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Editor
Arthur Tatnall

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Submissions are welcome for research articles of between about 5,000 and 10,000 words in any area relevant to the journal's coverage. Potential articles should, in the first instance, be sent to: Kate Hill at the Victoria Graduate School of Business: Kate.Hill@vu.edu.au

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Contents

Editorial

In its final issue for 2006 the *Journal of Business Systems, Governance and Ethics* again offers a variety range of business-related research issues that this time range from older people's use of the Internet in Australia to job satisfaction of Taiwanese expatriates. Other articles deal with agricultural innovation systems, plagiarism, letters of credit and technology to isolate software systems and agents from change.

Older people around the world are adopting the Internet at an increasing rate, and in the process are forming virtual community networks in a way that would not otherwise have been possible. In the first article in this issue: *Using Actor-Network Theory to Understanding Virtual Community Networks of Older People Using the Internet*, Lepa and Tatnall make use of actor-network theory to explore the phenomena of older people and their use of the Internet. Some of these Internet interactions, including e-mail, chat groups, community forums and discussion group, relate older people to other older people. Other virtual networks span age groups as when, for instance, a grandmother communicates by e-mail with her grandchildren. The article takes a socio-technical stance and provides an analysis of these virtual networks based on research in an Australian context.

The next article, by Sudath Arumapperuma, deals with *Agricultural Innovation System in Australia*. In the article the author identifies eleven actors: policy, education, finance and credit, marketing, input supply, research, extension and information, logistics, processing and storage, farmers and farm organisations and consumers. The study reveals that the majority of funding for innovation activities comes from the Federal Government and funding bodies, and survey results indicate that the main constrains/incentives are issues including funding, lack of qualified staff, equipment, environmental and Government policy issues.

Darbyshire and Burgess then tackle the issue of plagiarism in an article entitled: *Strategies for Dealing with Plagiarism and the Web in Higher Education*. They note that there were few academic publications dealing with plagiarism prior to the introduction of the Web, but that since its introduction this number has risen, suggesting that plagiarism is occurring on a more frequent basis since the introduction of the Web into university classrooms. In their paper they present a case study, from Victoria University, of changes made to adapt assessment procedures. The case study illustrates different approaches utilised in two different courses, both of which highlight how careful consideration of the design and assessment techniques used in learning activities can reduce or even remove the problem of plagiarism.

Chiu-yi (Pei-Chen) Lee next investigates: *Job Satisfaction Affecting Cross-Cultural Adjustment in Taiwanese Expatriates*. She notes that due to increasing internationalisation of world markets, international expatriate assignments have become essential for many multinational corporations. In this article Lee investigates the relationship between the job satisfaction and cross-cultural adjustment of Taiwanese Bank expatriates assigned to America.

Bergami then looks at: *The Link Between Incoterms 2000 and Letter of Credit Documentation Requirement and Payment Risk*. He begins by noting that letters of credit are an important finance instrument for international trade and are particularly useful where the transactional values and trading risks are high. The article explores the link between international delivery terms and documentary requirements of the letter of credit.

In the final article, Darbyshire investigates: *Using XML to Help Isolate Software Systems and Agents from Change Due to Communications*. Darbyshire notes that research and development related to distributed and agent-based systems has grown enormously over the last few years, and the number of practical applications for such systems has grown along with it as the technology and infrastructure improves to accommodate such systems. With the growth of distributed systems and Service Oriented

Architecture, however, another dimension of change needs to be considered: communication. This paper discusses the use of XML for the construction of agent-based messages, and presents a simple approach for the deconstruction of messages by receiving agents.

All papers in the journal have been subjected to a process of blind peer review by at least two reviewers. Articles were then only accepted after appropriate changes and corrections had been made by the authors. We hope that you find the content of this issue both interesting and readable.

Arthur Tatnall

Editor

Using Actor-Network Theory to Understanding Virtual Community Networks of Older People Using the Internet

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Abstract

Older people around the world are adopting the Internet at an increasing rate, and in the process are forming virtual community networks in a way that would not otherwise have been possible. Internet interactions by this group include e-mail, chat groups, community forums and discussion groups as well as the individual use of the Web for information purposes. Some of these virtual networks relate older people to other older people, while other networks span age groups as when, for instance, a grandmother communicates by e-mail with her grandchildren. But linking to the Internet is not always straightforward as family members, friends and the technology, along with other non-human actors, often intrude. This highlights the socio-technical nature of these networks and the need to investigate them in a way that allows this to be seen. To attempt an understanding of the formation and operation of virtual networks of older people, and the interactions involved, a socio-technical approach is required and this paper will attempt such an analysis based on research, in an Australian context, undertaken by the authors.

Introduction

Worldwide the proportion of older people is growing. Increasingly this group is accessing the World Wide Web for a variety of purposes including e-mail, finance, health and genealogy. Many use the Web as a means of reducing their social isolation (Swindell 2002), even though there is some evidence to suggest that social isolation may increase with the reduction of face-to-face contact with family and friends. The term 'virtual community of older people' is a very broad term describing the group of older people who access the Web. The literature reveals different interpretations of this term and also different types or classifications of virtual communities.

There are several different definitions of what constitutes an 'older person' but for the purposes of this paper we will define older people as those of sixty-five years of age and over, no longer in the full-time workforce. The proportion of older people in Australia will increase dramatically over the next 25 years. Foskey (1998) notes that since the 19th century there has been a 'longevity revolution' in the Western world and that in Australia during the past decade, the over sixty-five age group, living in non-metropolitan areas, has seen the greatest rate of growth.

Figures from the Australian Bureau of Statistics (ABS) indicate that older people are taking up Internet technology at a rapid rate, but that their use of the Internet for electronic commerce (e-commerce) activities remains quite low, with older people forming just 1% of the total of adult Internet shoppers (Australian Bureau of Statistics 2000). The ABS defines *older people*, for statistical purposes, as those who are *fifty-five* years of age and over.) Individual older people often have particular needs that differ from those of younger people, and it appears that use of the Internet may help with some of these. As people grow older they can become physically less mobile and could benefit if they were able to conduct more of their financial affairs, such as banking and bill paying, from home. In other words, e-commerce has something useful to offer them. The research literature (Williamson, Bow and Wale 1996; Council on the Ageing 2000; Mitchell 2000; Lloyd 2001), however, and also data from an Older Person Focus Group in Melbourne (Council on the Ageing 2000), reveals significant barriers to the adoption of e-commerce by older people.

This paper investigates older people's use of the GreyPath portal, a site designed to appeal to the interests of older Australians, but open to everyone. We argue that those older people making use of the portal constitute a virtual community (Lepa and Tatnall 2002; Lepa and Tatnall 2004).
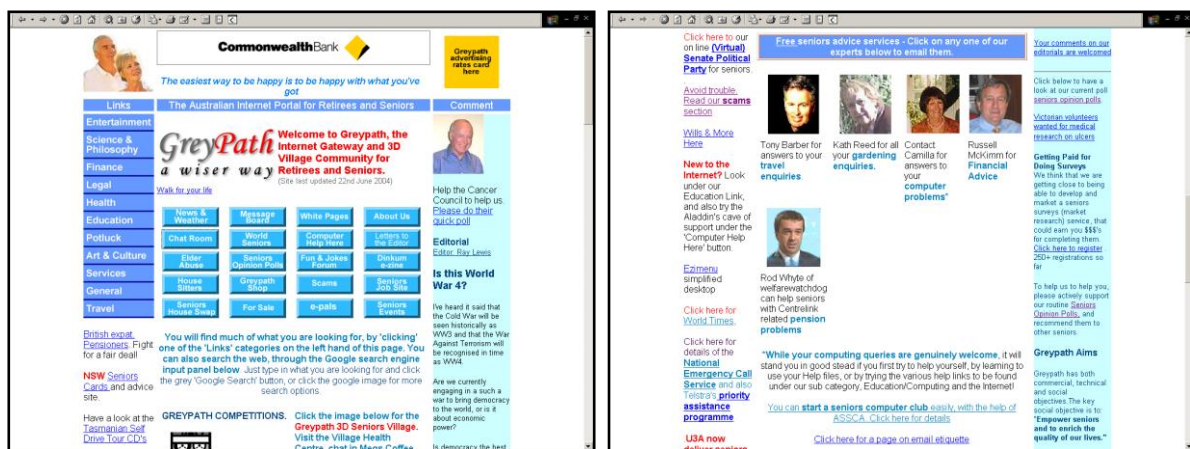

Figure 1: The GreyPath Portal – home page

Virtual Communities and the Internet

The Collins English Dictionary (1992) defines a *community* as "a group of people having cultural, religious, ethnic or other characteristics in common." A *virtual community* is a group of people who share a common interest or bond, but rather than meeting physically they "form communities that cross geographical, social, cultural and economic boundaries" (Matathia 1998:156) and communicate via the Internet (Matathia 1998; Schneider and Perry 2001:10). Rheingold (1993:5) defines virtual communities as "social aggregations that emerge from the Net where enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace". Examples of virtual communities on the Internet include music lovers with an affection for a particular genre, teenagers battling through 'the trials and tribulations of adolescence', and the group of older people who share a common life stage (Matathia 1998).

There are a number of alternative names for virtual communities such as 'communities of interest' (Hagel and Armstrong 1997) and 'Internet cultures' (Jones 1995). From an on-line marketing perspective Muniz (1997) calls them 'brand communities' and Kozinets (1998) uses the term 'virtual communities of consumption'. Barnatt (1998) suggests that there are two categories of virtual community: off-line and on-line. Both categories share common interests and bonds but on-line, Internet-based virtual communities today "allow a wide range of global individuals to argue, share information, make friends, and undertake economic exchanges, in a flexible and socially-compelling common on-line arena" (Barnatt 1998). In contrast, members of an off-line virtual community do not

communicate directly with one another but are reliant on 'broadcast' mediums such as newschapters, TV and radio to sustain their common interests or bonds.

The group of Australian older people who use the Web share the common bond of ageing (Bosler 2001) and can be considered to form an on-line virtual community. Matathia (1998) suggests that these on-line relationships can be every bit as strong and permanent as their 'real world' counterparts. Individuals in this group, prior to accessing the Internet, would have been classified as part of the off-line community of older Australian people.

The term 'online community' has various interpretations. Armstrong and Hagel (2000) refer to online communities as 'electronic communities', while Jones (1997) calls then 'virtual settlements'. Rheingold (1998), an early pioneer, states that "Virtual communities exist and play a socialisation role to the same extent as 'real' communities do". Barnatt (1998) suggests that "although a 'virtualised' community is "not there" in the same sense that a geographically based community is assumed to be, it is still guided by passions and projects, conflicts and relationships". Other authors, Henri and Pudelko (2003) note, do not support the concept of virtual communities. "… since for them the concept of community cannot be dissociated from a common physical space and from a history shared by its members, two elements on which complex social relationships are based." Jones (1997) suggests that a 'virtual settlement' has four major features:

1. a minimum level of conversation between communicators;
2. at least two communicators must participate;
3. the 'virtual settlement', can be a single or group of Web sites that should be readily identified as a place in cyberspace. Hamman (2003) calls this an 'online third place' which can take the form of chat rooms, chat groups, lists, electronic mail, and conferencing systems;
4. the 'virtual settlement' should feature a "sustained, long-term membership".

An online community, Preece (2000) suggests, should consists of:

1. "*people*, who interact socially as they strive to satisfy their own needs or perform special roles, such as leading or moderating;
2. a *shared* purpose, such as an interest, need, information exchange, or service that provides a reason for the community;
3. *policies,* in the form of tacit assumptions, rituals, protocols, rules and laws that guide people's interactions;
4. c*omputer systems,* to support and mediate social interaction and facilitate a sense of togetherness."

There are several types or classifications of virtual community including that proposed by Henri and Pudelko (2003) based upon Wenger's social learning theory. For this paper, however, we have chosen the classification proposed by Armstrong and Hagel (2000):

- **Communities of transaction**: involves the buying and selling of goods and services and members are encouraged to interact with one another by interchanging information about these goods and services. An example is www.wine.com – a virtual vineyard, but this site does not allow for visitors to trade information with each other.

- **Communities of interest**: members interact extensively on a specific topic area. Garden Web, www.gardenweb.com is a site where visitors can share ideas with others.

- **Communities of fantasy**: "participants create new personalities or personas for themselves and act out roles as in improvisational theatre". Participants, through the use of chat, can act out their fantasies by assuming the persona of someone like Superman or Batman.

- **Communities of relationship**: "sharing of intensely personal experiences generally while masking identities". These include groups of people focused on cancer care, divorce, widowhood or infertility.

Armstrong and Hagel's (2000) classification of 'electronic communities' and the definition of virtual community from Preece (2000) have been used to investigate the GreyPath portal. Communities of interest such as the group of older person book lovers and art lovers are established when accessing the chat facilities and message boards available through the GreyPath Village and also the main GreyPath site. Visitors to these areas of the GreyPath portal can interact socially and anonymously about their specific interests of books or art. It is possible for many virtual communities to exist at any one time and also the same people can belong to many different virtual communities concurrently. The GreyPath chat rooms and message boards facilitate all of this. A visit to the chat rooms at GreyPath did not show any evidence to support the existence of communities of fantasy or communities of relationship. The GreyPath portal does not support community of transactions as there is no buying and selling of goods or information exchanged between potential customers.

Older People and Their Needs

The US-based Spry Foundation (2000) sees the needs of older people revolving around four interrelated themes:
- financial security,
- physical health and well being,
- mental health and social environment, and
- engaging in intellectual endeavours.

Older people have many needs, and a recent study in the United States showed a wide range of responses in terms of the concerns of older people (Wenger 1997). The study did reveal, however, that health (physical and mental) and mobility concerns were paramount and showed a larger degree of consensus across the sample. Financial security is seen as particularly important by older people who, in retirement, need to be assured of adequate income to maintain their lifestyle. Many older people in Australia, as well as in Europe and North America, must arrange their own retirement finances and in doing so seek appropriate investment information (Cutler 1997; Manchester 1997).

The Australian Federal Government has released a number of issues papers that are related to older people's capacity to remain active and independent (Bishop 2000). An important feature of these papers is an emphasis on communication, in particular through the Internet that enables older people to communicate via e-mail with family and friends, to access information and to purchase goods. This emphasis is also consistent with literature sourced from overseas (Franklin 1997; Coulson 2000). The use of e-mail can also reduce social isolation for those older people with reduced mobility or living in remote or rural areas (Bishop 2000).

Mental Health and the Social Environment

Maintaining communication skills into old age is an important factor contributing to health and well-being (Worrall 1998). Communication skills can deteriorate with age due to reduced memory capacity, sensory deficits, and increasing word-finding difficulties. Shulman (Shulman 1988) suggests that as people grow older it is vital that their social networks and independence do not diminish in a society that revolves around more complex communication systems. Reduced communication skills in older people can result in social isolation. The Internet, particularly through its e-mail and chat technology, may help older people to avoid this isolation.

Social isolation can, potentially, be reduced through communication by accessing the Greypath Village chat rooms and also by leaving mail on the GreyPath Message Board. In the Village 3D virtual community visitors can chat anonymously at any time but particularly at popular times advertised by the Village Bulletin Board. Another way that the GreyPath portal may help older people to maintain social communication skills is by providing access to free on-line advisors who may not be available in a small local community either through physical access or via phone contact. For example, on the portal:

- o   Tony Barber will answer questions on travel.
- o   Free advice is available on gardening.
- o   Medical advice is available for queries on disability issues.
- o   Enquiries can be made regarding the health of pets.
- o   Assistance is also provided on problems with computers or the Internet.

These can be significant services as small rural communities, in particular, may not have a local travel agent and it may be too expensive or inconvenient for these people to phone one in a larger town or city. Similar comments may also be applied to pet shops, computer stores and gardening centres.

Physical Health and Well-being

Byles et al. (1996) point out some other health concerns of older people include falls, inappropriate medication use, incontinence and nutritional deficiencies. These medical problems, he notes, can often be alleviated with appropriate health education programs, and the Internet may be an effective medium for the delivery of these programs.

By entering the GreyPath Village older people may easily find their way to the Village Interactive Health Centre where they can obtain one free health consultation from qualified medical personnel. Future consultations are charged for. Also there is a pharmaceutical link which enables older people to find information and to purchase both prescription and non-prescription medication. The Village Interactive Health Centre also has a chat facility where people can share and discuss health problems anonymously. For many older people, this is an important vehicle whereby concerns regarding health may be aired and others who have had similar problems in the past may share their experiences and course of treatment.

Financial Security

Older people in retirement feel a need to be assured of adequate income to maintain their lifestyle. Many older persons must arrange their own finances, and seek appropriate investment information relating to direct shares, managed funds and fixed interest investments including bonds and term deposits (Cutler 1997; Manchester 1997; Sherman 1997). The Internet could also be of assistance in providing information for this purpose.

The main page of the GreyPath portal has a 'Finance' information button, allowing visitors access to general finance advice from organisations such as National Seniors Association, Financial Planners Association of Australia, Comsec, Australian Pensioners Network, the Australian Tax Department and many others. There are also a number of Government programs including CentreLink and the National Information Centre on Retirement Investments.

Intellectual Endeavours

Many people are now working past the minimum retirement age (in Australia) of 55; indeed some older people are commencing new careers and having to learn a new set of skills (Baldi 1997). Others are taking up the challenge of further study, some even commencing degrees at university. Lifelong learning is seen to be a very positive aspect of a healthy ageing process (Bishop 2000), and while this is often delivered well by institutions such as the University of the Third Age (U3A) and the Centre for Adult Education (CAE), the Internet offers the possibility of providing a suitable vehicle for this purpose.

The GreyPath portal also has things that pertain to the 'mind'; catering for older people's intellectual needs. For example, the Village has a number of buildings with chat facilities where people can discuss matters of importance to themselves. The Lyceum building, a site for art enthusiasts, enables visitors to discuss their art interests anonymously. A single click allows the visitor entry to the Lyceum building where they can participate in an anonymous chat session. In addition to chatting, visitors to the Village Lyceum have the opportunity to enjoy a free art appreciation course, covering post 1945 Australian

'icon' artists. 'Lookart', a virtual gallery, together with GreyPath, will be showcasing the works of a series of famous Australian artists over the next 12 months, focussing on a new artist every two weeks. One artist that has been reviewed is Howard Arkley, including information on his career development and exhibitions. Visitors are encouraged to return to the site via GreyPath with the promise of being able to explore the works of many other Australian artists such as Albert Tucker, John Perceval, Fred Williams, Joy Hester, Russell Drysdale, Arthur Boyd, Brett Whiteley, Jeffery Smart and Sidney Nolan. The Lookart virtual gallery provides links back to art gallery sites where some of the pieces displayed will be available for sale along with those advertised through Lookart.

Special Needs of Older People in Rural Areas

People living in regional areas and rural communities may not have the access to all the facilities that are available to those residing in metropolitan areas of Australia's large cities. For example, information needs and provision in rural areas can be different and some rural councils can offer only very limited transport for older and disabled people (Foskey 1998). Because of these problems, people living in regional and rural areas may find the Internet even more valuable than their counterparts in metropolitan Australia. The Internet is *location independent* and so ideal for use in these areas, providing the communications infrastructure is present.

Foskey (1998) speaks of the rhetoric in discussions of aged care that concerns enabling people to 'age in place' and points out how this is particularly significant in the case of rural communities where economic and emotional ties make moving an "unacceptable or unviable option" for many older people. She notes that in some cases they are 'locked' in place by not being able to afford to move because of declining rural property values.

The GreyPath Portal

The GreyPath portal concept was devised by Ray Lewis, a senior, who perceived a need for an Internet portal dedicated to other Australian seniors. As a consequence he developed and manages this portal (Lewis 2002). A Web portal can be seen as a special Internet (or intranet) site designed to act as a *gateway* to give access to *all network-accessible resources* whether involving intranets, extranets, or the Internet (Tatnall 2005). There are many different types of portal including: General Portals, Community Portals, Vertical Industry Portals, Horizontal Industry Portals, Enterprise Information Portals, e-Marketplace Portals, Personal/Mobile Portals, Information Portals and Niche Portals (Davison, Burgess and Tatnall 2004). The GreyPath portal can best be classified as a Community Portal.

