Salinas.
Sunday 5 th November	Drove to Sacramento and had lunch with Ann Veneman, partner with law firm Nossaman, Guthner, Knox and Elliott, LLP, where she specializes in food, agriculture, environment, technology, and trade related issues. Drove to San Francisco, seeing the sites and sounds of the city before staying overnight.
Monday 6 th November	Breakfast with Will Henwood, an Australian working with a venture capital company in the Silicon Valley near San Francisco.
	Met in Davis with John Smythe, Business Development manager with agricultural commodity exchange web site, Horsepower.com.
	Drove to Fresno, staying four nights.
Tuesday 7 th November	US Federal Election day with a visit to a polling booth at a local school very interesting.
	Visited the offices of Beeline Navigator, a PA company in Fresno meeting with technical and marketing staff.
	Drove south to Leemore to visit Ted Sheely, a large farmer participating in the AG 2020 program for PA involving various universities, USDA and NASA.
Wednesday 8 th November	Met in Fresno with Brock Taylor, an agronomic consultant, regarded as a leader in California at interpreting PA data for farmers, in particular tomatoes.
	Met in Fresno with Richard Mead, Product Development and Sales with mPower3, a web based information and imagery company offering data storage and management for farmers.
	Drove south to Corcoran to visit the cotton operations of corporate farm, JG Boswell which extensively uses PA technology for 24 hour operations.
Thursday 9 th November	Drove north to Firebaugh to visit Jesse Sanchez, farm manager of RA Sano Farms, a large corporate farm which extensively uses PA technology for variable rate application of inputs and yield monitoring.
Friday 10 th November	Breakfast in Fresno with Dianne Friend, a farmer in San Joaquin Valley who together with her husband founded Horsepower.com, an agricultural commodity exchange web site.
	Met in Fresno with John Hill, an Australian who set up Beeline Navigator in the US, dealing with business partners and major farmer clients.
	Lunch in Tulare, south of Fresno with Brian Bassett, an agronomic consultant doing interpretation of data for farmer clients and developing cost effective solutions for entry into PA.
	Drove to a farm just south of Tulare to meet with Russ Friend, Business Development Manager, business partner and brother to the founder of Horsepower.com
	Drove to Monarch Beach, south of Los Angeles, staying two nights with family.
Monday 13 th November	Drove to Corona, east of Los Angeles, to meet with Stan Bird, Imagination Unlimited, an agricultural publisher and conference convenor for the e-commerce display at the Tulare Ag Show, one of the largest agricultural shows in the US.
Monday 13 th November	Flew from Los Angeles, California to Dallas Fort Worth, Texas, catching a bus into the city then waiting from 11pm to 4am in the Dallas Central Greyhound Bus Station for a connection.