Lewis (2002) describes GreyPath as "a uniquely styled, demographically 'inclusive', user-friendly, seniors web portal and virtual community that has been designed first and foremost to empower seniors and to enrich the quality of their lives." GreyPath aims to encourage site loyalty (Lepa and Tatnall 2002), identification with, and participation from its constituency, and in 2002 the portal received some 400,000 hits per month, constituting about 5000 to 6000 different visitors (Lewis 2002). Lewis indicates general benchmark figures for people consistently returning to Web sites are around 20-25 %, but that GreyPath is getting about 37% return rate which suggests a very high loyalty factor. He points out that it is crucial to have people coming back as this means that with the new people you also attract, you are ever increasing your numbers.

GreyPath has three major components:
1. Firstly, there are links that are informational, or categories that pertain to the 'mind' (Lewis 2002). These include finance, legal, health, education, services, travel, art and culture, and entertainment.
2. The second group are more everyday needs type categories that Lewis describes as pertaining to the 'heart' such as relationships, news and the weather.
3. The third major component of the portal is the Village, an innovative virtual community where older people can chat and communicate with each other anonymously about common interests.

Figure 2: The GreyPath Portal – a variety of screens

Lewis (2002) describes the GreyPath Village as a "world's first with a carefully specified and atmospherically crafted Virtual 3D community for seniors." The Village offers a variety of activities and a number of specialised chat rooms Lewis suggests that older people will find it more attractive to chat in the Village compared to many other more sophisticated sites spread across the world. He considers that advantages of the Village include simplicity (user friendliness), a naturalised visual environment, and clear potential for further development. The Village at GreyPath, through its Internet chat rooms, creates a virtual community of older people (Lepa and Tatnall 2002). The Village has eight chat rooms: Town Hall, Megs Café,

Figure 3: The GreyPath Village

Murphy's Pub, the Public Library, St. Isadores, The Lyceum, Village Health Centre, and Monkey Island Golf Club. The idea is that these different chat rooms will allow people to speak easily about different topics with others who have similar interests. A major value of the Village is in strengthening the virtual community by encouraging frequent interactions by its members.

Research Framework

Many older people are quite innovative and entrepreneurial, and are prepared to consider the advantages offered by using the Internet. Conversely, others are happy to continue to do things in the same way they always have and see no need to investigate use of this technology. How and why people differ in this way, and why some adopt some technologies and not others should be considered using the framework of innovation theory. An innovation can be seen as "... an idea, practice, or object that is perceived as new by an individual …" (Rogers 1995), and we will argue that the adoption of the Internet by an older person should be seen as an innovation and considered through the lens of innovation theory. The most widely accepted theory of how technological innovation takes place is provided by innovation diffusion (Rogers 1995), but most of the research based on this model involves studies of large organisations like General Electric, Xerox Park and the British Navy, or societal groups such as bottle-fed babies, adopters of mobile phones and organic farmers (Rogers 1995). This paper argues that another approach – that of innovation translation, has more to offer when considering details of the adoption of the Internet by older people.

The innovation translation approach draws on the sociology of translations, more commonly known as actor-network theory (ANT). In considering how the adoption of e-commerce by older people occurs it is necessary to examine their interactions with a number of other people. It is also important not to ignore the influence of the many non-human actors that are involved, including computers, modems, Web browsers, Internet service providers, e-mail documents and Web pages. In trying to understand this adoption it is useful to see these interactions in terms of negotiations, not just between humans but also involving non-humans.

Actor-network theory (Callon 1986; Law 1992; Latour 1996) attempts impartiality between all actors, whether human or non-human, and makes no distinction in approach between the social, the natural and the technological. Using an actor-network approach all the factors (both human and non-human) influencing e-commerce adoption are seen as actors, and the combination of all of these in terms of networks. It is a feature of actor-network theory that the extent of a network is determined by actors that are able to make their presence *individually felt* (Law 1987) by other actors. Grint and Woolgar (1997) note that an actor-network is configured by the enrolment of both human and non-human allies, and that this is done by means of a series of negotiations in a process of re-definition (Callon 1986) where one set of actors seeks to impose definitions and roles on others. In an innovation translation model the

movement of an innovation is in the hands of people (Latour 1996) whom may react to it in different ways.

One reason often given by older people (Gross 1998; Bosler 2001) for adopting Internet technologies is, quite simply, so that the world does not pass them by and so that they won't be left out of things. The means of social interaction is increasingly moving away from posted letters to e-mail, and those not using e-mail are finding it harder to keep in touch. A growing number of older people are finding that an e-mail address has become essential (Perry 2000). Many older people consider that being able to keep in touch and to converse sensibly about technology with their grandchildren is very important (Alexander 2000). As this requires that they spend some time coming to grips with, and using the technology (Philbeck 1997) they make adoption decisions for this reason. In the same vein, being able to understand what is meant by a 'dot com', and why some people see the continuing growth of Microsoft as a threat, means that they need to engage with the technology (Perry 2000).

These, and related reasons for adoption of Internet technologies such as "All my friends use e-mail and I'll be left out if I don't" (Council on the Ageing 2000) suggest that characteristics of the technology have less to do with things than do social interactions and the creation and maintenance of interpersonal networks. We will illustrate this further in the brief case study examples that follow. Whereas innovation diffusion (Rogers 1995) places considerable importance on (supposedly) innate characteristics of the technology, innovation translation offers a research approach based on networks of human and non-human actors. For older people the issue of whether or not to adopt Internet technologies has been problematised (Callon 1986) in this context, not as one that relates to diverse characteristics of the technology, but as one *specifically* of communication and keeping in touch with family and friends. The growth of seniors' computer clubs is another example of this. The Internet, that is capable of so much, has been *translated* here to include just the means by which these people can maintain their place in society and keep relevant to their family and friends (Bosler 2001). What they have adopted is not the Internet as a business might know it, but a translation of the Internet resulting in technology that offers a means of maintaining contact with the world.

The three short accounts of Internet adoption by older people that follow result from research undertaken by the authors, and give some useful insights into how and why these people *really* adopt this technology. These accounts were derived from a series of interviews with older Internet users in 2001-2002. An important piece of methodological advice offered by the proponents of actor-network theory is to 'follow the actors' (Callon 1986; Latour 1996) and let them set the framework and limits of the study themselves. After initial discussions with the Focus Group, leaders in seniors computing clubs and other people involved in promoting the use of the Internet by older people, this process was followed to identify others to be interviewed. The accounts given below represent only a few of those obtained in this research.

Bernie (2001), a recently retired retail sales manager, has an interest in the stock market. He had, in the past, invested small sums through a firm of stockbrokers, and watched the fate of his shares with interest. The problem had been time, as he had been very busy at work. The lure of purchasing shares had always been, to him, more in the gamble than as a means of making money. Now that he had retired and had a lot more spare time, he had decided to indulge in this hobby in a bigger way. One day he read an article in the newspaper about using the Internet for share trading, and decided to give it a go. Knowing little of computers and the WWW he now needed to do some research into how to proceed. After purchasing the necessary hardware, setting up an account with an Internet Service Provider, and another with the on-line share broking service offered by his bank, he tried to make sense of using the Internet, and came to a full stop. It was all too hard. His motivation to succeed, however, was strong. He found out about a class offered by the local municipal library in use of the WWW, enrolled for the class, and overcame the block. Attending the class reinforced his early view that most of what was on the WWW was of little interest to him, but he did now know how to access any given site and could proceed with his on-line share trading. In terms of innovation translation he had *problematised* the Internet as a share broking service. If Bernie needed any more convincing, the fact that using the Internet was cheaper than his stockbroker, and that it removed the need to listen to the advice of the

cocky young 'share expert', had provided it. This *interessement* quickly came between him and the stockbroker and led to his *enrolment* of the Internet as a means of share trading. *Mobilisation* occurred when he joined an investment club for retired people and began to convince the other members of the advantages of using the Internet.

Roy (2002), a retired history and geography teacher, has an interest in researching genealogy, and in the history of hand-tools used in woodwork, and has made use of the Internet for this purpose. With no background at all in the use of information technology he was initially most concerned that he would not be able to learn to use a computer, but a former colleague who lived nearby sat down with him and gave him some lessons in use of the WWW. He now makes occasional use of the Internet, by accessing computers at the local library, where he looks up information relating to his genealogical interests. He also accesses the Web sites of wood-working tool clubs around the world. With this *translation* the Internet became, to him, just a means of obtaining this information. Other aspects of the Internet were of little interest, and he would not have made the adoption based on what might be considered its *innate characteristics* (Rogers 1995). Roy could not accurately be said to have adopted the Internet as such at all, but rather a translation of it relating just to its use for obtaining information relating to genealogy and wood-working tools.

In a final example consider the case of Jean (2001), a Melbourne grandmother with family in London and Rome, considering the adoption of e-mail as a means of keeping in touch with them. Like many older people she had previously relied on posting airmail letters as she found the cost of phone calls too high. She also preferred writing to speaking on the phone. Electronic mail offered a problematisation of letter writing where the 'letters' could be short, informal, and sent as frequently as required for low cost, in contrast to the longer, more formal style of airmail letters. This offered her a *translation* of Internet use to become just a means of writing letters as often as she wanted, that will be 'delivered' very quickly and for low cost (once the computer system has been set up). Jean saw no point in 'browsing' or 'surfing the Internet' and would not have adopted Internet use for these reasons. This *translation* of the Internet to ignore all these features and concentrate just on letter writing is what was instrumental in convincing her to consider its adoption. All the other characteristics of the Internet were irrelevant to her (Bosler 2001). Without this translation she saw the Internet as too intimidating; now it was something she could understand and handle. *Interessement* was then offered by the informality, lower cost and quicker delivery time of the e-mail, in comparison to ordinary letters. This came between her and her use of ordinary mail and made e-mail seem even more attractive. The result was *enrolment*, as she saw and became convinced of the benefits of e-mail and then adopted this technology. She soon began to *mobilise* the technology by attempting to get other friends in Perth or New York to whom she currently also sent letters, to also adopt e-mail so that she could more easily communicate with them also.

As mentioned previously, this paper aims to illustrate the potential of a Web portal like GreyPath to fulfil some of the information and communication needs of older people, but *not* to set out research evidence to show that it is currently achieving this potential. This research forms a part of an ethnographic project, undertaken by the authors (Tatnall and Lepa 2001), to investigate how older Australians make use of Internet technologies, and how this use affects them in their daily lives. The authors assume that many or most of the visitors to GreyPath are older Australian people, but acknowledge that younger people may also find the site appealing and useful. Unfortunately this makes using the 'hit statistics' made available by those operating the site a little suspect.

Further Research

Further research could consider general issues such as: how do older people gain access to the Internet? Do they use it mainly from home, from local libraries, clubs or elsewhere? What induces them to use the Internet? What barriers make Internet use difficult? What do they gain from using the Internet? More specifically related to GreyPath, further research could determine which features of the portal older people find useful and worthwhile, and which they do not. It might also attempt to judge whether the portal is providing a service to older people that they see as valuable. Much of the literature discussing

the needs of older people comes out of the USA, and some of this research is based upon such literature. Further work is needed to ascertain how the needs of older Australian people differ from those of North Americans. Further contact also needs to be made with researchers in the gerontology field, particularly regarding consideration of the effectiveness of the information included on the Web site, and how this is displayed to them.

Conclusion

In this paper we have outlined some of the needs of older people and proposed that use of Internet portals such as GreyPath offer a means of addressing these needs. In particular, because of their location-independence, Internet portals like GreyPath can be especially useful in providing services in rural areas. This technology has the potential to strengthen the bonds between older people living in a region that may be geographically far-flung, to make it into a vibrant virtual community (Tatnall and Lepa 2003). We have noted that while some older people find the idea of using the Internet threatening, others see it as a means of maintaining their independence. We have argued that in which of these groups older people find themselves has more to do with their network of interactions with both people and technology than with any innate characteristics of the technology itself.

Bernie was not interested in whether or not the Internet linked lots of sites around the world, or that it gave access to a wide range of interesting material; he only wanted to use it for share trading. Roy likewise only wanted to use the Internet to investigate genealogical information and sites relating to wood-working tools. That it provided access to much more information of other types was not the reason he adopted it. Jean's adoption of the Internet related only to her use of e-mail for communicating with her family and friends, not with browsing for information or amusement. In each case the adoption decisions of these people had little to do with any supposedly innate characteristics of the technology, but rather in *specific uses* of this technology that related to their social interactions and environment.

The theory of innovation diffusion concentrates largely on characteristics of the technology itself, while innovation translation looks at the formation of networks of human and non-human actors and how these networks interact. Translation looks more at the uses people might make of the innovation, and how the innovation needs to be *translated* for these uses to be achieved. It offers a means by which any number of small subtle factors can be addressed in each instance of adoption, rather than just looking for large-scale answers across the board. While diffusion theory may be useful in describing the worldwide movement to adopt Internet technologies, the cases described in this paper show that translation theory offers a better means of looking at the *detail* of individual adoptions. We contend that an innovation translation approach offers a useful way of investigating the *detail* of how and why older people adopt, or fail to adopt Internet technologies and electronic commerce. We argue that bringing out this detail is especially important in any understanding of how this complex process occurs, and that it allows useful insights that do not otherwise become apparent.

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Agricultural Innovation System in Australia

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Abstract

The aim of this paper is to document agricultural innovation systems (AIS) in Australia. We identified eleven broad categories (actors) in terms of their activities, namely: policy, education, finance and credit, marketing, input supply, research, extension and information, logistics, processing and storage, farmers and farm organisations and consumers. Survey results reveal that 11 kinds of innovation-related activities of research and education organisations with corresponding percentage weight are directly involved in innovation diffusion. Twelve pre-identified goals of innovation related activities of the above organisations surveyed with their corresponding percentage weight have also been revealed. The study reveals that the majority of funding (more than 80%) for innovation activities comes from the Federal Government and funding bodies. Finally survey results indicate that the main constrains/incentives are other issues such as funding, lack of qualified staff, equipment, environmental and Government policy issues etc.

Keywords: *Agricultural innovation, Innovation systems approach, AIS in Australia*

Introduction

Agriculture can be defined as the science and practice of cultivating the soil and rearing farm animals (Moore, 2002). Innovation is crucial to the development of agricultural production in order to stay competitive in world markets and to meet from the challenge of globalisation. Many innovations have come about by sharing knowledge, information and resources among stakeholders, with agriculture unusual in the extent of its traditional dependence upon public research.

Innovation in Agribusiness

Agricultural innovation can be differentiated into three categories as follows:

- Product innovation – such as pesticides, new seed varieties, new types of animal feed, treatments and veterinary medicines etc. For these sorts of products, the commercialisation of science is done by industry (mainly in industries like chemicals), and typically involves large multinational firms. As a result information about the new product is driven by the firms in the form of product marketing. It is not transferred directly from the researcher to the farmer. The driver is the producer (e.g. Monsanto etc.), and the link is more likely to be the local distributor/retailer agricultural supplier.

- Process innovation – activities relating to new/improved ways of tilling and planting, new breeding and feeding practices, and new ways of tending (e.g. application of pesticides or animal feed etc.). These may be related to the use of new products. The links between research and farming practices in these processes are more direct. The links are also more diffuse, learning based and involve family, community

and extension/information. It will also be localised and conditional.

- Event responses – there may be a third area of innovation relating to responses to occasional unusual events, so there is less knowledge about what to do from experience at the farm level. Examples might be plagues (mice, locusts etc.), diseases (avian flu, foot and mouth etc.), fire, flood etc. Again the links between research and farming practices in these processes are likely to be more direct. However, they are also diffuse and involve family and community, though possibly with more reliance on extension/information (i.e. drawing on wider experience). The existence of some mandatory regulatory actions that might by themselves bring about innovation, for example in a situation where a new animal husbandry regime is to be followed in response/prevention to a disease to threat of disease. In itself this may force "innovation".

All play a part in the ongoing development of agricultural production.

The Innovation Systems Approach

The innovation systems approach is a holistic approach that has emerged during the past decade and has become well established. It is widely used in the academic context and as a conceptual framework for innovation studies. It is also a useful tool to study industrial and agricultural innovations in the economy. In fact, the systems approach is crucial in identifying economic, social, political, organisational, institutional activities and functions of the innovation system. These activities are conducted by sets of agents that interact to achieve a common goal through exchange of information and by learning from each other.

The reality of agricultural innovation is that it involves a more diverse set of agents than is conventionally acknowledged by the linear approach. As a result, innovation requires different sets of functions, the most important ones being technological invention, communication and the adaptation of new ideas for current practice. Every function is equally important, and actors or stakeholders need to collaborate in order to achieve innovation. Termel et al (2001) define the agricultural innovation system (AIS) as a:

> *set of agents that jointly and/or individually contribute to the development, diffusion, and use of agriculture-related new technologies, and that directly and/or indirectly influence the process of technological change in agriculture (p. 6)*

The innovation system approach also provides a useful framework to explore the linkages between stakeholders in agricultural innovation diffusion. Those actors belong to various companies, organisations, institutes, corporations, universities or research centres. They can be classified as private, public and NGO/semi-public depending on size, nature of funding sources and whether they operate as a service or profit-oriented enterprise. These actors can be local, regional, national or international in their scope.

Methodology and Data Sources

To document the innovation system in agriculture in Australia the following data collection tools were used:

1. Desk-based research identified the stakeholders who play a role in the agricultural innovation system in Australia.

2. A structured survey questionnaire was sent to a sample of stakeholders (identified by step number 1) by mail to gather information regarding the role of stakeholders in agricultural innovation activities and to analyse stakeholders' interaction in the innovation process (N=50). The questionnaire was similar in format to Temels' (2001) questionnaire for an agricultural innovation study in Azerbaijan.

In order to develop a picture of the agricultural sector, data were sourced from the Australian Bureau of Statistics (ABS) and Australian Food Statistics (AFS).

Australian Agriculture

Australia has advanced in 200 years from a land largely without widespread, systematic agriculture to one of the world's leading producers and exporters of food, livestock and natural fibres (Reid, 1990). This achievement has taken place in the face of harsh climatic and environmental conditions, which necessitated the development of highly specialised agricultural systems, skills and technology.

The gross value of Australia's farm production in 2004 is $25 billion (4-6 per cent of GDP) with an export value of $29.5 billion. Around 375,000 (4 per cent of the national labour force) are employed in the rural farm sector. In 2003-4, agriculture accounted for around 5 per cent of Australia's investment effort and employed a similar proportion of Australian's net stock of capital. In 2003-04, it directly accounted for around 22 % of Australia's total goods and service exports (Trends in Australian Agriculture, 2005).

Australian farms range in size from small hobby and horticultural properties to large grazing and cropping farms. In 2003-4 farms under 50 hectares accounted for around 20 per cent of all farms (25,400). Thirty-three per cent of farms were sized between 100 and 499 hectares while farms over 2500 hectares accounted for 11 per cent of all farms. The median estimated value of operations of all Australian farms was $109,000, around 17 per cent of farms (21,600) had an income below $22,500, while around 11 per cent (14,100) had an median estimated value of operations of more than $500 000. Ninety-nine per cent of Australian farms are family owned and operated (Trends in Australian Agriculture, 2005).

Australian agriculture has undergone much change over the last few decades. Key drivers have been shifts in consumer demand, changes in government policies, technological advances and innovation, emerging environmental concerns and an unrelenting decline in the sector's terms of trade. Australian agriculture has become increasingly export oriented over the last two decades, with around two-thirds of production now exported. Exports have also become more diverse, with less reliance on traditional commodities such as wool and more on processed products such as wine, cheese and seafood (Trends in Australian Agriculture, 2005).