Tuesday 14 th November	Caught a bus to Texas A&M University, College Station to meet with Steve Searcy, a pioneer of PA research in the US. Toured the campus and met with an Australian research economist on sabbatical at Texas A&M before catching a bus back to Dallas and staying overnight.
Wednesday 15 th November	Toured sights around Dallas city centre including where Kennedy was assassinated before flying from Dallas, Texas to Atlanta, Georgia and staying overnight.
Thursday 16 th November	Hired a car and drove south to Tifton, staying three nights.
	Visited the University of Georgia's Tifton Research Station. Met with the Director of the National Environmentally Sound Production Agriculture Laboratory (NESPAL), Craig Kvien and Stu Pocknee, an Australian working on PA with local farmers.
Friday 17 th November	Drove with Stu Pocknee to the main campus of the University of Georgia in Athens. Met with Shannon Wilder, New Media Strategist working on on-line delivery of the university's research information. Toured the campus and watched the prematch of an American football game. Returned to Tifton.
Saturday 18 th November	Drove with Stu Pocknee to Arlington to visit Tony Smith, a farmer working with NESPAL to apply PA in the identification of management zones on his peanut, soybean and beef cattle farm.
Sunday 19 th November	Drove back up north to Atlanta, staying overnight.
Monday 20 th November	Toured sights around the Atlanta city centre including The Underground, various shopping centres and The World of Coca-Cola.
	Met in Atlanta with Jennifer Campbell and Mac Holladay, Market Street Services, an internationally recognised leader in regional development and working with communities to sustain populations and viability.
	Stayed overnight in Atlanta.
Tuesday 21 st November	Flew from Atlanta, Georgia to Chicago, Illinois, catching a limousine to have lunch with Tony Wisker, AFS Product Performance Manager with Case New Holland at Burr Ridge, south of Chicago.
	Toured the Case New Holland Technology Park at Burr Ridge and saw machinery simulations and several new technological developments, in particular for PA.
	Caught a limousine to the Caterpillar factory at DeKalb to meet with Sam Freesmeyer, Senior Project Engineer to discuss PA and e-commerce applications.
	Caught a limousine to Dundee, west of Chicago to visit Warren Clark, a leading US consultant in PA and Internet applications for agriculture, staying for four nights.
Wednesday 22 nd November	Caught a train into the Chicago city centre and visited the Chicago Board of Trade (CBOT) with a tour of the trading floor with Steve Gunning and Tim Bauer from Prudential Securities.
	Met with UBS Warburg to discuss the application of the Internet in real time trading and procurement of contracts.
	Toured sights around the Chicago city centre before catching a train back to Dundee.
	Attended a congregation for the Community Church with Warren and his family, along with 3500 other people where results of a fund raising campaign were announced, totalling in excess of US\$70million.
Thursday 23 rd November	Thanksgiving Day in the US. Attended a traditional lunch at a restaurant with Warren Clarke and his family. Thanksgiving also signals the start of putting up Christmas lights on US homes.
Friday 24 th November	Drove with Warren Clarke to Waterman, south of Chicago to meet with Steve and Maureen Bremner, founders of FarmPage.com, a web site providing independent information on pesticides and herbicides, driven by a comprehensive database of available products.
	Drove with Warren Clarke to DeKalb to visit the farm operations of Bob Johnson, which utilise PA applications for variable rate application of inputs on corn and soybean crops.
Saturday 25 th November	Drove with Warren Clarke to Mazon to visit the farm operations of Doug Harford who sits on a Producer Advisory Board of Rooster.com, described as a leading web site providing producers one-stop selling and buying through the Internet.
	Dinner with Warren Clarke then returned to Dundee.

Sunday 26 th November	Flew from Chicago to Washington DC, spending the day touring the sites of the US capital including the Smithsonian National Museum of American History, Capitol Hill and the National Monument.
Monday 27 th November	Caught train from Washington DC to New York to meet with Michael Wolthius and Ties Jan de Blij, Rabobank who are investing in a range of Internet initiatives, under the banner of vTraction.
	Toured the sights of New York including a walk through Central Park, had dinner with long time friend, Nat Barnett before catching a late train back to Washington DC.
Tuesday 28 th November	Met with Charles Batchelor, AgAbuzz to discuss new technology enabling messages sent by subscribers to an information service to be read and re-routed to other interested subscribers.
Wednesday 29 th November	Caught a train to McLean, Virginia to meet with JB Penn, Senior Vice President and Elizabeth Bechdol, Vice President, Sparks Companies a internationally recognised leader in agricultural and food industry research and analysis.
Thursday 30 th November	Met in Washington with Peter Stenberg, Economic Research Service, USDA to discuss usage of the Internet in the US, new developments and any impediments to adoption.
	Met in Washington with Stan Daberkow, Production Technology and Management Branch, USDA to discuss PA technology adoption in the US.
	Flew from Washington to London arriving Friday 1 st December.
Friday 1 st December	Toured the sights of the City of London including a visit to the High Commissioner for Australia.
	Dinner with long time friend Fiona Plant, staying in London.
Saturday 2 nd December	Flew from London to Melbourne via Singapore arriving Monday 4 th December.