The agricultural workforce has a number of distinctive features, including: a high proportion of self-employed, family and casual workers; long job tenure; and a relatively old workforce with relatively low education levels and employee wages. Performance within the sector has been mixed. Over the last three decades the cropping industry recorded the highest productivity gains, and the sheep and sheep-beef industries recorded the lowest (Trends in Australian Agriculture, 2005).

SECTOR	GDP %
Agriculture	3.6
Industry	26.4
Services	70.0

Table 1: Sectoral Comparison of GDP% (Source: ABS (2005))

The agricultural sector contributed only 3.6 per cent of GDP in Australia in 2005. This is quite small compared to other sectors, such as manufacturing and services. However it contributes a diverse set of food production activities ranging from grape-growing to cotton-farming. Table 2 shows the number of farming enterprises engaged in agricultural food production activities in Australia from 1999 to 2004. It shows that reduction of number of activities listed during 1999 to 2004. However according to Australian farming brief (2006) the total land use on farms (769.2million hectares per year) unchanged during the same period. As a result there has been a consolidation of activities during the above period, with larger units emerging in many areas of agricultural production.

Main activity	1999-00	2000-01	2001-02	2002-03	2003-04
Grape growing	5924	6115	6081	5714	5836
Apple and pear growing	1145	969	860	836	897
Stone fruit growing	993	1000	984	1096	1030
Other fruit	4499	4495	4344	4382	4098
Vegetables	4557	4480	4303	3930	3819
Grain growing	15578	15682	15297	11411	14189
Grain-sheep/beef cattle farming	17492	15384	15197	16662	15856
Sheep-beef cattle farming	8014	7993	7421	9009	7803
Sheep farming	10853	9925	10767	10803	9981
Beef cattle farming	19582	21169	19245	24195	23769
Dairy cattle farming	13566	12605	10999	10709	10178
Poultry farming (meat)	845	782	773	717	709
Poultry farming (eggs)	454	463	481	457	344
Pig farming	1040	1052	1061	921	808
Deer farming	85	88	49	194	5
Sugar cane farming	4909	4743	4747	4762	4538
Cotton farming	974	996	697	520	562
Total	**110510**	**107941**	**103306**	**106278**	**104422**

Table 2: Number of enterprises engaged in agricultural food production in Australia (Source: Australian Food Statistics (2005))

Jayasuriya (2003) identified and categorized 13 major farming systems in Australia (Table 3). Those farming systems consist not only of crop farming but also of animal husbandry and forestry. Jayasuriya (2003) also explored major farming systems in Australia in order to quantify the percentage of each farming system, the number of farm families employed and what they grow.

Farming system	Land area / % of country	Farm families / people employed	Enterprises
Dryland	15% of the country	33,200 families	Wheat, sorghum, sunflower, wool meat, beef
Pastoral	45% of the country	Not available	Beef, sheep meat, wool
Irrigated and dryland Mixed	Not available	Not available	Maize, sorghum, soybeans, canola, wheat, barley, oats, pastures, sheep and cattle
Irrigated Rice	155,000 ha	2,000 families	Paddy rice, cereals, sheep
Irrigated Cotton	459,300 ha	1,300 families	Cotton lint and seed, other crops, sheep, cattle grazing
Irrigated Sugarcane	419,000 ha	6,900 growers. 23,000 employed	Sugarcane, raw sugar and by products molasses, bagasse and fibre
Horticulture	Annual vegetables & perennial fruit 136,500 ha each and wine grapes 128,000 ha	93,000 employed across 13,865 properties 4,500 wine grape growers	Annual vegetables and perennial citrus, nuts, pome fruit, stone fruit, tropical fruit, berry fruit, banana, wine and table grapes, cut flowers
Dairy	305 million ha	13,900 farms employ 50,000 directly, another 50,000 provide related services	Fresh milk and manufactured dairy products
Poultry, Swine and Goat	Not available	Poultry 1850 farms, swine 3600 farms and goat 2400 farms	Broiler meat, eggs, pig meat, milk and skin

Table 3: Major farming systems in Australia (Source: Jayasuriya (2005))

The supply network

Australian agricultural producers consumed $8.9 billion in inputs during 1998-9, of which $8.1 billion were supplied domestically and $778 million were imported. Table 4 provides the overview of who are the main suppliers and who are the main customers of agricultural industry in Australia. Services to agriculture were largest individual category of domestically produced input supplies, costing 1,226million in 1998-9.

Other significant inputs to agricultural producers included medicinal and pharmaceutical products (1.3 billion), Road and rail transport (835 million) and basic chemicals (800 million).

Suppliers & supplies	Agricultural producers	Markets & consumers
Supply $8,911m	Agriculture $30,428m	Consumption $30,428m
Domestic supply $8,133m	Domestic production $28,900m	Intermediate (business) uses $18,428m
Medicinal and pharmaceutical products, pesticides $1,275 Services to agriculture, hunting and trapping $1,226m Other food products $654m Basic chemicals $799m Agricultural machinery $126m Wholesale trade $733m Road and rail transport $835m Banking $496m Legal, accounting, and business Management services $461m Water supply; sewerage and drainage services $395m Services to transport and storage $340m Petroleum and coal products $362m Other $431m		Meat and meat products $5,720m Dairy products $2,871m Other food products $1,715m Services to agriculture, hunting and trapping $1,201m Wine and sprits $988m Textile fibres, yarns and woven fabrics $886m Flour mill products and cereal foods $684m Fruit and vegetable products $549m Accommodation, cafes and restaurants $472m Sport, gambling and recreational Services $427m Beer and malt $250m Retail trade $176m Bakery products $36m Other $1,715m
Imported Inputs	Imports	Final Demand
$778m	$1,527m	$12,000m
		Household consumption $3,803m Private capital expenditure $1,287m Inventories $368m Exports $6,542m

Table 4: Australia's agricultural producers supply chain, 1998-9 (Source: ABS (2006))

The Agricultural Innovation System (AIS) in Australia

The Agricultural Innovation System involves the collaboration of various actors who perform specific roles in the innovation-dissemination process. They can be categorised depending on the role they perform in the innovation system as policy makers, education providers, finance/credit providers, research organisations, input suppliers, extension and information providers, farmers and farm organizations, logistics providers, processing companies, storage facilities providers, marketing

companies and consumers. Major actors in the AIS and the way they link with farmers (or farm organisations) are shown in Figure 1.
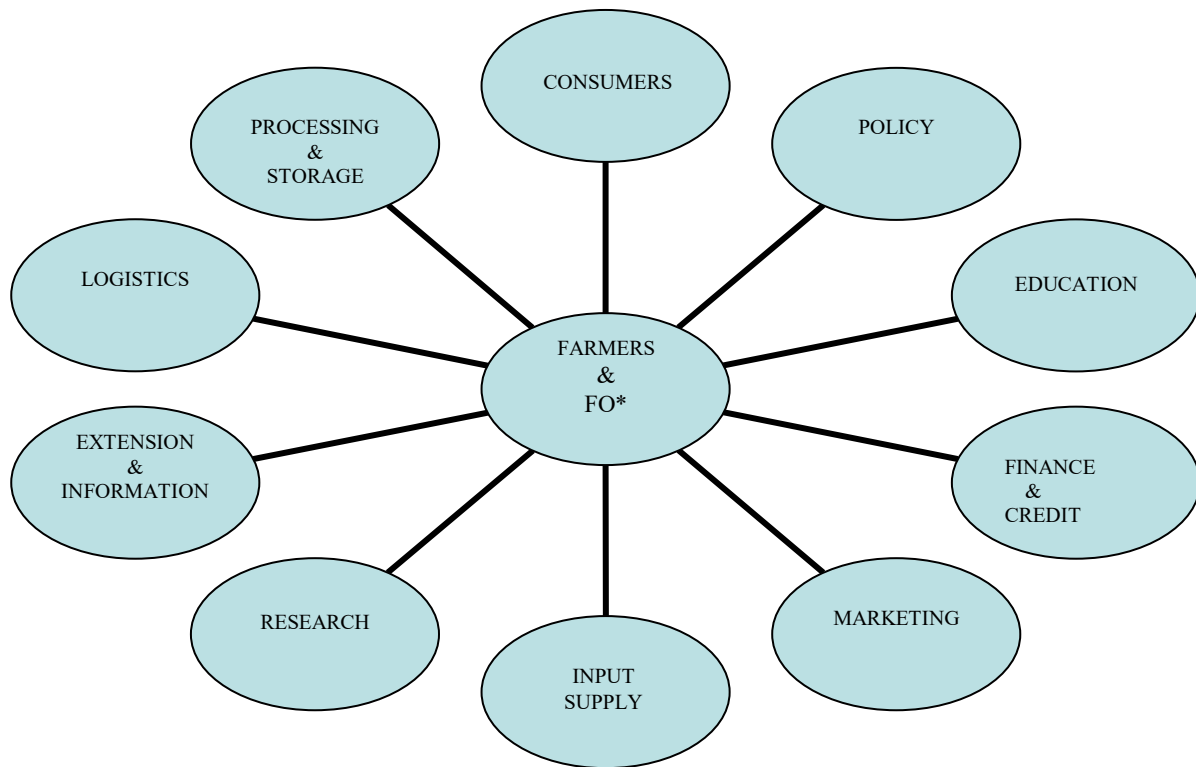
Figure 1: Agricultural Innovation System (AIS) in Australia (FO* = Farmer Organisations)

However, there are not only linkages with farmers but also among the other actors. Linkages can exist between any stakeholders of the system. They can be pictured as a cobweb where the above actors are linked with each other through nodes. Examples of public and private organisations/companies who perform a specific role in agricultural innovation in Australia are listed in Figure 2.

Figure 2 (below) depicts the systematic nature of major players in AIS in Australia. It also helps to identify major contributors of the each broad category. Left-Right arrow indicated that both way of information and resources flows, also described as inflows and feedback loops.

The Empirical Results

This study has undertaken an empirical investigation into identified research organisations/institutes and University research centres in Australia. A survey of 50 research organisations/centres, including a number of universities, was conducted during 2005 to determine the: (a) type of innovation related activities of the organisation; (b) goals of innovation related activities of the organisation; (c) how the behaviour of an organisation is shaped by organisational/institutional constrains and/or incentives for innovation; and (d) funding sources for their innovation activities.

Using a sample of organisations/centres identified via web-search in 2005, an explanatory letter and questionnaire was distributed by post. Fifteen organisations (7 Government departments, 4 Universities and 4 Research and Development Corporations) responded to the survey. This represents a response rate of 30 per cent.

Policy	Finance/Credit	Research
• Federal Government • State Government • Government Departments • Industry organisations • Industry affiliations • CRCs	• State Government • Federal Government • Banks (e.g. Commonwealth) • Industry levies • Private Companies	• CSIRO • CRCs • ABARE • Universities • Bayer Australia Ltd.
Extension/Information	**Education**	**Input Supply**
• State Government • CRCs' • CSIRO • Farmers Federation • Industry Organisations • Pestcert Ltd	• Universities • CSIRO • CRCs • TAFEs • Universities-Overseas	• Monsanto Ltd • GoldAcres Trading Pty. Ltd • Dow AgroSciences Australia Ltd • Terranova Seeds Ltd
Processing/Storage	**Marketing**	**Logistics**
• Sea Food Services Ltd. • Sydney Food Handlers Ltd • Oakey Abattoir Ltd. • Kraft Ltd. • Coldstream Hills (wine) Ltd	• AWB • Bulk Handlers Ltd • ACSA • Woolworth Ltd • IGA Ltd	• P&O • Lin FOX Ltd • Woolworth Ltd • IGA Ltd • Coles Ltd

Figure 2: System diagram of selected actors of AIS in Australia

Types of innovation-related activities

Table 5 indicates responses regarding types of innovation-related activities. Respondents could select more than one option. Most organisations conducted more than one innovation-related activity. As a result responses do not add to 100 per cent. Organisations that participated in the survey have conducted all (11) types of innovation-related activities in Australia in varying degrees.

Table 5 indicates those activities in chronological order. Almost all organisations surveyed were involved in technology development (93%). And more than 50 per cent of organisations involved technology diffusion (67 per cent), training (60 per cent) and demonstration (53 per cent) respectively. Further, survey revelled that technology evaluation, integration, use, policy, introduction/selling, acquisition and financing represented less than 50% of innovation-related activities of the organisations.

This shows that these activities are conducted by other organisations such as state government and private companies.

No	Kind of Innovation	Number	Percentage (%)
1	Technology development	14	93
2	Technology dissemination	10	67
3	Technology training	9	60
4	Technology demonstration	8	53
5	Technology evaluation	7	47
6	Technology integration	5	33
7	Technology use	4	27
8	Technology policy	4	27
9	Technology introduction/selling	3	20
10	Technology acquisition (local/international)	3	20
11	Technology financing	2	13

Table 5: Types of innovation related activities of the organization

Goals of innovation related activities

Table 6 reveals the responses relating to the goals of innovation related activities. Most organisations conducted more than one innovation-related activity. As a result responses do not add to 100 per cent.

More than 50 per cent of organisations indicated that their goals for innovation-related activities were to provide knowledge and information (87 per cent), introduce new products and services (80 per cent), increase commodity quality (80 per cent) and production (73 per cent), reduce environmental damage (67 per cent) and increase market opportunities (60 per cent). Table 6 presents the detail.

No	Goals of innovation related activities	Number	Percentage (%)
1	Provide knowledge and information	13	87
2	Introduce new products or processes	12	80
3	Increase commodity quality	12	80
4	Increase commodity production	11	73
5	Reduced environmental damage	10	67
6	Increase market opportunities	9	60
7	Improve production flexibility	7	47
8	Reduced labour costs	5	33
9	Generate own income	5	33
10	Fulfil regulation or standards	5	33
11	Reduced material costs	4	27
12	Reduced energy consumption	4	27

Table 6: Goals of innovation related activities of the organization

Funding sources

Table 7 shows responses relating to funding sources for the innovation activities in research organisation in Australia. Most organisations conducted more than one innovation-related activity. As a result responses do not add to 100 per cent.

It reveals mix of funding bodies. However, most of the funding (more than 80 per cent) derived from Federal government and related funding bodies/agencies. This suggests that most agricultural research and development funding for the surveyed organisations come from public sources. The reason was that almost all organisations surveyed own by Federal or State Government. State government funded relatively less (13 per cent) to agricultural research and development. This indicates that the Federal Government mainly responsible for research and development of agricultural activities.

No	Funding Source	Number	Percentage (%)
1	From Federal government	13	87
2	Funding bodies/agencies	12	80
3	Collaborative contracts	10	67
4	Competitive grants	9	60
5	Non-competitive grants	6	40
6	Industry levies	4	27
7	Patents and copy rights	3	20
8	Awards and prices	3	20
9	Own resources	3	20
10	From State government	2	13
11	International donor assistance	1	7
12	Loans and credits	0	0

Table 7: Funding source of innovation activities

Constraints and incentives for innovation

Finally, table 8 indicates responses relating to how behaviours are shaped by organisational /institutional constraints and/or incentives for innovation. Most organisations conducted more than one innovation-related activity. As a result responses do not add to 100 per cent.

The majority of respondents (53 per cent) indicated that other issues, such as funding, staff, equipment, environment and government policy, affected innovation in their organisations more than kind of behaviour listed. The most commonly cited constraints (53 per cent) on innovation were the finding was difficult to obtain funding followed by a deficiency of skilled staff and equipment.

No	Behaviour of organisation	Number	Percentage (%)
1	Other*	8	53
2	Cultural Norms	5	33
3	Laws	3	20
4	Health Regulations	3	20
5	Social Rules	3	20
6	Technical Standards	2	13

Table 8: Which incentives/constraints have most affected the innovation behaviour of your organisation. Other issues* – funding, staff, equipment, environmental, government policy issues

Summary and Conclusions

In this paper we identified 11 actors in terms of their function within the Australian Agricultural Innovation System. They are policy makers, education providers, finance/credit providers, research organisations, input suppliers, extension and information providers, farmers and farm organizations, logistics providers, processing companies, storage facilities providers, marketing companies and consumers. These actors are inter-linked with each other in order to share knowledge, information and resources to meet requirements to innovate. A systems approach was utilised to identify the systematic nature of the collaborative links of the above actors.

The study concludes that actors in the AIS in Australia are linked to each other in sharing knowledge, information and resources. Some organisations perform more than one role in the AIS in Australia, such as State Governments and universities.

Even though the Australian agricultural sector contributes a relatively small percentage (3.6 per cent in 2005) to its total economy, the AIS in Australia involves a significant portion of the manufacturing and services sectors. Analysing Australian agricultural producer's supply chain in 1998-9, it is possible to conclude that one-third of agricultural production was exported. On the supply side, most inputs were

produced by domestically. However, most important inputs for agriculture (machinery and chemicals) were imported.

Surveyed organisations indicated that the major types of innovation-related activities are technology development (93 per cent), technology diffusion (67 per cent), technology training (60 per cent) and technology demonstration (53 per cent). The survey also revealed that major goals (80 per cent or more) of innovation-related activities were: provide knowledge and information, introduce new products and processes and increase commodity quality, with most of the funding for the activities come from Federal Government and its funding bodies. Finally the survey indicated that the major constraints for innovation can be categorised under funding, staff, equipment, environmental and government policy issues. Therefore it is vital to address the above issues to enhance innovation-related activities in the AIS in Australia in general and in surveyed organisations in particular.

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Strategies for Dealing With Plagiarism
and the Web in Higher Education

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Abstract

There are few publications dealing with plagiarism prior to the introduction of the Web, yet in the decade since its introduction there has been a rise in the number of publications dealing with the topic. This literature suggests that plagiarism is occurring on a more frequent basis since the introduction of the Web into classrooms. Students now have access to vast amounts of information through the Internet. The ease of accessibility and low access price of the information does little to establish a sense of information value in the mind of students. This phenomenon is calling into question established academic practices and the credibility of some courses. While online classes often receive much attention in this regard, the perceived rise in plagiarism is not restricted to this new paradigm. Indeed, the occurrence of plagiarism is no less evident in the traditional classroom. While the Internet may provide the means of plagiarism for many, it is not the cause. The Internet is part of a technological evolution we are experiencing in teaching and society in general. This evolution is forcing us to adopt many new paradigms and thus consequently change old teaching habits. With easy access to the Internet, education is operating in a new landscape, and assessment procedures need to adapt to the landscape in order to survive. In this paper we present a case study of a number of effective changes made to adapt assessment procedures to the new landscape at Victoria University, Australia. In particular, two very different approaches utilized in two different courses are documented. Both cases highlight how careful consideration of the design and assessment techniques used in learning activities can reduce or even remove the problem of plagiarism.

Keywords

Internet, Plagiarism, Teaching, Cases.

Introduction

It is ironic that Universities have been instrumental in the development of the Internet, and yet that instrument in turn is precipitating many paradigm shifts within the academic environment. Online learning has been viewed as perhaps the major paradigm shift for Universities to emerge from this new technology in recent years. Yet, we may be on the edge of a more significant change to the higher education landscape forced on us by claims of rising levels of plagiarism attributed to the new technology.

The Internet represents an evolution for information accessibility, in many cases allowing easy access to an overabundance of information. This can de-value the information retrieved and result in a lack of

appreciation of the processes involved in producing it. The ubiquitous nature of the Web and the tools used to access the information facilitate an environment in which plagiarism can emerge. It seems that education programs, in the form of ethics classes and plagiarism awareness procedures, do not deter the instances of plagiarism. If education is not the answer, then evolution must be. While detection mechanisms for plagiarism are important, these new frontiers also provide opportunities for innovative approaches to combating plagiarism.

This article discusses two separate case studies related to how the problem of plagiarism has been approached within two courses in the School of Information Systems at Victoria University, Australia, but commences with some background related to the problem of plagiarism.