UNITED KINGDOM AND EUROPE, JUNE 2001

Date	Activity
Friday 1 st June	Flew from Sydney to Melbourne then on to London via Singapore, arriving Saturday 2 nd June and staying two nights in London.
Saturday 2 nd June	Drove with friends to a farm just north east of London for the day, surviving until 10pm that night to the surprise of many having arrived at 6am that morning from Australia.
Sunday 3 rd June	Toured the sights of London including lunch at Hampstead Heath.
Monday 4 th June	Caught a train south east of London to West Malling, Kent to meet with Graeme Kemsley, Business Links, a not-for-profit franchise company providing business skills to SME's, particularly in agriculture with an emphasis on technology such as the Internet.
	Drove with Graeme Kemsley to Yalding and stayed overnight.
Tuesday 5 th June	Picked up by local farmer, Bernard Veall who provided a tour of the conventional and organic farms he owns in the Yalding district.
	Drove to Maidstone with Bernard Veall to tour Weald Granary (grain storage facility operated by a marketing cooperative), meeting with Chairman Richard Pierce and also Steve Harrison, a grain trader with SCATS (Southern County Agricultural Trading), the firm that does the marketing of the grain stored at Weald Granary.
	Caught a train back to London, staying two nights.
Wednesday 6 th June	Met in London with John Colley, Senior Agriculture Manager with HSBC who bought Midland Bank in 1993 and have a very large agricultural portfolio.
	Met in London with Paul Ibbott, Chief Arable Adviser, National Farmers Union.
Thursday 7 th June	Met in London with Prof. Graham Jellis, Director of Research, HGCA who collect grower levies to fund grains industry R&D.
	Caught a train to Bristol, south west of London staying four nights with friends.
Friday 8 th June	Drove to Bath to tour the sights.
Saturday 9 th June	Toured the sights of Bristol and drove to neighbouring farming land affected by FMD outbreak, on the Severn, between England and Wales.
Sunday 10 th June	Watched Australia play England in a one day international in Bristol, unfortunately not live at the ground but live on TV due to tickets being sold out five months in advance.
Monday 11 th June	Caught a train to Norwich, Norfolk, north east of London to visit the nearby Morley Research Centre where independent agronomic research is conducted on behalf of 1500 subscribing farmer members. More information is to be delivered on-line and PA and aerial mapping utilised to provide more specialised services.
	Met with Peter Riley, Managing Director of Morley Agricultural Consultants, a separate company to the Research Centre, contracting services per acre. Stayed with his family overnight.
Tuesday 12 th June	Caught a train to Nottingham to meet with Dr Louise Crewe at the University of Nottingham, researching the impacts of e-commerce on consumer trends, including the fashion industry.

	Caught a train to Leicester to meet with Bernard Auxenfans, CEO of FOL Networks, (formerly known as Farming On-line) a company recognised internationally as a leader in web development for agriculture. Stayed overnight in Lutterworth, a small village outside Leicester.
Wednesday 13 th June	Caught a train to Bedford, north west of London to visit the Silsoe Research Institute, the leading research centre for PA in the UK. Met with Dr Murray Lark working on combining the technology with a lot of soil data to better explain variability within fields and Helen Wheeler working on weed mapping and the application of radiometry.
	Caught a train back to London, staying overnight.
Thursday 14 th June	Met in London with Dr Christopher Brown, Technologist with leading specialist retailer, Marks and Spencer working in the Protein Section (fish, eggs, beef, bacon, ...) to discuss the impacts of e-commerce on the sector and opportunities for better supply chain management using these technologies.
	Flew to Rome, staying overnight.
Friday 15 th June	Met in Rome with Jan Poulisse, Senior Economics Officer, Land and Water Development Division, Food and Agriculture Organisation of the United Nations (FAO) to discuss global technology adoption in agriculture and limitations to that adoption.
	Caught an overnight train to Paris.
Saturday 16 th June	Caught a TGV fast train to Poitiers, south west of Paris to visit the 250ha family farm of Cyril Melin adjacent to a nearby village.
	Drove to visit Melin's family holiday home on the Atlantic Coast then back to Poitiers, staying overnight with Cyril's family.
Sunday 17 th June	Visited a neighbouring 1000ha farm which uses PA and is a lot larger than the average which is less than 80ha.
	Large lunch with the Melin family including cousins and other friends.
	Caught a train from Poitiers to Montpellier in the south of France, staying four nights.
Monday 18 th June	Registered for the Third European Conference on Precision Agriculture (ECPA), convened in concert with the Third European Conference of the European Federation for Information Technology in Agriculture, Food and the Environment (EFITA), held in Montpellier.
	Attended a concert in the historical Saint-Pierre Cathedral in Montpellier followed by a dinner party for conference delegates at the Agro-Montpellier Campus, a joint convenor of the conference.
Tuesday 19 th June	Attended the conference all day before catching a bus with other delegates to a dinner at Mas Saint Gabriel, a farm set up to cater for tourists, complete with horses, gypsy singers and traditional French food and wine, to the south east of Montpellier.
Wednesday 20 th June	Attended the conference all day before walking around the city of Montpellier, seeing the sights and having dinner with several Australians that had also attended the conference.
Thursday 21 st June	Caught a bus to the beach and had a swim in the Mediterranean before flying from Montpellier to London.
	Attended a play at the Arts Theatre in London's West End, called 'Closer to Heaven', written by the Pet Shop Boys. Stayed overnight in London.
Friday 22 nd June	Met in London with Stephen Roe and Aidan Bocci, KPMG Consulting to discuss technology adoption in general and more specifically supply chain management in the retail sector globally.
	Flew from London to Sydney via Bangkok.