Related Work

One thing that seems to be consistent amongst the literature dealing with plagiarism is that the extent of it, as a problem, is difficult to identify. Cabral-Cardoso (2004) cites a number of studies which indicate that the relative frequency of plagiarism is "relatively rare in the literature" (p.77), but suggests that it is not known whether these are rare cases or the "tip of the iceberg" (p.77). According to Tribe and Rendell (2003), there were very few publications dealing with plagiarism prior to 1995. By the year 2000 it seems to have become a very serious problem, although it is difficult to establish the extent of plagiarism and other forms of cheating. Cabral-Cardoso (2004) does cite some studies that indicate ranges of alleged plagiarism between 4.1% to more than 50%. Some alarming figures have been presented by various studies. McMurty (2001), reports that in 1998, 80% of a group of approx 3000 students admitted to instances of plagiarism. This figure represented a 10% increase over a 15 year period where the same question was posed. Hamlin and Ryan report similar figures on instances of plagiarism with a group of over 2000 students (Hamlin & Ryan 2003). Selingo (2004) has also identified an increase in the rate of plagiarism for engineering students, with 82% admitting cheating in 1996, compared to 58% in 1964 (Selingo 2004). Thus, it seems that there has been a general rise in plagiarism, some of which was occurring before the Internet became ubiquitous.

So, is it reasonable to suggest that the Internet has become the tool of choice for committing plagiarism? Prior to the advent of the Web, plagiarism required some effort, with students having to spend many hours finding sources or at the very least, retyping someone else's work (Evans (2000); Pean (2000); Tribe & Rendell (2003)). What the Internet offers is the ability to find vast amounts of information very quickly with basic mastery of a search engine and some carefully selected key words. Compounding the problem are online sources such as 'e-Journals' and online databases where students can copy and paste the material into their word processors and put their own name to the material (McMurtry 2001). Goffe and Sosin (2005) provide an example of this cyber-plagiarism. Cabral-Cardoso (2004) suggests that most authors agree that the incidence of plagiarism is likely to increase in the new web environment.

One approach to the problem is to educate students about plagiarism, its various forms and to discuss this openly. This is often done in the wider setting of a course on Ethics in their respective degrees. According to Buchanan (2004), students themselves identify the need for such an ethics course, but of the students surveyed, plagiarism was only ranked by 2% as an area of concern. Many universities have an ethics course, or a component of ethics within their courses, and yet plagiarism remains a problem. The Faculty of Business and Law at Victoria University (where the cases discussed later in this article are discussed), requires each student to submit a signed declaration with each assignment stating that they understand the university regulations on collusion and plagiarism.

Although not dealt with specifically in this article, it seems reasonable to ask if plagiarism seems to be more prevalent in online classes? Few comparative studies have been done. However, one such study, Grijalva, Kirklet and Nowell (2003) reported than in a single online class, plagiarism is no more evident than in a traditional class. This was attributed to the design of online courses which in many cases may reduce some types of cheating such as 'panic' cheating.

Dealing with Plagiarism

Wood and Warnken (2004), writing from the viewpoint where one of them has been the chair of a university academic grievance tribunal for a number of years, put forward a number of observations about plagiarism:

- Students are often confused about the notion of paraphrasing and attribution of sources.

- They are focussed on the end product and the need for haste may influence their decision to plagiarise.

- They are confused about how to work 'individually' in an environment of group work and collaboration on projects.

- Students do not see their own work as something of value – to be protected – especially if they are not interested or see no value in the work. It is what they have to do to pass.

- They are not able to critically analyse information, especially web-based sources. "All information is equal, truthful, and has the same value--free and available" (Wood and Warnken 2004).

Written in the context of ethnic Chinese students studying in a New Zealand university, Holmes (2004) suggests three reasons as to why plagiarism may occur:

- Cultural differences in attitudes to knowledge. An example is given where Chinese students have been educated in a system that gives greater weighting to established authorities.

- A lack of understanding between what commencing students think is acceptable and the standards that educators expect.

- Students familiar with a different language may favour a strategy where they attempt to keep close to the meaning of the original source.

Some literature suggests that the way to tackle plagiarism is through the redesign of curriculum to account for the new landscape, and to consider carefully the design of assignments and their assessment (Freedman, 1998; McMurtry, 2001; Tribe & Rendell, 2003). Hunt (2002) argues that the plagiarism phenomenon due to the new landscape is a good thing, as it is presenting challenges which we as academics will be forced to respond to. The result will probably be a fundamental change in educational direction and assessment.

Before the Event

McLafferty and Faust (2004) suggest that the best tool against plagiarism is to prevent its occurrence and that when students are given appropriate instructions and/or particular types of assignments, plagiarism is minimised or even eliminated completely.

Martin (2005) conducted a study involving 129 papers submitted by business graduate students at a university in south-eastern US between 2002 and 2004. Students in later semesters were told that their papers would be submitted to an online plagiarism detection system. Although limited in scope, the study did appear to indicate that students were less likely to plagiarise if they knew about the online detection system and that their instructor would use it. Martin (2005) in fact suggests that the following guidelines should be adopted when using this type of approach:

- Tell the students in the course outline that written assignments should be submitted in both printed and electronic versions.

- Make sure they know what is meant by plagiarism and provide examples.

- Explain what will happen if plagiarism is detected.

When considering overseas students studying in 'Western' countries Holmes (2004) suggests that a number of strategies could be put in place to deal with plagiarism:

- Educators could alter the methods of assessment to include a greater sensitivity towards cross cultural differences.

- Prepare overseas students better for the "reality shock" of the new learning environment.

- Find ways to value overseas students as a valuable teaching resource in their own right to develop awareness of diversity across the entire student group.

- Conduct more research into understanding communication differences.

After the Event

One of the problems that can be associated with battling plagiarism is that it needs to be detected in the first place! The Internet, often the catalyst for plagiarism, also offers some form of detection via the online plagiarism detection systems mentioned in the previous section (Martin (2005);Torres and Roig (2005)).

McLafferty and Faust (2004) provide a number of hints for detecting plagiarism:

- Incongruence – for instance, where a student turns in a paper that is of significantly higher or lower standard than may be expected by the educator, or arguments within the paper itself appear to be inconsistent.

- Anachronism – for instance, a paper full of old references when many useful recent references are available, or reference to an event in the past as a current event.

- Lack of fit – with the assigned topic.

Another technique to test for plagiarism is to examine a students' understanding of material they have submitted by returning submitted written work to them with words missing. This is known as the Cloze test, and assumes that a student who is familiar with the concepts of the written work will much more easily fill in the missing words than one who is not. Poor recall of missing words is a sign of a lack of understanding and thus a pointer to plagiarism (Torres and Roig 2005). Of course, these are quite time consuming activities for both faculty and students.

Case Studies

Two vastly different techniques to combat plagiarism in courses offered by the School of Information Systems at Victoria University are outlined here. Each takes a different approach by concentrating on the learning required of the assessment tasks and combating plagiarism at a different phase of the task. The issue of how plagiarism is dealt with in the university as a whole is briefly discussed before presenting the cases.

Each of the three faculties in the university has a student handbook, which outlines the rules and regulations governing a student studying in that faculty. In the Appendix to each handbook a reference is made to plagiarism. Whilst this is not an in-depth description of what the university regards as plagiarism, the website for the university's Centre for Educational Development and Support (CEDS) has a link to the university's (July 2004) 'Plagiarism Policy'. This is a 17-page document that outlines principles of 'academic honesty', what plagiarism is and how it can be dealt with when detected. It is primarily targeted at the academic as one of the appendices suggests that it is the responsibility of Heads of Schools and Departments to ensure that students are informed about these matters. There is a section on the CEDS website that is more targeted to students, with brief sections describing what plagiarism is and how to avoid it. There are also links to websites of other universities that describe how to avoid plagiarism when preparing assignments. The website also points out that the university uses one of the commercial online plagiarism detection systems.

There is also a briefer description of plagiarism, prepared by the university's Student Services department specifically for new International students. It describes plagiarism in the following manner:

> *In Australian Universities plagiarism is thought of as a type of stealing. Plagiarism is when the words or ideas of an author are copied (or almost copied, that is changed slightly) from books, articles, the internet etc. without the writer (in this case you, the student) acknowledging where these words or ideas have come from. In your essays or reports then, it is essential that you:*
>
> - *Do not just patch together bits and pieces from other sources*
>
> - *Do use other sources to support what you write*
>
> - *Make it clear to the reader where you have found words, ideas & information used in your assignments*
>
> - *Know & follow (carefully) the rules for quoting & referencing*
>
> *(Source: Victoria University Student Services, Information Guide for International Students, 2005, p.18)*

All of these initiatives could be seen as attempts by the university to address the issues related to plagiarism that have been identified earlier in this article.

Beyond this support for academics and students, the onus is still on individual academics to decide how they will combat plagiarism or deal with it if it arises. Once it had been detected, the university's Plagiarism Policy does have discipline procedures in place if academics wish to pursue them.

Case 1: Combating Plagiarism and Improving Value

This case discusses learning activities in the course "BCO6653 Management of Information Technology," offered by the School of Information Systems, part of the M.Bus (Information Systems). The program consists of a total of twelve courses, usually taken over three semesters full time. BCO6653 is a core course in the program, and one of the first courses that students study. Enrolment in this course ranges from 50 to 80 students per semester. Over 80% of these students are full-time overseas students. A number of these students do not have any prior working experience in information technology or in the management arena. The purpose of this course is to introduce students to the issues faced by the manager of an information technology (IT) department.

Specifically, the course aims for each student to:

- Be familiar with current research and developments in information technology management;

- Be familiar with important management issues in managing information technology;

- Understand the information management approach, its nature and importance

- Be able to apply relevant methods and techniques to better manage information resources;

- Have applied a relevant method or part of a method to an organisation or part of an organisation and prepared a report;

- Plan and prepare a substantial research paper on a designated topic; and

- Have critically reviewed research papers, presented the evaluations and lead group discussions on the evaluations.

In order to achieve these objectives, the course is based around a number of major issues that are examined in each of the two major learning activities (assignments). The number of issues covered varies slightly from semester to semester. Many of these topics are covered in other courses in the program. An important component of this course is that it concentrates upon each of the topics in relation to how they affect the manager of an IT department in an organisation. Students are constantly reminded of this as they prepare their assessment tasks for the course.

How is a student's appreciation and learning of the various current issues in the management of IT facilitated? Learning activities are designed around the concept of constructivism. The application of constructivism in teaching means that a student's learning is based on the degree to which the course content is made meaningful to the student with respect to the student's world view; that in order for a student to learn, he/she must be able to personally construct meaning from the course content. In other words, the course will mean something to the student if the student is supported in constructing meaning for it. This 'meaningfulness' is evident if students feel a 'need-to-know':

> *When students feel this need-to-know, they try to focus on underlying meaning: on main ideas, themes, principles or successful applications…students needing to know will naturally try to learn the details as well as making sure they understand. When using the deep approach in handling a task, students have positive feelings: interest, a sense of importance, challenge, even of exhilaration.*

(Biggs, 1999).

It can be argued that developing this 'meaningfulness' involves encouraging the student to participate and interact, at an intellectual level, with the material presented. One way this can be done is through the structuring of learning activities that pose an IT management-based question or problem to a student. It is argued here that facing a relevant problem will motivate the student to look for information that will help answer the problem. The students then assess the relevance of the information and communicate what they have found. Applying this technique can be an effective strategy in facilitating a student's learning of 'management of IT' issues. The assessment of the course is divided into two major learning activities.

Both major learning activities/ assignments involve students selecting one of the major topics and investigating it at some depth. Students prepare a paper for the first learning activity. The paper is based upon 'theory' and 'practice'. For 'theory', the students have to search the online databases (such as ABI/Inform or Business Source Complete) for materials to prepare a 'mini' literature analysis.

Having been the director of this course since 2002, an author of this paper noticed a disturbing trend very early on where students would submit their first learning activity with large portions of text obviously cut and pasted from other articles – many times without citing the material at all. Often this material would come from non-academic, and sometimes proprietary, sources. This was despite making the students aware of the penalties for plagiarism early on in the semester and just before the due date for submission of the learning activity. In a few instances, assignments had been 'recycled' from other students in a previous semester. As indicated earlier, the penalties for plagiarism at the university are specifically set out, but there has always been the possibility, at the extreme, of bringing a student before some type of disciplinary board. The chosen penalty in this instance was to give zero marks for the sections of the learning activity that were plagiarised. A 'global' verbal admonishment to the students in lectures (where no *individual* students were identified), given immediately after the return of the assessed first learning activity, resulted in a dramatic reduction of instances of plagiarism (in relation to citing) and marked (but not dramatic) improvement in the levels of 'cutting and pasting' and the 'academic' nature of the references being cited. The lecturer's viewpoint up until this stage was that the students had been warned and that should be enough. After another semester of this, and some consultation with other lecturers and the university's student learning unit, it was decided that the problem was more likely to be lessened with a different strategy. This had to be carried out in conjunction with an understanding of the objectives of the course.

It should be pointed out here that the students generally study this course in conjunction with another, Information Systems Research and Writing (ISRW), where many of the issues that are discussed here are dealt with. The problem is by the time the students develop the understanding to the level required in ISRW it is too late in the semester for it to help in the Management of Information Technology course. After consulting with ISRW lecturers, it was decided that students needed to be provided with a brief 'primer', preparing them for the first learning activity whilst not going to the depths of the ISRW course. At this stage it was also realised that plagiarism was one part of a series of problems related to

researching and writing assignments in general – and a strategy was need to address it as part of the overall set of problems (it is not perhaps surprising, then, to find that the Victoria University plagiarism related materials identified earlier are housed in sections of the website devoted to academic writing in general). The following paragraphs document a series of changes that were made over the next few semesters and the effect of the changes.

The authors believe that it is important that students are encouraged to access these materials from wherever is convenient (home, school, work or even an Internet café). It seems easier to embrace these technologies rather than try to avoid or restrict them. One change that was made was to bring forward the explanation to students of the value of selecting 'peer reviewed' journals (over web sites that were found just using a search engine) from *after* the assessed learning activity was handed back to *before* it was due. It was quite obvious from the student reactions that this was the first time that they had received this *detailed* explanation about the quality of the sources they research. Remember that these were postgraduate students, so they have had some exposure to researching and presenting researched papers in the past. Students were thus introduced to the notion of gathering research in the area from peer-reviewed publications and comparing it in some way to actual practice. The students were tutored in researching materials, preparing literature reviews and case studies using a website specifically set up to encourage these practices within the school (refer Figure 1).

Another technique used was to modify the particular 'practical' task to be performed each semester. In this way, students were unable to use work from previous semesters, or even download 'typical' papers from the Internet as they never exactly match the topic being covered. This had the effect of virtually eliminating this form of plagiarism. In addition, students were then required to *only* include material of the highest quality (from peer reviewed journals) in the assignment. They were even supplied with a template that required them to list the registration number of the article from the particular online database they are using (such Business Source Complete or Emerald). If students wished to use other materials (such as books or even other Internet sources) they were required to gain permission from one of their course lecturers. If they suggested a site which is unsuitable (for instance, a proprietary site) the limitations of such a selection were explained. When a student submitted an assignment that included online references that were not approved those sections of the assessment were assessed as if there was no supporting reference at all. Most students soon got the idea and stopped using Google as their first port of call for assignment research! The design of this assignment would be consistent with McLafferty and Faust's (2004) idea of designing 'particular' assignments that can help combat plagiarism. This has the dual advantage of not only helping to reduce plagiarism (by the listing of the registration number) but also dramatically improving the quality of material being sourced by the students.

A more recent initiative (introduced in Semester One, 2005) has been to ask students to bring along their references to show their tutor in the week before the first learning activity is due. A small percentage of assessment is tied to this. This not only has the affect of ensuring that students are finding their own materials, but also means that they have to be able to discuss the suitability of the references with the lecturer. This idea of matching the student's understanding about the suitability of the reference with the topic to be covered is not unlike the idea behind the Cloze test (Torres and Roig, 2005). This has had the dual effect of not only reducing instances of plagiarism, but has initiated some interesting discussions in relation to the suitability of references for the topic at hand.

The second learning activity involves students conducting interviews with IT managers on selected issues – but also involves a literature analysis. By this time of the semester, the standard of literature analysis submitted is quite high, being original work based upon high quality references and is typically well crafted. This case represented an example of the redesign of the learning activities and the assessment helped to reduce the instances of plagiarism (Freedman, 1998; McMurtry, 2001; Tribe & Rendell, 2003).

Case 2: Combating Plagiarism by testing specific task knowledge

This case discusses learning activities in the course "BCO3345 Object Oriented Systems" offered by the School of Information Systems as part of the undergraduate Bachelor of Business (Information Systems) program. BCO3345 is an elective course which primarily focuses on Object Oriented programming in Java. For assessment, the course has a final exam component worth 60% and an assignment component worth 40%, which is earned by the accumulative score of three semester assignments. The course is usually taken by a mix of part-time and full-time students, with the full-time students accounting for approx 80% of the numbers. At least 50% of the students are usually overseas students where English is not the first language. Due to the Faculty and School prerequisite regulations, this course can be undertaken with only after an introductory programming concepts course has previously been completed.

Plagiarism on the assignment work has always been a problem, partly due to the lack of English skills of many of the students, and partly due to the lack of programming background due to the course structure. Plagiarism occurs mostly between the students in the same class, but also often enough from available sources on the Internet. When detected, plagiarism is dealt with. However, not all cases are detected (or can be conclusively proven). A method was needed which allowed the students to work together on the assignments (particularly the overseas students) and yet, which allowed their individual learning from the assignment itself to be tested.

In Semester 2, 2001, a method was trialled for three consecutive semesters which helped to achieve these goals. The students were given three assignments each semester, with each assignment requiring them to build software using particular techniques to achieve desired goals. The students were instructed that they could work individually or with others, but the assignment was not to be submitted. Instead, after the due date for the assignment had passed, the students would be given a small multiple choice test in the next class after the due date. These tests were specifically designed to test the knowledge the student should have gained during the course of doing the assignment.

Table 1 Sample Question to test specific assignment knowledge

The following code relates to the next two questions. Examine it and answer the next two questions. This code assumes the Vector bankObjects is created elsewhere, and the sample classes from assignment 1 have been used

```java
static Savings anothermethod(long aid) {
 Savings a;
 Object o;
 int i;

 for (i = 0; i < bankObjects.size(); i++) {
  o = bankObjects.elementAt(i);

  if (o instanceof Savings) {
   a = (Savings) o;
   if (a.getAccountNum() == aid) return a;
  }
 }
 return null;
}
```

11. Which of the following do you think best describes the purpose of this method?

a. To see if a Savings object with accountNum field equal to the parameter exists
b. To retrieve and return a Savings object which has the given accountNum
c. To return a Boolean value equal to true if the Savings account exists
d. To return a null value

For example, in one assignment, the purpose is to create many objects during the course of running a small simulated banking system. The objects were all to be stored in one Java Vector and then a mechanism constructed to retrieve specific objects from that Vector. A sample question from the assignment test is shown in Table 1.

During the course of the assignment, the students could consult with their lecturer, tutor, or work with any other student. The student could even opt to not do the assignment if they wished. However, all students were warned that while they could get help from any source, they should be familiar with all aspects of the assignment solution, as the knowledge they should have accumulated would be tested. Three different copies of each test were made, with the order of the questions and the alternatives for each question different on each test. Each student had a different version that the person on each side of them when it was undertaken. This method was trialled on all three assignments for a period of three semesters.

This technique was exceptionally successful in removing plagiarism that was previously evident in the learning activities by redesigning the assessment. This approach, although using a different approach to the previous case, also illustrates the importance of careful consideration of the design and assessment of learning activities.

It is an interesting exercise to compare the results from the three trial semesters to another three semesters where standard assignments were set then individually graded. The results are shown in Table 2.

The shaded bottom portion of the data in Table 2 represents those semesters where the specific assignment tests were used. In some cases, over the three year period, the total assignment component of the course was worth a different percentage. All the figures displayed in Table 2 were after the data was adjusted so the total assignment score represented a score out of 40. 'Avg. Score' represents the student average score out of 40 marks for all three assignments. 'Std. Deviation' is the standard deviation of the sample. 'Avg. Deviation' is the average of the absolute deviations from the mean.