HIGHLIGHTS

My study trip got off to a great start with a lunch meeting in Sacramento two days prior to the US Federal Election with Ann Veneman who was to become the US Secretary of Agriculture under George W. Bush's administration three weeks later. Ann's knowledge of agriculture and strong belief in the need to make best use of available technology and seize whatever efficiencies possible in agriculture were inspiring. The first few days in San Francisco and surrounds were great, loving that city in particular. Being in the US during the 2000 Election was also an interesting experience given all the delays in deciding the eventual winner!

The collective knowledge of the staff and major clients of Beeline Navigator in and around Fresno, California helped explain and demonstrate the real potential of precision agriculture and the progression of agriculture. Meeting in Fresno with Richard Mead from mPower3, a subsidiary of Conagra, further enhanced my thinking on supply chain integrity and applications for both precision agriculture and e-commerce to achieve efficiencies.

Sitting in a bus station from 11pm to 4am in Dallas, Texas was an experience not for the faint hearted but really eye opening, nonetheless. The bus trip south to Texas A&M University was worth it, seeing some interesting technology but also enjoying experiencing the campus in full swing. Similarly, driving from Atlanta to Tifton in the south of Georgia was a great opportunity to experience the southern states and a different sort of agriculture to other parts of the US.

A meeting with Market Street Services in Atlanta gave me an excellent insight into regional development in the US and how to work with communities to sustain populations and viability with lessons for Australia.

Chicago was great, visiting the Board of Trade and other sights with so much going on and a feeling it is a city where things really happen. Illinois is the home of the big agricultural machinery companies and it was good to see first hand the new product development and innovation from Case New Holland and Caterpillar. They are very progressive and aware of the needs of growers in a global market place.

Washington DC is a real national capital with the history and inference of power everywhere but a diversion to New York was well worth it, meeting with Rabobank to discuss some e-commerce projects they are working with as well as seeing the amazing place that is New York City.

A return to Australia mid-project for family reasons provided an opportunity to think about what I had seen in the US before going on to the UK and Europe. I resumed my travels with a stronger belief that these technologies were not only beneficial but essential to address the increased demand for integrity of agricultural supply chains and better environmental management.

A visit to a training provider in Kent, working with SME's particularly in agriculture to enhance business skills including the use of the Internet, reinforced the need to upskill farmers to be able to take advantage of these new technologies. Visiting farmers in Kent and other parts of the UK was a great experience to get a handle on the extent to which agriculture is struggling, in particular due to Foot and Mouth Disease, Mad Cow Disease and increasing consumer pressures. It is clear that agriculture is losing its influence in the UK and the rest of Europe and there is more of a land management than a production focus for governments.

Key people I met with in London included a banker with HSBC and a scientist with a large specialist retailer, Marks and Spencer. Their perspective on agriculture and where it is heading was invaluable. A dinner meeting with Bernard Auxenfans, CEO of agricultural web publishing company FOL Networks, (formerly COO of Monsanto) was a fantastic opportunity to discuss a range of issues relating to agriculture globally, not least being how to embrace technology and obtain its full potential.

Half a day with Jan Poulisse, Senior Economics Officer, Land and Water Development Division with the FAO vindicated my decision to travel to Rome. He gave a global perspective on agriculture and gave parallels to the adoption of precision agriculture from third world countries but also the developed nations, describing key influences and impacts. There is a need to do more with the FAO to gain that wider perspective on these sorts of issues.

To spend a few days visiting French farms was another great opportunity to experience first hand the problems facing agriculture in Europe, despite the language barrier. Scale and over regulation are seen as the two things holding the industry back. Distortions due to the Common Agricultural Policy are everywhere and changes are apparent as new entrants to the EU wait in the wings.

Attending the Third European Conference on Precision Agriculture (ECPA), convened in concert with the Third European Conference of the European Federation for Information Technology in Agriculture, Food and the Environment (EFITA), in Montpellier was great timing. These two conferences covered exactly the intent of my Fellowship and gave me exposure to the 'who's who' in Europe on these topics. Their simultaneous nature reaffirmed a

belief that there will be a convergence between these technologies to move agriculture forward. An interesting observation was that no one in Europe has really advanced precision agriculture very far in recent years and the stand out performers at the conference were Australians from the Australian centre for Precision Agriculture at the University of Sydney!

The final meeting of my travels was with two KPMG Consulting staff in London on my way home to Australia and it proved well worthwhile. It provided a diagrammatic summary of how technology can make best use of people's skills by automating mundane tasks such as data collection, freeing up people to be able to think and make decisions based on the data being collected. It helped answered my question of impact on communities and gave the way to sell the adoption of these technologies to people in Australia.

APPENDIX

UNITED STATES OF AMERICA

The Nation

The US is as big and brash as I thought it would be and the people are very open but tend to be very US centric, perhaps best defended by the strong patriotism to their country, shown by the Stars and Stripes being everywhere, in houses, cars, shops, and schools. Being in the US less than two months after the Sydney Olympics, the US loved Australia and a surprising number knew of Roy and HG!

The big cities were fantastic despite no clear air and no clean water in the cities; a cost of so called progress in any big city. The best aspect of the cities, apart from the tourist sites like where JFK was shot and the Golden Gate Bridge, was the many different sorts of people. In particular the group of people you find in a Dallas bus station at 2am in the morning. A more bizarre feature noted while travelling were the drive through ATMs, which were a spin out, especially as they still have the Braille on the key pads!

The difference between the north and the south still remains despite the Civil War being in the late 1800s. There also appears to be a very thin veneer of righteousness over deep held racism in the southern states.

Roads and infrastructure

Driving on the wrong side of the road was weird at first but not too bad although the cars are amazing, being predominantly new, with everyone driving huge 'pickups' and guzzling fuel like it is free which it almost is, especially compared to current Australian fuel prices. Everyone travels at least 10mph over the speed limit and few indicate when turning or changing lanes. All the bumper stickers relate to either religion or politics and tend only to be found on old cars.

The Interstates, designed by Eisenhower post WWII are fantastic, making logistics work so well with overnight delivery possible to anywhere in the US. The car will always be king in the US, but here is a shift being made back to rail, as it is seen as more efficient and cost effective.

US Presidential Election

The presidential race was all consuming in the media leading up to the election but on the streets and at the polling booths on Election Day, it was very low key and many of the booths are located in schools but classes are operating as per usual. The low key approach was likely to be due to voting not being compulsory so that any one at the booth has made his or her decision prior to getting there so no one bothers. People will quite openly tell you for whom they are going to vote.

The failure of a clear result was a source of great embarrassment for many US people, so proud of their democracy, the most revered in the world. However, democracy was at its finest with every vote counting in the final decision. Worst part of the inability to get a result was the airtime on all the TV stations with a choice of the protracted US election dramas or religious evangelists!

The Economy

The US economy appeared to be slowing dramatically and the so-called new economies of the Internet and dot com's had really hit the skids in November 2000 with venture capital running out and few results coming from the hype of the new era. This was very prevalent in the agricultural dot com's.

Agriculture

US agriculture is facing many of the same issues as their Australian counterparts. Those of greatest importance include continually declining margins and increasing government regulation on land use and management practices. Government reporting for EPA requirements on things like pesticide application is becoming far more demanding, reflecting societal attitudes, especially in higher population areas like California. Water is becoming almost prohibitively expensive at approximately US\$100/acre and requirements for efficient use are dramatically increasing.

Government wants efficiencies in agriculture but are not allowing consolidation of farms to get scale due to land ownership laws in many states being very restrictive. The most extreme case being a Californian farmer's 14 year old son legally separating from his parents under the Emancipation Act to be able to own land in his own right.

There is a lot of social pressure to maintain or perpetuate family farm unit for social not economic policy, something which could arguably be better handled by welfare agencies than the US Department of Agriculture (USDA). There is a real apparent threat to family farms with larger corporate style farms becoming predominant in areas where permitted, giving the economies of scale required to afford the latest technology such as PA. There is also an argument that the corporate farm is easier to manage for environmental compliance.