Table 2 Analysis of assignment data from 6 semesters

Course Run	Avg. Score	Std. Deviation	Avg. Deviation
Semester 1 1999 (26)	28.700	6.000	4.475
Semester 2 1999 (28)	28.489	6.715	5.518
Semester 1 2003 (27)	27.692	6.820	4.915
Semester 2 2001 (56)	23.616	6.625	4.725
Semester 1 2002 (36)	23.443	6.429	5.144
Semester 2 2002 (40)	25.289	7.064	5.522

As can be seen in Table 2, the most obvious feature is a lower average accumulated score for the assignments administered using the new methodology. The standard deviations and average deviations tend to be higher for the trial period, indicating more variance in the assignment scores. Table 3 shows the overall course assessment for the student groups in the same trial and non-trial periods.

The delivery of the courses in the trial and non-trial periods was carried out by an author, with minimal changes in the curriculum during both periods. The authors believe that it is reasonable to surmise that any major changes in the assessed scores in learning activities was due to the change in delivery and assessment methods.

Table 3. Pass rates and grade distributions for 6 semesters

Course Run		pass rate	Grade Distributions					
			HD	D	C	P	N1	N2
Semester 1 1999		80.8	3	2	9	7	1	4
Semester 2 1999		85.7	2	8	9	5	3	1
Semester 1 2003		88.8		8	14	2	2	1
	avg	*85.1*						
	std	*4.03*						
Semester 2 2001		85.7	4	12	14	18	2	6
Semester 1 2002		88.8	4	7	11	10	3	1
Semester 2 2002		90.9	3	14	12	11		4
	avg	*88.5*						
	std	*2.62*						

The shaded bottom portion of Table 3 represents those semesters where the specific assignment tests were used. The grade system used is based on a percentage grade out of 100 and is as follows: HD (High Distinction) 80+; D (Distinction) 70-79; C (Credit) 60-69; P (Pass) 50-59; N1 (Fail) 40-49; N2 (Grade 2 Fail) 0-39.

In this instance, the research proposition suggests that the results in the trial period would be different to those in the non-trial period, primarily due to the changes in delivery and assessment of learning activities (H1). The proposition that the changes made no significant difference was explored by testing using the null hypothesis (H0 – Assignment Testing made no difference to the overall outcome) as per Sincich (1990). H0 was tested using both t-Test and F-Test comparisons of population means and standard deviations respectively (refer Figure 2 and Figure 3). In both cases, the null hypothesis was not rejected at the 5% significance level. Furthermore. given the calculated p-values in both tests below, the null hypothesis was not rejected at the 1% significance level.

Comparison of Population Means					
	Sample Size	Sample Mean	Lower 95.0% Conf. Limit	Upper 95.0% Conf. Limit	Sample Std. Deviation
Using Assignment Tests	3	88.47	81.9616	94.9784	2.62
Without Assignment Tests	3	85.1	75.0889	95.1111	4.03
Difference		3.37	-4.33523	11.0752	
t-Test					
Null Hyp.	Alt. Hyp.	Test Statistic	P-Value		
0.0	Not equal	1.21	0.2914		
Do not reject the null hypothesis at the 5.0% significance level.					

Figure 1: Null hypothesis test using t-Test

Comparison of Population Standard Deviations				
	Sample Size	Sample Sigma	Lower 95.0% Conf. Limit	Upper 95.0% Conf. Limit
Using Assignment Tests	5	2.62	1.36412	16.466
Without Assignment Tests	8	4.03	2.09825	25.3275
Ratio		0.650124	0.0108375	16.4838
F Test				
Null Hyp.	Alt. Hyp.	Test Statistic	P-Value	
1.0	Not equal	0.42	0.5942	
Do not reject the null hypothesis at the 5.0% significance level.				

Figure 2: Null hypothesis test using F-test

While the use of assignment testing does not seem to have made any difference to the overall performance of the students, in terms of either passing or failing, there is some observable difference in the grade distributions. Figure 4 shows a comparative bar graph of the grade distributions of all three classes where assignment testing was utilized compared to all three classes where it was not used. The main observable difference from Figure 4 is that the peak of the Credit grade is flattened out, with the Pass and Credit grades now showing a more even distribution.
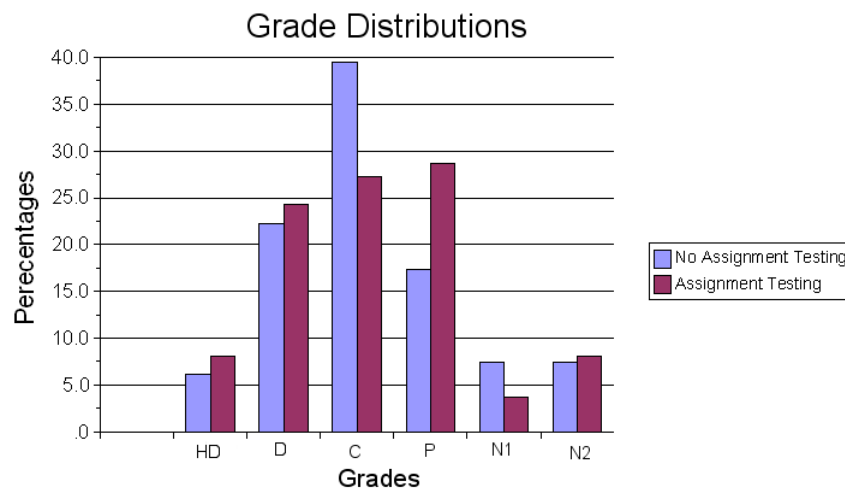
Figure 3: Chart of grade distributions

The challenge when constructing the test questions is to not include general knowledge questions, but test only specific learning outcomes of the assessment task. Setting the assignment requires no more effort than before, but obviously extra effort is required in constructing the multiple choice test to test the specific knowledge gained in performing the assignment. However, this is then offset by the reduction in time required for grading.

Conclusion

The advent of the Internet into higher education has had many profound effects on teaching paradigms and pedagogies. Unfortunately, all great innovations have unwanted side-effects, and it seems that ease of plagiarism is an unanticipated side-effect of the Web. While it is unclear whether cases of plagiarism have indeed risen since the advent of the Internet, it has increased the ease with which plagiarism can be conducted. Many academics and indeed many institutions concentrate on the detection of plagiarism and follow-up procedures, however simply making students aware of plagiarism and of the penalties do not seem to be the answer. While there are many reasons put forward for this.

Plagiarism occurs for many reasons, and there are many strategies that can be adopted ~~we can do~~ to combat this. This article has discussed two case studies where different techniques were used in the prevention of plagiarism. However, it is important to recognise that both approaches required careful consideration (and modification to) design and assessment of learning activities. Both approaches effectively dealt with plagiarism during different phases of the assessment task process, and both were successful in their own way. In the first case, the assessment was designed around prescriptive process, which made plagiarism ineffective. In the second case, innovative assignment testing techniques thwarted plagiarism.

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Job Satisfaction Affecting Cross-Cultural Adjustment in Taiwanese Expatriates

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Abstract

By means of the increasing global competition and internationalization of world markets, international expatriates assignments are more and more essential to successful worldwide development for many multinational corporations. Therefore, international expatriates are imperative to the survival of globe enterprises in the twenty-first century. Expatriates can become an important human resource to international enterprises or multinational operations. Also, for the past two decades, research has examined a variety of correlates for the performance problems and dissatisfaction associated with global assignment. To facilitate business expatriates adjust to an overseas environment and work effectively, Multinational Corporations (MNCs) need to recognise the expatriates' job satisfaction factor to affect cross-cultural adjustment. The main purpose of this study is utilising previous researcher Lee's (2002) questionnaire to investigate the relationship between the job satisfaction and cross-cultural adjustment of Taiwanese Banks' expatriates assigned to America, and this study employed same questionnaire to examine the relationship between the job satisfaction and cross-cultural adjustment of Taiwanese expatriates in several different industries assigned to Mainland China. Also, the empirical outcomes were compared between Taiwanese expatriates located in Mainland China and United States.

In examining the significant degree of Taiwanese expatriates assigned to Mainland China, the instrument was a questionnaire survey conducted to this study. The variables of interest were measured using items Likert-type questions, and those items are divided into seven categories. Data collected from 353 participants who have experience of a posting to Mainland China for international assignments. Multiple regression and correlation were employed to analyse data.

The statistical results of this study were compared Lee's (2002) research that associated with Taiwanese banking expatriates in United States. Both studies indicated that the expatriates' job satisfaction factor to affect cross-cultural adjustment without doubt. This thesis concludes with suggestions for both international enterprises or MNCs and individual expatriate who operate overseas journey in their normal path of business.

Introduction

In the current climate of rapid globalisation, expatriation has been an important element of international business operations. Parent companies often send expatriates abroad as corporate representatives and ambassadors (Gregersen *et al*., 1996). Usually, moving people out of the parent company to work in a foreign subsidiary appears to serve three main purposes: filling staff vacancies, management development and organisational development (Edstrom and Galbraith, 1997; Tung, 1982; Ondrack, 1985). For these strategic reasons, despite the problems and costs (eg. Kobrin, 1998;

Boyacigiller, 1990), and suggestions of reduced dependence on expatriates (Adler and Bartholomew, 1992; Kobrin, 1998; Schuler, Fulkerson and Dowling, 1991), expatriation is likely to continue.

Much of the expatriate management literature on this topic has focused on the management of cross-cultural adjustment (eg. Harris and Moran, 1989; Berry, Kim and Boski, 1988; Black and Gregerson, 1991). This is because expatriates possibly working in an overseas environment with extremely dissimilar political, cultural and economic conditions often face both job-related and personal problems (Birdseye and Hills, 1995). If ignored, these problems bring about stress and dissatisfaction inside and outside of an expatriate's professional life and may lead to staff turnover. Indeed, failure rates of staying among expatriates, measured as those who return prematurely, can reach staggering proportions and be quite costly (Arthur and Bennett, 1995; Cavusgil *et al.*, 1992; Harvey, 1985; Oddou, 1991) not only to the international organisations which transfer the employee and his/her family abroad but also to the expatriates themselves. Furthermore, expatriates who cannot adjust but nevertheless remain on the assignment and perform poorly can be even more damaging to the international organisations than those who return prematurely (Harzing, 1995; Forster, 1997).

Since 1987 an open door policy under the Chinese government has allowed more investment to flow into Mainland China from Taiwan, to the benefit of both countries. At the same time, Taiwan's government deregulated control over foreign exchange and this led to a rapid increase in outward investment by Taiwan's enterprises. Economic relations between Taiwan and China have developed rapidly. In earlier days, only a few people wanted to be assigned to work in Mainland China. But nowadays, following the increasing investment, many more people volunteer to develop their careers in Mainland China for a longer period. Due to the high costs associated with failures and poor overseas performance, MNCs need to ensure that the executives they post to foreign assignments have successful experiences. In order to reach the successful goal, MNCs need to comprehend the correlates and consequences of expatriate' job satisfaction. With this in mind, the purpose of the study reported here was to examine the relationships, this study investigate the effect of job satisfaction on cross-cultural adjustment by using a sample of expatriates in Mainland China.

Literature Review

Job Satisfaction

Job satisfaction is the extent an employee feels negatively or positively about his/her job (Odom et al., 1990). Black et al. (1991) pointed to the importance of job factors for both degree and mode of adjustment. Job satisfaction is one of the predicted outcomes of cross-cultural adjustment; it can be defined as the positive emotional state resulting form the overall evaluation of one's job (Shaffer and Harrison, 1998).

In a study on relocation attitudes and work adjustment, Fisher and Shaw (1994) demonstrated that satisfaction was an outcome of expatriates' adjustment. Feldman and Tompson (1993) determined that various corporate career development programs contributed significantly to several aspects of employee satisfaction. One such practice was ensuring that the expatriate assignment fitted in with the employee's overall career plan. Furthermore, providing mentors as well as opportunities for employees to develop new skills, was significant to expatriate satisfaction.

Cross-cultural Adjustment

Cross-cultural adjustment is generally defined as the process of adaptation to living and working in a foreign culture. It is the perceived degree of psychological comfort and familiarity a person has with the new host culture (Black, 1988; Mendenhall and oddou, 1987). Several researchers have highlighted factors affecting the process of adjustment. For example, Black, Mendenhall and Oddou (1991) identified anticipatory (before-leaving) and in-country (post-arrival) factors. In addition, they noted work, interactions and general adjustment as three levels of adjustment. Feldman and Tompson (1993)

identified six sets of factors: demographic variables; the extent of 'internationalness' of the job change; job characteristics variables; amount of organisation support vis a vis assistance and career development; degree of difference between successive job assignments; and types of individual coping strategies. It is possible to classify factors affecting cross-cultural adjustment into two broad types; extrinsic (those relating to the organisation and environment) and intrinsic factors (those relating to the characteristics, psychological and physical, of the individual. Many studies have found that the crucial problem for the expatriate is that adaptation to the unfamiliar culture than with their professional expertise (eg. Aahad and Osman-Gani, 2000; Dowling et al., 1999; McEnery and DesHarnais, 1990; Osland, 1995). Successful adaptation and cultural adjustment not only directly influence expatriates performance but also lead to corporate success in the international stage.

Methodology

In order to investigate the job satisfaction of Taiwanese expatriates adjustment in Mainland China, the study was adopted quantitative research approach, where the quantitative research approach will then be employed to test the hypotheses.

Sample

The target population of this study was 1,786 Taiwanese manufacturing firms located in Shanghai. Shanghai is the most developed city of east China and many Taiwanese investors set up their manufacturing company in here. This study used a stratified sampling procedure based on type of industry to select the sample. There are 20 different categories of industries such as food industry, plastics industry, cement industry, spinning and weaving, electric machinery, electric equipment and so on included in these 1,786 firms. Ten companies were selected from each industry by using a random numbers table. Therefore, there a total of 200 firms were selected from the address book that is issued by the Straits Exchange Foundation of Taiwan. Non-response was managed by replacement. In this study, the respondents targeted are one expatriate in the each firm.

Statistics Analysis

All of statistical data analyses were performed using SPSS (Statistical Package for Social Science) for Windows. The analysis used Correlation Coefficient; Descriptive statistics methods were used to describe the sample and inferential statistics to draw conclusions about the theoretical model.

Correlation Coefficient

Correlation coefficients were computed between the job satisfaction and cross-cultural adjustment. The correlation coefficient was used to describe directions and strengths between the independent variable and the dependent variable.

Research Results

Total of 1200 questionnaires initially mailed to Taiwanese business expatriates in Shanghai and followed-up by e-mail. Total responses were 353, but there were 22 invalid questionnaires. As a result, total response 353 minus the invalid questionnaires 22; therefore, 331 returned surveys were usable. The percentage of valid questionnaires was 27.58 percent. Table 1 also showed the Standard Deviation of job satisfaction was 0.6916.

This section of the study, through regression analysis investigated the influence of job satisfaction on cross-cultural adjustment through the stepwise method.

Because stepwise regression was requested, SPSS first investigated a model with the correlated independent variable job satisfaction, as demonstrated in Table 5.3. It also revealed that the partial

correlation for job satisfaction was 0.501, In effect, independent variable as job satisfaction was significant for explaining the cross-cultural adjustment model. The bi-variate correlation between job satisfaction and cross-cultural adjustment was positive. At the same time, the independent variable was statistically significant as revealed in Table 2 and Table 3 below: Job satisfaction (P= 0.000 < 0.05). This appeared to verify that the practical predictor in this study for cross-cultural adjustment was job satisfaction. It accounted for 39.44 percent (0.628^{2}) of the variance of cross-cultural adjustment.

	Mean	Std. Deviation	N
Cross-cultural Adjustment	4.5075	1.0039	331
Job Satisfaction	3.3541	.6916	331

Table 1: Descriptive Statistics

		Cross-cultural Adjustment	Job Satisfaction
Pearson Correlation	Cross-cultural Adjustment	1.000	.628
	Job Satisfaction	.628	1.000
Sig. (1-tailed)	Cross-cultural Adjustment		.000
	Job Satisfaction	.000	
N	Job Satisfaction	331	331

Table 2: Correlations

	Un-standardised Coefficients		Standardised Coefficients			95% Confidence Interval for B	
Model	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
Constant	-3.860	.506		-7.633	.000	-4.855	-2.865
Job Satisfaction	.610	.058	.420	10.441	.000	0.495	0.725

	Correlations		
Model	**Zero-Order**	**Partial**	**Part**
Job Satisfaction	0.628	0.501	0.372

Table 3: Coefficients of Proposed Model

a Dependent Variable: CCA (Cross-cultural Adjustment)

Comparison and Discussion

The results of this study were also compared with Lee's (2002) research shown in Table 4. Results were quite not different between Taiwanese located in the United State and Mainland China. In this section, independent variable which was significant in the present study: job satisfaction was statistically significant, and the statistical result of Taiwanese expatriates assigned to Mainland China was compared with the Taiwanese expatriates located in the United States (Lee 2002) as shown in Table 4 below.

The Significance of the Relationship of Independent Variable to Adjust in Mainland China and the U.S.		
	Mainland China	**United States** ∗
Job Satisfaction	Significant	Significant

Table 4: The Significance of the Relationship of Independent Variable to Adjust In Mainland China and the United States (Source: Lee, H.W. 2002, '*A study of Taiwanese banking expatriates in the United States*', Published dissertation of University of Idaho.)

Based on the statistical analysis of this study, the data revealed that the correlation between job satisfaction and cross-cultural adjustment was positive. Similarly, Lee's (2002) research demonstrated that job satisfaction ($r=0.49$, $p < 0.05$) was an important factor in cross-cultural adjustment. Previous research by Black et. al. (1991), Miller (1975) and Shaffer and Harrison (1998) also demonstrated the significance of job satisfaction for adjustment. Thus, job satisfaction was an indispensable factor affecting on cross-cultural adjustment for both Taiwanese expatriates posted to Mainland China and to the United States.

As the overall evaluation or emotional state resulting from the appraisal of one's job or one's experiences, job satisfaction is clearly and primarily work-related. It is presumed to arise from successful adaptation to overseas job requirements and from effective development of interpersonal relationships within the host country's workforce and customers. If maladjustment is equated with stress, then it is an aversive psychological state that will create negative evaluations of and negative affect toward the stimulus that created it. In other words, both work as well as interaction adjustment may result in job satisfaction.

Not surprisingly, work-related factors had the positive relationship to expatriate adjustment. A possible explanation is that expatriate international assignments usually require considerable responsibility and autonomy and are often marred by policy and procedural conflicts that occur between the parent company and its overseas performance. Undeniably, it makes sense that ambiguity, discretion and conflict will influence the capability of expatriates to adjust to their new work assignments overseas.

The findings of this study suggest that to achieve the ideal fit between Taiwanese expatriates and the new work and socio-cultural environment of Mainland China, both the Taiwanese MNCs and expatriates need to comprehend the influence of job satisfaction factor on the adjustment of individuals. The majority of the respondents considered that the cross-cultural adjustment of Taiwanese expatriates in Mainland China was affected by job satisfaction. Job satisfaction factor indeed facilitated the adjustment of Taiwanese expatriates assigned to Mainland China.

It appears that, Taiwanese MNCs must cooperate with affiliates and involve their management in the recognising the key influence of this factor on adjustment. Furthermore, Taiwanese MNCs must provide continuous support to the employees throughout their assignment in their Mainland China assignment.

Conclusion

Job Satisfaction with the expatriation experience is an important determinant of an expatriate's success in overseas assignments.

Job satisfaction is defined as a pleasurable feeling that results from the perception that one's job is fulfilling, or allows for fulfillment. According to this definition, the existence of this can mean that workers with higher job satisfaction have less intention to leave their jobs. If expatriates are not satisfied while on assignment, the motivation to perform well and/or to remain abroad for the specified length of time is diminished. Referring to the findings of this study the data indicated that job satisfaction of Taiwanese business expatriates obviously affected their cross-cultural adjustment to Mainland China. Similarly, job satisfaction was the significant factor affecting the cross-cultural adjustment of Taiwanese assigned to both Mainland China and the United States.

In today's challenging global arena, the finding of this study offers positive ideas for improving the retention of employees to multinational organisations developing expatriates to Mainland China and elsewhere. The successful management of expatriation process will continue to be an important human resource challenge facing companies in the next millennium.

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The Link Between Incoterms 2000 and Letter of Credit Documentation Requirement and Payment Risk

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Abstract

Letters of credit are an important finance instrument for international trade. These instruments are particularly useful in trade where the transactional values and trading risks are high. Essentially the letter of credit is a substitute for a buyer's risk with that of his bank, as it underwrites the transaction. Exporters experience difficulties in achieving documentary compliance to the bank's satisfaction and therefore run the risk of not being paid. Compliance is based on the accuracy and form of data content on documents required by the letter of credit. The more voluminous and complex the documentary requirements, the higher the non-compliance risk. This paper explores the link between international delivery terms and documentary requirements of the letter of credit. Preliminary data from an industry survey suggests that exporters are contracting on international delivery terms that may leave them unnecessarily exposed to non-payment risks. Although further investigation is required to determine whether alternate delivery terms would diminish the exporter's risk, preliminary results indicate that it is possible to reduce payment risk by the strategic use of international delivery terms.

Introduction

Letters of Credit (L/C) are considered to be one the most important financial instrument in international trade transactions, having been described as the "life blood of international commerce" (D'Arcy, Murray and Cleave 2000). The actual amount of L/C transactions has proved difficult to quantify. Estimates from personal interviews with senior banking personnel in Thailand and Malaysia have indicated that L/C transactions account for nearly half of their international trade transactions. Anecdotal evidence in Australia seems to support these statements. Raw data for Australia's L/C trade does not appear to be publicly available. The lack of data is probably due to the fact that the Australian banking industry has an oligopolistic structure and there is no evidence that data on international trade transaction details is publicly released. In attempt to gather some information about this aspect of banking, enquiries were made to the major banks in Australia, the Reserve Bank of Australia and SWIFT (the banking system electronic international communication and clearing house, but the release of information was declined, even at the macro level. However, overseas data for the US suggests annual commercial L/C business turnover of approximately USD 51,648 millions in 2003 (Documentary Credit World 2003). The total value of US trade for the same period is estimated at USD 1,922,724 millions (United States International Trade Commission 2004). The commercial L/C business therefore accounts for approximately 4 percent of trade. These figures indicate that, as an international finance tool, L/C are significant and widely used, accounting for billions of dollars in annual trade. As the L/C business is largely international, it may be presumed that similar usage proportions apply to the Australian situation.

L/Cs typically work through the banking

system and are subject to the Uniform Customs and Practice for Documentary Credits (UCP 500) rules devised by the International Chamber of Commerce (ICC). These rules were issued in 1993 and are currently under review. For the exporter, the L/C substitutes the credit risk of the buyer with that of his bank. The L/C is a conditional 'payment guarantee' (AusIndustry 1996, p. 18). The Issuing Bank (buyer's bank) undertakes to "buy" specified documents (representing the existence of the goods) from the beneficiary (exporter), provided they comply 100% with the L/C requirements, otherwise the 'payment guarantee' is lost. Non-compliance is a significant problem as, according to the ICC, world-wide documentary discrepancy rates against L/Cs are between 60% to 70% (ICC Thailand 2002). The mechanics of L/C transactions give rise to a complex web of interactions between banks, traders and service providers alike providing a fertile ground for discrepancies.

The Contractual Arrangements of L/C Transactions

The decision to use the L/C as a payment method gives rise to a number of separate contracts, as shown in Figure 1.
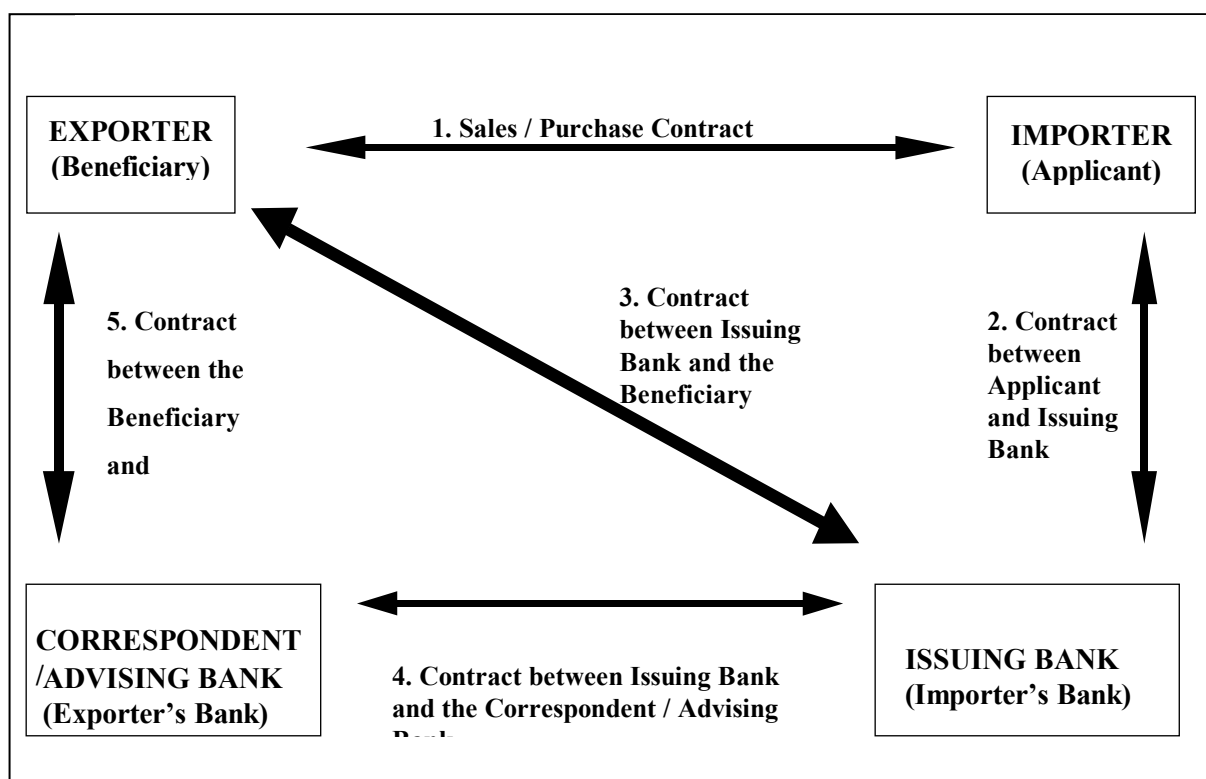
Figure 4: Typical contracts of a letter of credit transaction (Bergami 2006, p. 415)

Contract number 3 in Figure 1 is the crucial link between the payment guarantee and the banking requirements. It can be observed that, in so far as payment is concerned, there are no other direct links between the seller and the buyer, other than the contract of sale. This situation reflects the independence principle that operates in L/C transactions, as per UCP 500 article 3 that states in part:

> *… credits, by their nature are separate transactions from the sales or other contract(s) on which they may be based and banks are in no way concerned with or bound by such contract(s), even if any reference whatsoever is included in the credit (International Chamber of Commerce 1993).*

However the banking requirements that trigger the payment under a L/C transaction depend on documentation, as per UCP 500 article 4 that states: In credit operations all parties concerned deal with documents, and not with goods, services and/or other performances to which the documents may relate (International Chamber of Commerce 1993).

The question of documentation and its required data contents therefore becomes a central issue in considering the risks involved in an L/C transaction. In essence the exporter must present documents that are L/C compliant to assure payment. Whilst the UCP 500 separates contract from payment, the documentary requirements are influenced by business practices between the parties that lead to the contract formation in the first instance. The contract of sale is the starting point for all subsequent action, as shown in Figure 1, Contract number 1. Therefore it is necessary to delivery terms of a contract, because these terms determine the documentation requirements that are subsequently incorporated into the L/C.

Incoterms 2000: International Delivery Terms

One of the fundamental considerations in any international contract for the sale of goods is the delivery of the cargo to an agreed place, and this is where the Incoterms play a vital role. Devised by the ICC, Incoterms are an acronym for International Commercial Terms. Issued for the first time in 1936, they have been regularly updated with the current version being the Incoterms 2000. These terms are not an international convention, and therefore their incorporation into international contracts is voluntary. Incoterms 2000 have been readily accepted by the trading world for over a decade, probably since the United Nation's Commission on International Trade Law that, on 12 May 1992, officially endorsed ICC Incoterms 1990 and commended their use in international sales transactions (ICC Australian Council 1992).

There are thirteen Incoterms, each different with different rights, duties, obligations and responsibilities on the trading parties. The choice of Incoterms therefore controls the amount of risk exposure each parties has. A number of subsidiary contracts result from the usage of Incoterms and these are shown in Figure 2. The exporter will need to deliver according to the Incoterm chosen, and this will be reflected in the documentary L/C requirement.
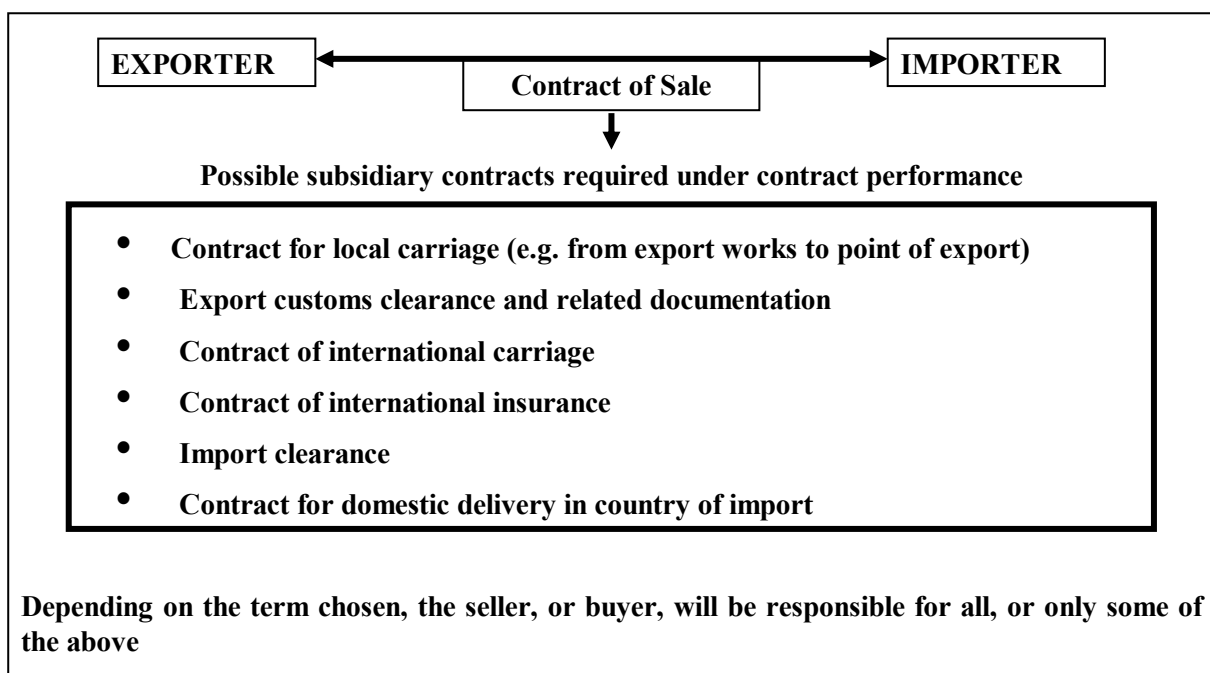
Figure 5: Subsidiary contract (for the movement of goods) arising from the sales contract. (Bergami 2006)

Incoterms apportion the actions to be taken by one party or the other on a mutually exclusive basis, that is to say, if the exporter is responsible for arranging export customs clearance, the importer will not be. It is therefore important to understand the obligation imposed by each term, as this is linked to the provision of documents. The international transaction is complex and typically involves a number of external service providers. Whilst some of the required documentation may be produced in-house by the

exporter, other documents, such as transport documents, can only be acquired from external sources. Incoterms comprise of four groups and each of these is detailed below.

1. Group E: EX -Works (EXW)

There is only one terms in this group, requiring the least effort from the exporter. Basically the exporter only has to pack, mark and label the goods in accordance with the contractual requirements and make the cargo available at the agreed works (place of cargo collection). There is no obligation for the exporter to load the goods on the collecting vehicle, become engaged in customs clearance formalities for export or import, or be a party to any of the contracts of carriage or insurance (International Chamber of Commerce 1999). Consequently the documentary requirements under EXW are minimal. The provision of a commercial invoice and at best proof of collection of the goods from the nominated warehouse would be all that is required.

2. Group F: Free Carrier (FCA); Free Alongside Ship (FAS); Free On Board (FOB)

With this group, the exporter is responsible for export clearance and the placement of the consignment, at an agreed point in his country (International Chamber of Commerce 1999). The burden of documentation is increased and whilst the exporter is under no obligation to enter into a contract of carriage he must "render the buyer at the latter's request, risk and expense, every assistance in obtaining a transport document for the contract of carriage" (International Chamber of Commerce 1999). The seller's responsibility to render this type of assistance is translated in practice to a letter of credit demand for the transport document to be submitted as part of the documentary requirement, particularly in FCA and FOB transactions.

3. Group C: Cost and Freight (CFR); Cost, Insurance and Freight (CIF); Carriage Paid to (CPT); Carriage and Insurance Paid To (CIP)

The exporter's documentation burden is further increased under this group. In all four terms the exporter has an obligation to enter into a contract of carriage and therefore tender the transport document to the buyer (International Chamber of Commerce 1999). In an L/C transaction the transport document will invariably be sought by the bank. For CIF and CIP terms, the exporter is additionally required to enter into a contract of cargo insurance "with underwriters or an insurance company of good repute" (International Chamber of Commerce 1999). The exporter must "provide the buyer with the insurance policy or other evidence of insurance cover" (International Chamber of Commerce 1999). This is to enable the buyer, once the risk in transit has transferred to him, to independently lodge a claim with the insurers as after all, the buyer has paid for this insurance cover through the price charged for the goods (Ramberg 1999). It is important to note that insurance cover notes are not usually accepted by banks, unless specifically allowed for in the L/C under UCP 500 Article 34(c) (International Chamber of Commerce 1993; Technical Officers of Global International Trade & Business Finance 2000)

4. Group D: Delivered at Frontier (DAF); Delivered EX Ship (DES); Delivered EX Quay (DEQ); Delivered Duty Unpaid (DDU); Delivered Duty Paid (DDP)

The exporter's obligations under this group include the responsibility of causing the product to be placed at an agreed delivery point. Because the movement of cargo is undertaken at the exporter's risk, there is no requirement for the buyer to receive proof of insurance and consequently no insurance documents will be provided or called for by banks in a L/C transaction. Proof of delivery in this group may need to be provided by a number of different means. This may take the form of a delivery order to the frontier for DAF transactions (International Chamber of Commerce 1999), or a transport document/delivery order that would enable the buyer to claim or collect the goods at the arrival port, or other agreed delivery location.

The type of documentation required is therefore linked to the chosen Incoterm. As discussed in the next section, the sequence of events in establishing the L/C influences the documentary requirements.
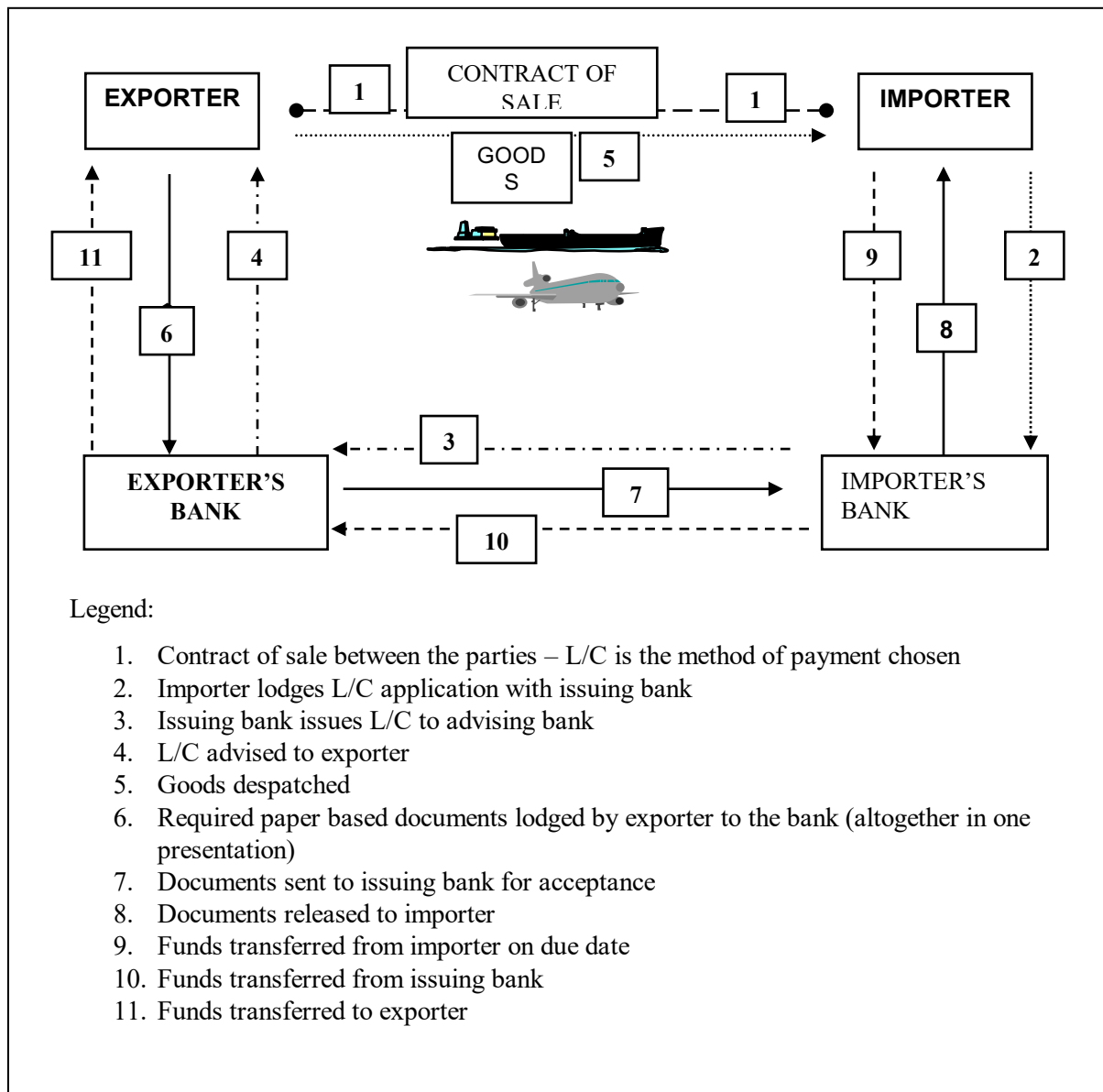
The L/C Operations

Figure 6: Typical letter of credit transaction cycle (deferred payment option)

Step 2 in Figure 3, is the L/C application by the buyer (importer/applicant). This application outlines the requirements for the transaction and is meant to reflect the spirit of the contract of sale. It is at this stage that the importer indicates to the issuing bank the documentary requirements. Typically this is conveyed through a standard L/C application form, modelled on the Society for Worldwide Interbank Financial Telecommunication (SWIFT) messaging system. SWIFT is the electronic messaging system that banks in developed countries commonly use, as is the case in Australia. The completed application form replicates the data fields to be completed in the SWIFT system. The application is lodged by the buyer and scrutinised by the bank that may, after having conducted the usual commercial assessment of the application, decide to issue the L/C to the exporter (seller/beneficiary). The L/C is typically advised through the banking system due to security and integrity concerns (step 3). Once the L/C has been received and verified as authentic it is forwarded to the exporter (step 4). It is at this stage that the exporter should check that the terms and conditions of the letter of credit match those of the sales contract and that the documentary requirements can be met. Any discrepancies or difficulties should be corrected before the goods are sent.