Urbanisation Impacts

The major competing land use is urbanisation with cities expanding as people move away from rural areas. For example, in the 1950s, more than 50% of people were employed in agriculturally related industry in the southern states, but that figure is now less than 5%. This drain of people is also undermining the political clout of agriculture in the US, a traditionally strong lobby group that is losing its influence and also becoming more fragmented. This loss of influence is highlighted by the failure of both presidential candidates to mention agriculture in accepting nomination for the 2000 US Presidential Election, and there was only a single question on agriculture in the three separate nationally televised debates involving the two candidates.

R&D and Information

Despite this decline and a fall in contribution of agriculture to the US economy, funding for land grant universities is seen by most as a sacred cow and unlikely to be touched in the foreseeable future due to political will and tradition of such funding. Land grants for "agricultural and engineering" universities commenced in 1862, passed by Lincoln while US Civil War was going on to "educate the common people", that is the general public.

Universities are very well resourced, employing a lot of people and acting as the focus for much of the research and extension across the country, servicing US farmers very well. Pressure on academics is less commercial and more peer review with positions very competitively sought after. This lack of commercial focus is reflected in the lack of sensitivity to poaching of information, with little protection of IP. However, it is becoming more of an issue with South America stealing market share from traditional US markets, using US ideas and methodologies.

Labour

Attracting good staff into agriculture is increasingly difficult and there are often labour shortages. This is becoming more of a problem as equipment and technology becomes more advanced. People are not staying in rural areas, preferring to move to the cities and if they do stay they want more money. The seasonal nature of farm work makes it less attractive and peak times such as harvest are very difficult.

Progressive Farmers

Most leading farmers have a level of vertical integration in their business either up (inputs) or down (processing) the value chain eg: shares in a cotton gin, ag dot com's.

Many of these same leading farmers who are frustrated with traditional delivery methods such as the land grant universities and the USDA are now seeking greater levels of information, linking directly with industry and consultants, indicating a surprising willingness to pay. The largely free extension services have distorted many farmers' perception of the real value of information such as the cost of attending formal training courses. Despite this, a concept such as *Shared Solutions* with information freely distributed amongst groups of farmers is very unlikely to happen in the US. This is something that is needed to ensure the US agricultural sector can prosper in a changing environment.

Most farmers do not see marketing as part of their required skill set for production agriculture but more and more recognise the need to get assistance in this area. An interesting comment indicated that farmers are the best buyers, being able to sniff out a bargain so should also be to be good sellers as the skills are similar but this is not often the case. US farmers are just as concerned as Australian farmers are of multinationals controlling too many elements of the supply chain.

UNITED KINGDOM

The Nation

The square mile of the City of London controls the finance of the world, contributing so much to the country's economy. A lot of wealth has returned to London in recent years, especially from Hong Kong and the sub-continent.

The concentration of population in the cities, in particular London, is amazing. It is claimed that the highest concentration of people in the world is between Leeds and Liverpool ie Manchester, Halifax in the old industrial north of England!

Almost 60% of UK households are only 1-2 people and the average meal preparation time is 15 minutes and falling all the time, with the mother no longer in the home preparing meals all day. Supermarkets are specifically catering for this market and patriotic purchasing is becoming a nonsense idea, with consumers needing a real reason to buy British.

The Economy

On the day of the UK election (7th June, 2001) the British pound dropped to its lowest level in 15 years against the US dollar, with speculation as to whether the UK would join the common European currency. Financial markets in London, where the most Euros are traded, see it as a likely positive. The UK would need to join the Euro at the right price level, with 67p being close to optimum, considering agriculture and other aspects of the economy. The Labour Party, the successful candidate in the election, is seen as more favourable to entering the Euro and while most of the population see joining as inevitable, they would prefer to retain the British pound.

UK Election

The election in the UK was very different to that in the US, with people far more reserved about whom they vote for and greater campaigning on polling day. The outcome was seen by many as inevitable, with little opposition to Labour from the Tory Party. Tony Blair appears to have surprised many with the successful way he has handled the role of Prime Minister, but many of his Cabinet are very unpopular.

Agriculture

Declining Prices and Impact of the British Pound

Agriculture in the UK is in a poor state and poor profitability in recent years has stemmed any technology adoption and advancement of the industry. This has been recognised by government, with moves to a strong focus on lifting the business skills of farmers.