Once the cargo has been despatched (step 5) the exporter's task is gather the necessary documentation and present this to the bank (step 6). This is the most critical step in the whole transaction. If the exporter is able to present compliant documents, payment is assured.

Why are Documentary Discrepancies so High?

Although not highly researched, documentary L/C compliance has been a problem for some time in international business, as evidenced by surveys undertaken in 1983/1984 and again in 1989/1991 and in 2003, the ICC figures of 50% to 60% discrepancies were confirmed (SITPRO Ltd. 2003, p. 3). In one study in the US, discrepancy rates were reported to be 73% (Mann 2000, p. 2497). The method employed in assessing the existence of documentary discrepancies in the US study was the systematic examination of data from files held by banks. In the UK the method used for gathering data was by means of a survey of three banks. Discrepancies certainly cost money:

> *The review estimates that in 2000 the UK lost £ 113 million through non-compliant documents being presented under letters of credit. This is merely the amount that can be measured and does not include other factors such as lost opportunity and cash flow problems. This is an enormous amount of money to be taken out of often very narrow margins (SITPRO Ltd. 2003).*

The above comments reflect the reality of the situation for exporters in both the US and the UK, but similar problems face Australian exporters. Industry sources in Australia claim that discrepancy rates are in line with estimates by the ICC. To gather data on discrepancy rates in Australia, a random survey of Australian manufacturing exporters to ASEAN was conducted in 2005 and preliminary results from this survey are discussed below. It should be noted that discussion on the complete survey is beyond the scope of this paper, and consequently only the relevant responses are considered here.

Survey of Discrepancy Rates and Incoterms 2000 Usage

The survey attracted 102 respondents, and they reported the discrepancy rates experienced in L/C export transactions, shown in Figure 4 below.
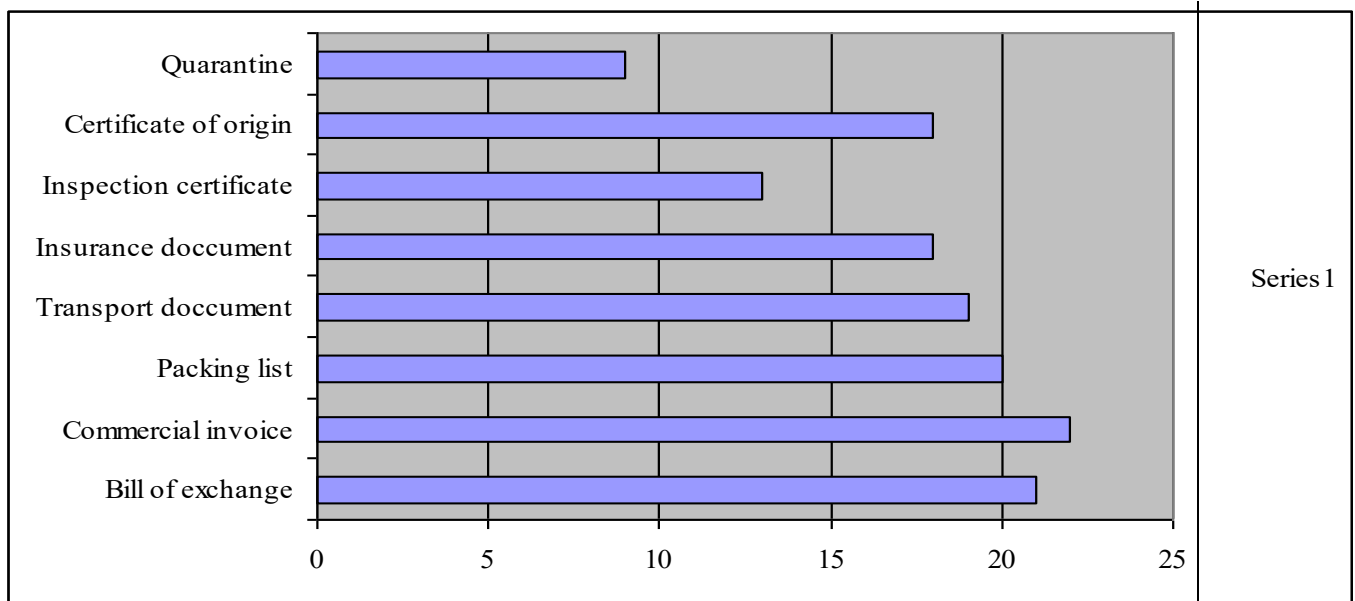

Figure 7: Discrepancy frequency on export letter of credit

From the list provided, only three of the eight documents identified are capable of being produced in-house by the exporter, these being the Bill of exchange, the Commercial invoice and the Packing list. Arguably the Insurance document could also be produced in-house where an Open Insurance policy

exists. This type of insurance policy allows the exporter to complete his own insurance declaration and issue certificates of insurance acting as a virtual agent of the insurance company for such purposes. The remaining documents are produced externally, without exception, although the instructions for the completion of such documents may actually originate with the exporter. For example the transport document and certificate of origin is usually completed based on information provided from the exporter to the transport provider or certification authority prior to the carriage of the goods.

Having identified the discrepancy areas in the documentation, the usage of Incoterms also needs to be considered to determine whether there are any links between the choice of Incoterms and the resultant mandatory provision of documentation that form part of the L/C transaction.

The Incoterms 2000 Usage and Patterns

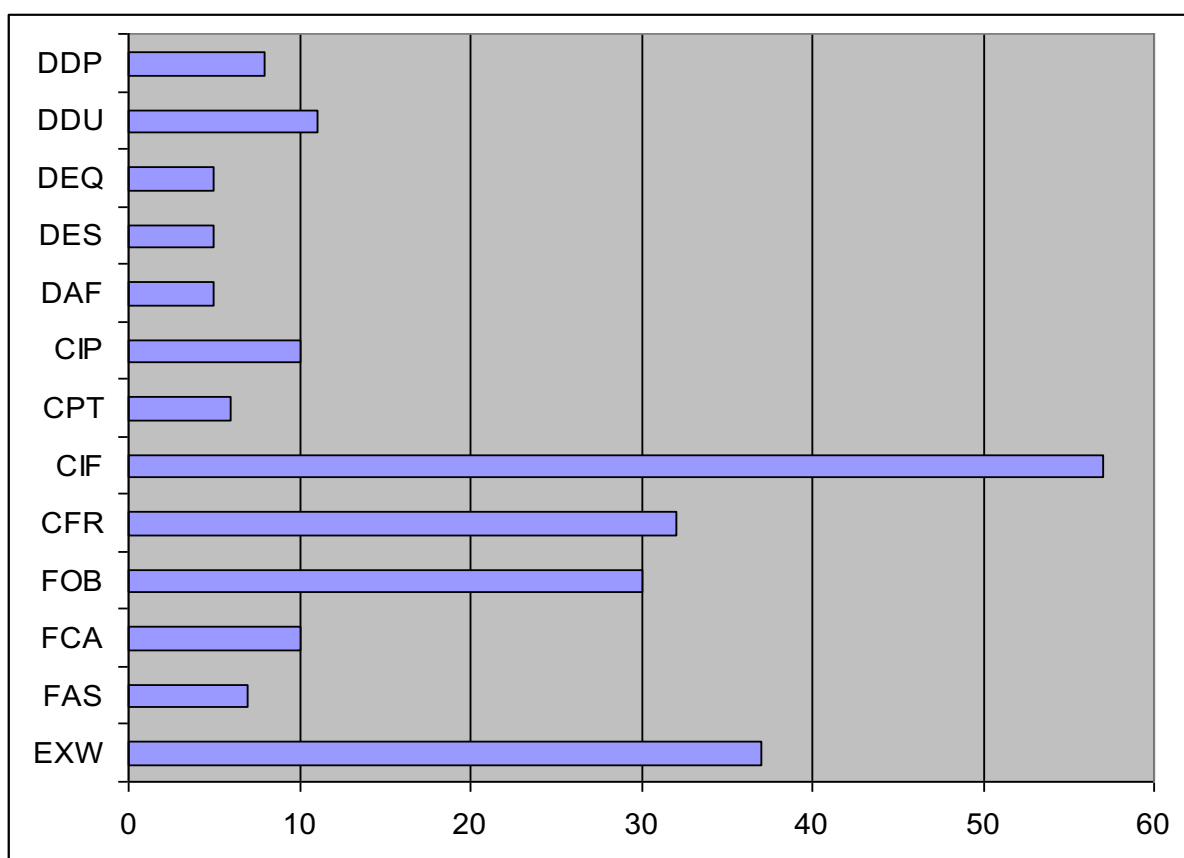Figure 5 shows the preferred usage of Incoterms among the surveyed Australian manufacturing export base.

Figure 8: Incoterms preferences

It is clear that the term CIF is the most popular, followed by EXW, and then CFR and FOB. If the data is analysed on the basis of the Incoterms groups identified earlier, exporters appear to prefer to use of Group C terms, as shown in Figure 6.
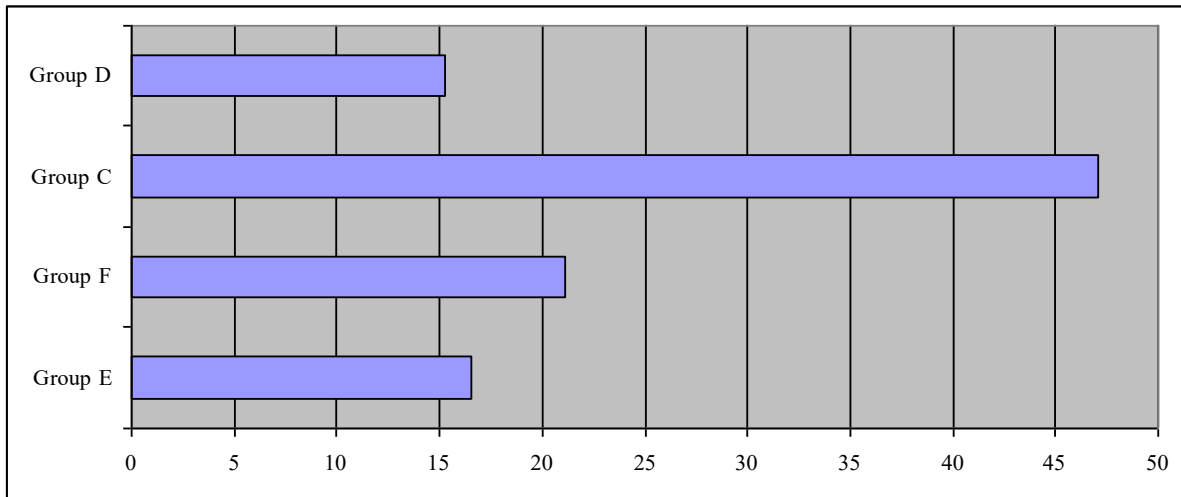
Figure 9: Incoterms Group preference

The most widely used mode of transport therefore links in with the above data and is shown below.
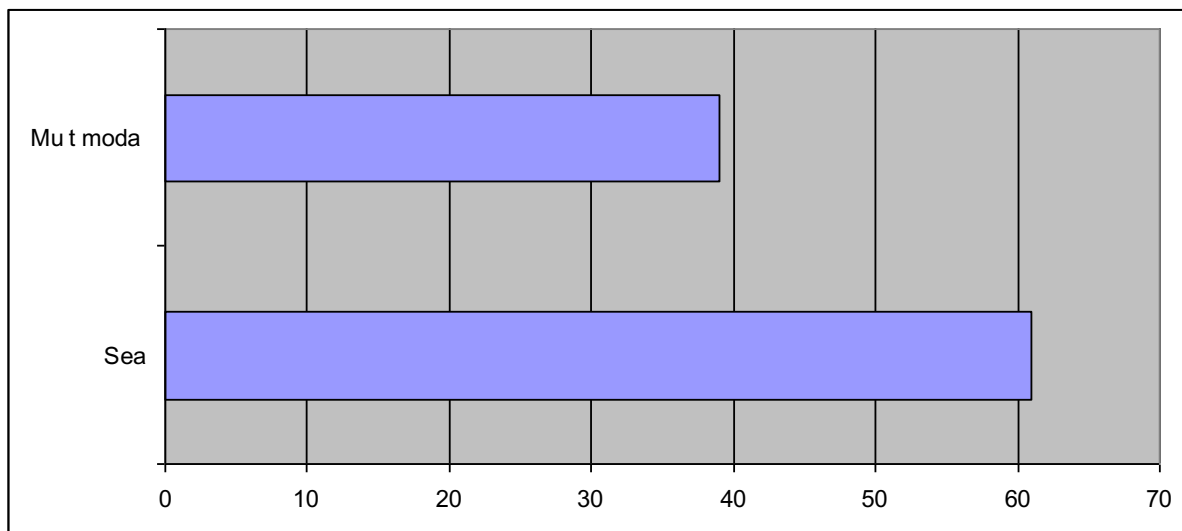
Figure 10: Mode of transport usage

Linking Incoterms to Documentary Requirements

In this section discussion will be limited to externally produced documents based on the Incoterms 2000 obligations. Internally produced documents are considered to be of a lesser risk category, because the exporter has control on their production and consequently control over their data content and manipulation. The same cannot be claimed for externally produced documents that may not be able to be changed, as doing so would be fraudulent. For example, changing the sailing date on a sea transport document would be an illegal act.

From Figure 5 it can be observed that CIF is the most popular term. This term has quite onerous documentary obligations for the exporter, demanding the provision of a transport document and evidence of insurance. It is significant to note that the responses shown in Figure 4 highlight that the transport and insurance documents are two of the most common problem areas. It is not possible to explain at this stage the reason for the popularity of this term and the associated area of discrepancies in the required documents.

EXW is shown as the second most preferred Incoterms option and this may be a good choice for exporters, given the minimal involvement required in a transaction, resulting in a equally minimal

documentary requirement. There are no requirements for external documents in an EXW transaction. The presumption is that the exporter will be able to meet the documentary requirements of the L/C because of his ability to control the production, and therefore, the data content of any document.

CFR and FOB are the next two most popular terms and, by comparison with the CIF term, these terms remove at least one source of discrepancies by not demanding the provision of an insurance document. Otherwise the documentary requirements remain the same.

The remainder of the terms in Figure 5 are more or less equally spread, and their documentary requirements are closely aligned with those of FOB, insofar as a transport document or equivalent is to be provided to the buyer.

It is noteworthy that Group D terms, as shown in Figure 6 have proven to be the least popular group of terms and the explanation for this may be more the reluctance of exporters to become highly responsible for the placement of a consignment abroad, rather than a focus on documentation.

Conclusion

The L/C is an important tool in international trade transactions and it is readily agreed to between buyers and sellers. For the exporter it provides a conditional guarantee of payment and a degree of financial certainty. However, there is a paradoxical situation that has developed with L/Cs, and that is the risk of non-payment through non-compliance.

The L/C mechanism is administered by the bank and payment will only follow the provision of compliant documents to the bank. The bank's role is merely to check the documents as an independent source of information without regard to any underlying contracts or other arrangements. Regardless of the relationship between the exporter and the buyer, the bank has an obligation to accept compliant documents on the one hand, and on the other refuse documents that fail to comply.

The documentary requirements of a L/C are influenced by the choice and inclusion of Incoterms into the contract of sale. The more onerous the terms are in relation to the burden of proof of delivery, the more paperwork will be demanded with a higher risk of discrepancies. It is logical to argue that as information requirements multiply the chances of errors likewise increase.

To ensure that exporters maximise their chances of documentary compliance, one approach may be to negotiate contracts with Incoterms that require the minimum of external documentation to be provided from exporter to buyer. The lesser the documents and data content the higher the chances of complying. Of course this argument is not without limitations. One such limitation may be the inability of the exporter to negotiate better Incoterms due to market considerations. However, this opportunity should be explored by the exporter if at all possible.

In conclusion, for exporters to maximise their documentary compliance under L/C transaction the use of the EXW term is the preferred option, whilst the use of the CIF/CIP terms are to be resisted as these terms demand the highest level of documentation and data content, making it potentially more risky for the exporter to comply with the bank's requirements, thereby jeopardising payment.

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Using XML To Help Isolate Software Systems and Agents From Change Due to Communications

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Abstract

Development and research into distributed and agent based systems has grown enormously over the last few years, and the number of practical applications for such systems has grown along with it as the technology and infrastructure improves to accommodate such systems. As with all systems, evolution and change is inevitable, but with the growth of distributed systems and the Service Oriented Architecture, we have another dimension of change we need to consider; that of communication. The importance of the role of communication between these systems has been highlighted by many researchers, particularly for multi-agent systems and for distributed communicating agents. But the form of such communication often remains a mystery. Communication aspects are often dependent on other factors within an architectural framework, particularly the data. In order to reduce unnecessary changes to the communication aspects of a system, we need to insulate the communication as much as possible from consequential change effected by architectural other framework elements. A message system using an XML-type syntax is more extensible and adaptable for use in a changing environment. It helps to isolate the communication from the structure and content of the message, thereby reducing consequential change. This paper discusses the use of XML for the construction of agent-based messages, and presents a simple approach for the deconstruction of messages by receiving agents.

Keywords

Agent, Communication, XML, Java, ACL, Architecture Framework

Introduction

The topic of software communication has become important in the wider business context, not just in computer science circles. Given the current trend towards agent based software, SOA architecture, distributed systems and Enterprise Application Integration in the general IS application domain, communication aspects of software systems will become a major component. If little thought is given to the structure of the protocols and messages used, follow-on maintenance costs are likely to be incurred, and likely to be expensive. Such follow-on maintenance can be caused by development efforts in other subsystems, or from further developments in external systems that communicate with the software, and affect the structure of the messages to be sent and received.. We need a way of isolating the communication component from changes in other systems or subsystems to reduce the costs of maintenance.

Distributed systems, web services and software agents represent the first steps in new software development paradigms. The Service Oriented Architecture (SOA) supports the requirements of business processes by linking together loosely coupled software services (Channabasavaiah, Holley and Tuggle. 2003). The SOA does not restrict itself to

Web Services alone, though these have achieved much attention lately. The SOA is an architecture that is not restricted to any one technology, and agent based systems fit comfortably within the SOA domain. While the success of Web Services have shown the IT community that SOA works, the agent-based paradigm promises to be the next evolutionary step in software design, especially for distributed applications. However, the success or otherwise of these agent-based systems will largely rely on the inter-agent communication systems utilized. The whole approach of the paradigm is small persistent software units working together to solve a problem. Fundamental to cooperation between agents and agent systems is the ability to communicate effectively. In many of the descriptions of agent-based applications, the communication is implied but not detailed directly. Those papers dealing extensively with the communication aspects concentrate on the semantic structure of the messages. But the question remains, what of the structure of the actual message itself?

There are a number of standards describing message structure for communication between agents, for example, KQML, ACL and more recently FIPA ACL. While these standards are well advanced, the specifications stop short at defining a structure for the actual message payload. The message payload is that part of the message which is actually delivered to the receiving agent for subsequent action (depicted in **Figure 11**). Most of the standards specify the structure of the envelope, such the standards specifying the SOAP envelope used by many Web Services, but leave the payload structure to the application. However, the structure of the payload is important for a number of reasons: the receiving agent must de-construct the message-payload to derive meaning, hence there are practical considerations from the programming perspective; the complexity of the message payload will dictate to some degree the flexibility of the agents in relation to changes in the payload structure; a hierarchically structured payload will allow for extensibility of the messaging system without requiring changes to existing receiving agents.
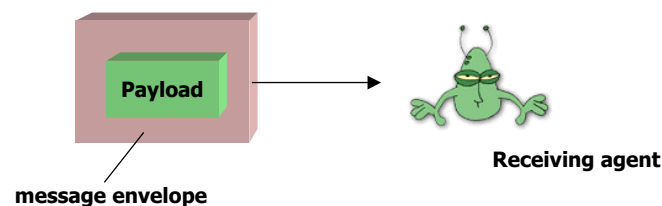

Figure 11 message payload

The payload is that component which is most vulnerable to change when there is a corresponding change in the data model or the business process model of the systems underlying architectural framework. If the structure of the payload is too closely aligned with either of these, then chances are that a change in either will effect a consequential change in the communication. One of the benefits of agent based systems and the SOA architecture is the promise of ease of component integration and integration with legacy systems. A need for a communication change in one system could trigger a cascade requiring communication change in others. We need a way of limiting this change and separating the data and business process models from the structure of the message payload. Using an XML syntactical structure we can send the message payload in an XML hierarchical format which then affords us a number or practical advantages, including easier message deconstruction and extensibility of the messaging system.