Currency is so critical to agriculture, and the high British pound against the Euro and US dollar has impacted heavily on UK agriculture, with other European countries gaining competitive advantage. Lower pound sterling and high grain prices saw a very good year in 1995 but there has been a 67% fall in farm incomes since that time, a drop no business can adjust to in such a short period of time, so agriculture is suffering badly. This has seen many UK farms become less viable but farmers are still trying to live the lifestyle their parents entertained!

Food Scares

The UK has had its fair share of food scares in recent years with Salmonella in eggs in the 80s; mad Cow Disease (BSE) in the 90s culminating in the House of Parliament banning beef exports in 1995; and now Foot and Mouth Disease (FMD). This outbreak has been catastrophic for much of the UK, exacerbated by abattoir closures, meaning further distances to travel to kill animals so diseases spread very quickly. Further to this, one animal may change hands 4-5 times before being slaughtered.

Four million cattle were slaughtered due to FMD but 600,000 are slaughtered each week in the UK normally. Four percent of the dairy herd was slaughtered due to FMD, equating to 13-14 days milk production. Flow on impacts for agriculture go far beyond lost animals, to include other aspects such as lost farm tourism, with many footpaths closed due to the FMD outbreak.

Ramblers who push the "free to roam" notion of being able to walk across farmers land any time they like have gained a better understanding of agriculture following these closures of public rights of way and footpaths as a result of the outbreaks.

Common Agricultural Policy (CAP)

The CAP is the biggest spend by the EU on any program but per farm is actually less than the US, reflecting the number of small farms in Europe, in particular on the continent. The UK and Germany are the only net contributors to the CAP within the EU while France is neutral and all others are net beneficiaries, with the program designed largely for these countries.

CAP consists of blue (production), orange (transition) and green (environmental/social) boxes for funding with far more to go into the green box, at the expense of the blue box in the next 5-10 years. That is, subsidies are likely to become more agrienvironmental in nature, a trend being seen globally. Due to the contribution of CAP to annual income, politicians exert a lot of power and have the ability to use the big stick approach to influence change in practices such as environmental considerations.

Taking away the CAP funds would see many farms not making a profit in the UK since almost 30% of their total farm receipts come from the EU subsidies. If the CAP was dropped, while the perception is that people would go broke, things would be likely to ratchet down to compensate with lower land rents and reduction in other services, currently inflated by the existence of the program.

Lessening Influence of Agriculture

There has been a definite loss in political clout for agriculture in the UK in recent years, best seen by UK government not accepting 2-3 billion pounds in EU money owed to them under CAP. This is money conditional on the UK government matching pound for pound and they are unwilling to do so!

Agriculture is only 1% of GDP in the UK compared to 40% in New Zealand with the potential to either ignore it completely or recognise the ability for the other 99% to support the 1%, a far easier equation than 60% supporting 40%.

The larger farm sizes relative to the rest of Europe makes the UK more able to withstand a reduction in EU support compared to countries such as Greece and Italy. In the UK, farms are traditionally left to the eldest son while in other European countries it is split between siblings preventing economies of scale to be achieved. Despite UK farms being far larger than the rest of Europe, scale is still a major issue. A viable unit is now 1200 acres, compared to 700 acres only 20 years ago. Restructuring is inevitable with sharefarming likely to become more prevalent in the UK. Wheat is the only crop that stands up economically in the UK, with oilseed rape (canola) the only break crop that comes close.

Farmers are starting to question why they are trying to produce low value commodities in such a high cost environment like the south east of England, due largely to competing land use, in particular for residential development. Many farmers are renting out buildings and houses to new local businesses or people wanting a lifestyle choice in the south east of England such as Kent. The "mad mothers in Volvos" syndrome can be seen throughout the south east with ladies driving their husband's company cars at great speeds around narrow country lanes, making life very treacherous for farmers and others. Transport vehicles are getting larger to handle greater volumes and accordingly also exacerbate this problem.

Farm size is increasing in the UK and the farming population is getting older, with many of the next generation not interested in farming. People talk of new entrants to agriculture but barriers, such as the cost of land, are too high. Furthermore, farm employment is falling, with only 2% of the population now involved in agriculture. Fewer and fewer people are producing more and more for people who care less and less about agriculture. They are more interested in the social and rural issues than agriculture itself and more interested in food standards than those producing the food.

The primarily urban population is having less and less to do with agriculture, creating a lot of misconceptions, exacerbated by the proximity of the agriculture to the population. Kent is right next door to London, being an hour by train and Londoners travel to East Anglia for the weekends. This does not really happen in the Mid-west of the US or Wheatbelt Western Australia. These people are the consumers of the produce and have become far more discerning of what goes into what they are buying. Chernobyl, Mad Cow Disease and Foot and Mouth outbreaks have not helped this consumer caution.

Initiatives such as the little red tractor from the National Farmers Union (NFU) have been instigated to try and regain consumer confidence, but with limited success. Customers such as supermarkets are trying to pass responsibility back down the chain to the farmer due to pressure from their customers, them being the consumers themselves.

Value Chain Programs

Many assurance schemes have been set up to attempt to avoid risks but in reality they are bastardised ISO9000 programs that assure very little but address market specifications. These are not well received by farmers with compliance (audit) costs a frustration, despite being quite cheap, being approx. 250-300 pounds annually. This

frustration is due to most of the procedures already being done by farmers as a matter of course such as calibration of sprayers, fertiliser spreaders. It is the need to formally record each of these that is seen by many as an unnecessary burden, adding more cost and no apparent benefit.

Similarly, these programs are not well received by supermarkets who see them not as QA schemes but farm specification schemes designed to let all farmers in! People from both sides seem to believe that market forces, not some QA process, will ultimately determine who does or does not sell their commodity.

Labour

Reliable and cheap labour is a large problem for agriculture, exacerbated by new labour and minimum wage laws introduced in 2000 by the Blair government. There are large schemes coordinated by the UK Home Office to attract cheap Eastern European labour each summer especially for harvesting soft fruits. However, 20% of the crop was still not harvested in 2000 due to labour shortages, despite almost 3000 people allowed in each year under the scheme. They all work hard with many earning more in a summer in the UK than in a whole year in salaried positions at home, as doctors and lawyers.

R&D and Information

In 1999, 52% of farmers sourced chemical advice from resellers, down from 65% two years earlier, reflecting a change in where information is coming from and a greater preparedness to pay for information. The balance was 29% independent advice and 19% only using their own recommendations. Concern has also arisen due to the concentration in recent years of chemical manufacture, in particular fertilisers, with only two main players remaining in the market and potential cartels being formed.

Banks and accountants can show that the better farmers are sourcing independent advice. Many of the major banks are targeting the top 25%, seeing them as being the ones in business in the future but many also feel some moral obligation to assisting others to adjust either within or outside the industry.

Grains R&D is now done largely by Home Grown Cereal Association (HGCA), after Thatcher stopped MAFF doing other than "core" research in 1987. This left "applied" or "near to market" R&D to HGCA but with far less financial resources available for applied research than before. HGCA is now seen as the authority in the UK on recommended lists for crops.

CONTINENTAL EUROPE

Many European countries need to get their act together, either due to environmental pressures or trade pressures. For example, Turkey wants to join the EU but is unlikely to be accepted unless changes are made to the structure of the industry and its impact on the environment. However, assuming they do so, there will be a greater productivity than ever before. Hungary is likely to reach current productivity levels in France within 20 years and Turkey will reach Hungary's current levels in 10 years.

There is a lot of pressure on land use in France due to urbanisation and environmental considerations with green lobby movement having a lot of influence. The influence of the green movement can be seen across Europe, with the German Agriculture Minister a former environmentalist and able to have a strong influence on broader EU policy.

The power base of farmers is being eroded in Europe, with consolidation of farms meaning fewer farmers and less representation on local councils where much of the power starts, leading on to provincial and federal governments. They still dump wheat on the Champs de Lysee but as much for sport as anything!

As in Australia, 20% produce 80% but the larger farmers do not like to flaunt their wealth in local communities, preferring to be modest. The average farm size in France is 35ha, with most paddocks less than 10ha in size. The lifestyle of farming is still highly valued by French farmers and while what this involves is not really appreciated by urban communities, farmers have maintained a good profile in the cities.

It is acknowledged by most that it is likely to be more economical to pay subsidies and keep farmers as producers, but more importantly land managers, than have a large welfare problem in rural areas.

Frustration about the "liberation" of France is now being lost due to regulation from government and industry and farmers can see real potential conflicts globally over land and water access. A number of French farmers are keen to form consortiums with other grain producing countries, similar to an OPEC analogy, to regain some control over their commodity whose value in real terms continues to decline.