This paper discusses some of the practical aspects of message payload deconstruction and demonstrates some of the advantages of structuring the payloads using XML. The remainder of this paper is organized as follows: some background information is given on agents, and agent communication languages, followed by a discussion on the construction of agent messages. The practical application of XML for structuring these messages, and the subsequent use of the XML Document Object Model for the deconstruction is then detailed. Finally, details of further research and some conclusions are presented.

Background

Agent technology emerged from the field of AI research, so the term 'Intelligent Agent' is often used. However, agents need not be intelligent, and in fact most tasks do not warrant the use of 'smart agents' (Nwana, 1996). Other adjectives often used with agents are, interface, autonomous, mobile, Internet, information and reactive. The term 'agent' can be thought of as an umbrella term under which many software applications may fall, but is in danger of becoming a noise term due to over use (Wooldridge & Jennings, 1995). Many agents are currently characterized by descriptive terms that accompany them, for example intelligent, smart, autonomous etc…

What makes agents different from standard software is the characteristics that agents must possess in order to be classified as agents. Nwana (Nwana, 1996) classifies agents according to primary attributes which agents should exhibit, such as cooperation, learning and autonomy. Indeed, by their very nature, cooperation is one of the primary characteristics which an agent must possess. Genesereth (Genesereth & Fikes, 1992; Labrou, Finin, & Peng, 1999), actually equates 'agency', with the ability to cooperate and exchange data. But while this may be a bit extreme, the nature of agents, being small autonomous software units for specific tasks, means they must cooperate with other agents to perform larger tasks. It is the practical form of this cooperation which has created a landscape of Agent Communication Languages (ACL's).

ACL's had their root in the Knowledge Sharing Effort (KSE) initiated by DARPA (Neches et al., 1991). The core concept of the KSE was that knowledge sharing required communication which in turn meant that a common language was required. The KSE focused on defining a language and proposed the Knowledge Interchange Format, based on a predicate calculus. At this time agents weren't considered when designing the language, but obviously the concepts were directly translatable to agents. Prior to this, each project would implement their own form of ACL (Singh, 1998).

The Knowledge Query Language Management (KQML) project was the first significant inter-project ACL (Singh, 1998) by the KSE in the late 1980's. The KQML language consists of 3 layers: the message layer; the communication layer; the content layer (DARPA, 1993; Labrou et al., 1999). The content layer provides for the actual message content, or the payload to be delivered to the receiving agent. KQML can carry payloads in any representation language, including strings and binary format, but every KQML implementation ignores the content layer (Labrou et al., 1999), and leaves the payload format up the implementing application.

An agent communication language simply called ACL was a variant on KQML, and actually specified or assumed KIF as the payload language. However, the latest emerging standards for agent communication are from the Foundation for Intelligent Physical Agents (FIPA), with FIPA ACL (FIPA, 2002). FIPA ACL does provide a comprehensive message specification language, and also provides the specification in an XML format (FIPA, 2003). This XML specification is in the form of a Document Type Definition, but again, like KQML, stops short in any specification for the message payload.

In May 2000, the Internet Engineering Task Force (ITEF) defined a Simple Commerce Messaging Protocol (SCMP) as an agent language for electronic commerce applications using the Internet (Arnold & Eaton, 2000). While this document does give an example of a message payload using an XML structured message, it was clearly stated that, "The SCMP protocol doesn't specify payload definitions or how trading partners are expected to process the payload, beyond basic functions related to processing SCMP headers". The objective was to allow trading partner's flexibility in implementing a standard commerce message format or some other non-standard payload format.

It is interesting that John McCarthy proposed a formal Common Business Communication Language (CBCL) in his paper 'The Common Business Communication language', written in 1975 (McCarthy 1982), but not actually published until 1982. In this paper, McCarthy proposed a language based on LISP which forecasted much of what XML was later to become. A language that was somewhat less verbose than XML, but one which was extendible so that as software improved, the messages could be extended. McCarthy was clear that it was important to keep the language incrementally extendable so

more detail could be added to messages at a later time. It is this type of language that we need to embrace for agent communication, one that is extendable, but won't require extensive modifications to the underlying communication software when the message is extended. Unfortunately, the features of a communication language alone won't achieve this, but a suitable communication language coupled with a platform independent standardized application programming interfaces will facilitate this.

Pragmatically it's difficult to provide a specification for message payload. There are many applications, both agent-based and traditional that may need to exchange all manner of data. However, the vast majority of communication between agents will take the form of simple messages that could be exchanged using a simple format. The XML specifications (Quin, 2003) provide for such a format. XML is almost universally becoming a standard for data exchange between applications and the Application Programming Interfaces (API's) for processing XML documents are well advanced. In particular, Java provides standard classes for dealing with XML documents, and these could readily be used by programmers to provide a practical and extensible message payload format between agents.

Dimensions of Change?

The architectural framework underlying any computer systems always has a number of elements or dimensions where change can be effected. A well known architectural framework is the Zachman Framework initially presented in its early form in 1987 (Zachman 1987). This framework has since been refined and is presented in textual format in Table 1 below.

	What (Data)	How (Function)	Where (Location)	Who (People)	When (Time)	Why (Motivation)
Scope {contextual} Planner	List of things important to the business	List of processes that the business performs	List of locations in which the business operates	List of organizations important to the business	List of events/cycles important for the business	List of business goals/strategies
Enterprise Model {conceptual}	e.g., Semantic Model	e.g., Business Process Model	e.g., Business Logistics System	e.g., Workflow Model	e.g., Master Schedule	e.g., Business Plan
Business Owner System Model {logical}	e.g., Logical Data Model	e.g., Application Architecture	e.g., Distributed System Architecture	e.g., Human Interface Architecture	e.g., Process Structure	e.g., Business Rule Model
Designer Technology Model {physical}	e.g., Physical Data Model	e.g., System Design	e.g., Technology Architecture	e.g.,Presentation Architecture	e.g., Control Structure	e.g., Rule Design
Implementer Detailed Representation {out of context}	e.g., Data Definition	e.g., Program	e.g., Network Architecture	e.g., Security Architecture	e.g., Timing Definition	e.g., Rule Definition
Subcontractor Functioning System	e.g., Data	e.g., Function	e.g., Network	e.g., Organization	e.g., Schedule	e.g., Strategy

Table 1: Textual representation of the Zachman Framework (Zachman 1987)

The Zachman Framework defines six (6) aspects of systems architecture: date, function, location, people, time and motivation. Each of these aspects becomes a dimension of possible change during the systems incremental change regime or evolution. We need to add another dimension to this; that of communication. As systems become distributed, or are developed using an SOA utilizing Web services or agents, communication takes on a greater role. Unfortunately, all these dimensions of change are not orthogonal, that is, each is not independent of the others when changes are implemented. Some areas in software engineering and systems architecture research are concerned with reducing the follow-on affects of change in some dimensions, due to change in another. For instance, implementing a Model View Controller design in database applications helps separate the business processes from the underlying data manipulation, thus allowing changes in one to not effect changes in the other.

Changes in the Data and Functionality dimensions in the Zachman framework are most likely to effect follow-on changes in communication. Changing the data to be delivered via a communication message may require communication protocols to be changed, and the corresponding sender and receiver to do

something differently. Similarly, a change in functionality may require different message structure and consequently changes in the communication aspect. Thus we need to design or select a communication language which will aid in reducing communication based changes due to other dimensional changes.

In the following sections, the practical aspects of using XML for message payloads are discussed and it is demonstrated that utilizing XML for message payload can help reduce these follow-on changes.

Typical Message Payload Construction

Given that the message payload format is usually left to the agent developers, then what form does it usually take? The form will depend heavily on the application and may include the transmission of binary data, but most applications including e-business applications can normally transmit message in the form of a simple string. The complexity of the string depends on the data being transmitted, for example if each data item is no more than a single word or number, then the items within the string can be simply separated by spaces, eg:

" SKU 167843T1 SIZE 12 STORE 8"

If a data item contains more than one sequence then the string will be delimited by a special character, such as a comma or a colon, eg:

"NAME,Paul James,CREDIT LIMIT,5000,ADDRESS,11 City Road"

However, more often than not, the data items appear without any preceding identifiers such as

"167843T1 12 8" or "Paul James,5000,11 City Road"

In such a situation, both the sending and receiving agents must be intimately aware of the structure of the message payload. During the deconstruction of the message, the receiving agent must parse the string into its various tokens, and assume the tokens are in the correct order. Continual error checking on the tokens as the message is parsed is the only way to check against an invalid message. The received tokens are checked against the agent's beliefs of the structure and makeup of the message, and any deviation from this is marked as an error. This leaves little room for extensibility of the message format without altering the beliefs of the receiving agents, and hence requiring modifications to the agent's message parsing components.

In the case where we wish to add extra data to the message for some agents, we could append this to the end of the current message. Depending on the message parsing implemented in agents which are to receive the message but not process the additional data, this may or may not require modification. In some cases, it may not be prudent to append the data to the message, but rather embed it within the message, thus changing the structure. This would require all agents receiving such messages to be aware of the new structure and deconstruct the messages accordingly. Of course, in some messaging systems, the structure of the message itself may be included in the payload, but this will require more complex coding and comes with its own problems.

The emergence of XML as dominant standard for data transfer provides us with an opportunity to utilize standardized XML API's for processing message payloads when structured using XML. This in turn will provide us standardized routines for deconstructing the message, and a message format that is essentially extensible in nature.

Using XML for Message Payload Construction

XML is good at representing information that is extensible and hierarchical in nature. In most cases the messages in agent-based systems, including web-based eBusiness applications can be represented in a hierarchical structure. In the example given previously, we can represent the customer information in the XML format as shown in Listing 1.

      <CustomerRequest>

```
        <CustomerName>Paul James</CustomerName>
        <CreditLimit>5000</CreditLimit>
        <Address>
                <Street>11 City Road</Street>
        </Address>
</CustomerRequest>
```

Listing 1 XML example message

The advantage of using XML for message structuring lies in the use of the XML Document Object Model (DOM), for retrieving the data in the message deconstruction. The Document Object Model is an Application Programming Interface for valid HTML and well-formed XML documents and is the foundation of XML. XML documents have a hierarchy of informational units called nodes and the DOM is a way of describing those nodes and the relationships between them. For instance, when processing an XML document, the document is read through a parser that analyses the structure of the document, and from there a representation of the document can be constructed in memory. As an XML document is hierarchical in nature beginning with the root element, the representation of the document in memory is also hierarchical, represented as a tree structure. Once we have a representation in memory of the XML document, it can be manipulated under program control. Although we use the term document here, the XML can be in the form of string passed to an agent as the payload of a message.

In a survey of 58 commercial and academic agent construction tools, the Java language was used in 31 of these tools (Odell, 2003). Java is becoming the language of choice for the constructing of agents due to the close association between the Web, Java and agent development. Agent technology is an offshoot from AI research, but its rise in popularity has coincided with that of the Web, as the Web offers an almost perfect environment for agent development. Java development is also closely related to Web development and Java includes many Applications Programming Interfaces for network programming and Web interfacing. Another set API's included with Java are those for parsing XML documents and interfacing to the DOM as specified by the Document Object Model Level 3 Core from the W3C (Le Hors et al., 2003).
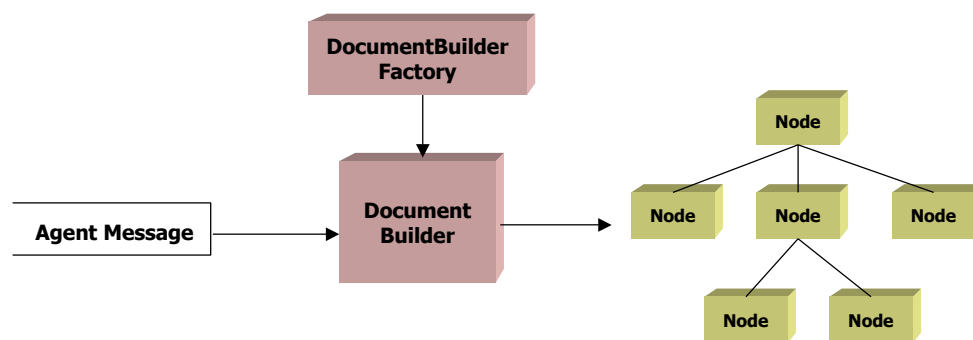

Figure 2 Parsing a message into a DOM

Using the DocumentBuilderFactory and DocumentBuilder classes we can very simply parse an agent message payload which is constructed using well-formed XML and produce a DOM internal structure in a few lines. This is depicted in Figure 2. The actual Java code snippet to achieve this is shown in Listing 2. As can be seen, from a practical perspective, the code to parse an XML message and build the DOM is quite small. If multi-agent systems that utilize communication to achieve cooperation are to be commonplace, then we need to be able to make use of such standards to cheaply and efficiently implement all communication aspects.

```
public void process(String msg) {
        DocumentBuilderFactory factory = DocumentBuilderFactory.newInstance();
        try {
                DocumentBuilder builder = factory.newDocumentBuilder();
                ByteArrayInputStream is = new ByteArrayInputStream(msg.getBytes());
                Document doc = builder.parse(is);
                                        :
```

Listing 2 Parsing an XML message

By utilizing the existing XML application programming interfaces in Java, the coding effort is minimal and results in a very practical structure for deconstructing the message. As indicated in Figure 2, the DOM is a hierarchical tree structure beginning with the root node of the XML message (the opening tag of the message). In the XML message shown in Listing 1, the opening tag would be <CustomerRequest>. An abstraction of the resultant DOM obtained by parsing the message in Listing 1 is shown in Figure 3. Of course the DOM in reality is slightly more complex with the separation of the XML tag information and actual element content into separate sub-nodes, but Figure 3 closely represents the structure of the DOM.
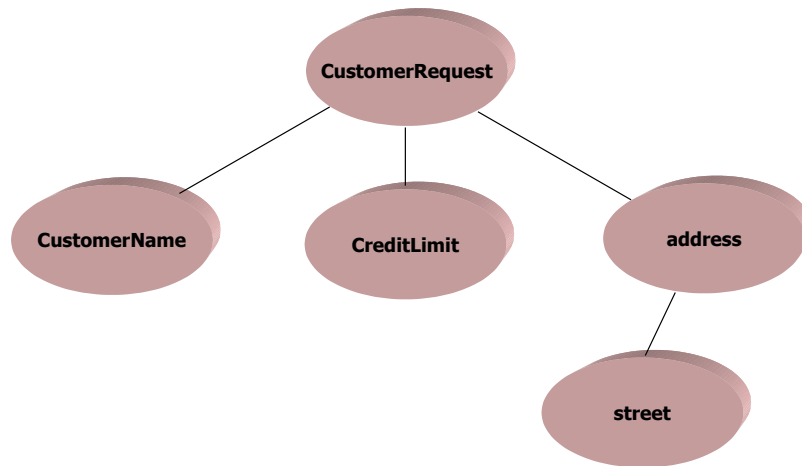

Figure 3 DOM structure for XML example

With the document object model created, the task of deconstructing has already been partially completed, a complete understanding of the message is then simply a matter of traversing the structure looking for the required information. The Java application programming interfaces include methods to traverse and update the document object model again simplifying the coding effort required by the programmer.

Extensibility of Messages

Messages constructed by an agent and subsequently deconstructed by another in this fashion are far more extensible than those expressed as simple strings. With the document object model representing the parsed message, to retrieve elements of the message, the code can 'drill down' the DOM looking for the elements it expects. Thus while the agent still needs a knowledge the elements of the message it expects to find, the order and placements of these elements in the message payload is no longer a primary concern. The document object model is what the agent will interrogate to derive meaning from the message.
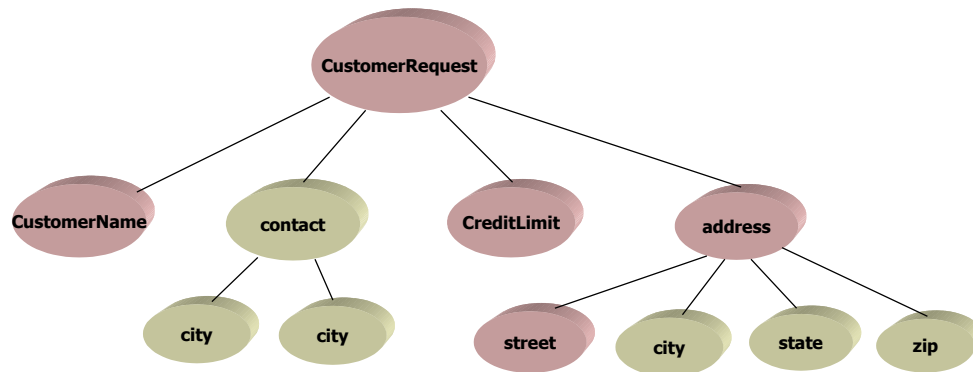
Figure 4 Modified payload document object model

The message payload can be substantially modified without affecting the receiving agents. For example, we may need to modify the content of the message in Listing 1 to add further address information and unrelated contact information for a newly developed agent which requires this extra information. By using XML syntax, Listing 1 could be modified which would result in the parsed document object model shown in Figure 1. Such an expanded document model would not affect existing agents, as by drilling down from the root of the DOM, the information they require is still there in the same format. Yet the new agent will also find the extra information added to the message. The placement of the tags and element data within the message payload is of no consequence to the receiving agents provided the XML message is well-formed.

Essentially, given the technique outlined, the structure of a message can be changed significantly from the original, as the XML application programming interfaces allow a message to be "drilled down into" when looking for elements within a hierarchy. Thus, no matter how the message structure is modified, as long as the original message structure is embedded somewhere in the expanded message due to the modifications, the receiving agents can correctly decode and interpret the message. This is depicted in Figure 5 below.
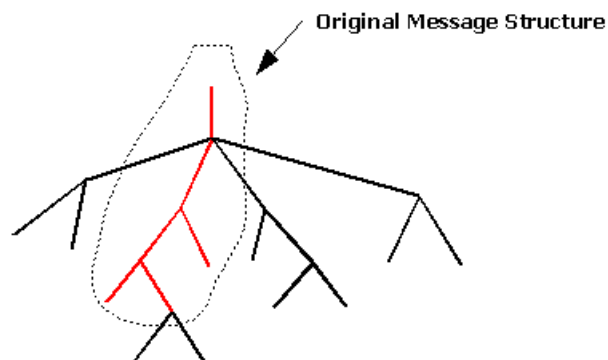

Figure 5 Original message structure embedded in expanded message

Such a system is far more extensible than a message constructed using a string as outlined in a previous section. In such a case, expansion of the message is error prone depending on the parsing methods used by these agents. More than likely, all receiving agents would need updating.

Validation

Another aspect of agent messaging is the validation of the structure of the message payload itself. This was mentioned briefly before, but in a string based message, the structure of the message is continually checked for errors as the string is parsed and tokens are extracted. Each token is validated against the type of data that is expected at that particular point in the token sequence. Thus the code of the parser is highly structured towards the expected sequence. By using XML for the message payload, as we have seen, the order of the XML tags in the input message is no longer important. The parsing routines

implemented by the documentBuilder class ensure the XML is well formed, otherwise the document object model would not be constructed and an error would result. Thus the placement of the code in Listing 2 within a Java try … catch statement.

If the XML is well formed and the document object model is built, there is still no guarantee that the DOM contains all the required tags for the receiving agent. In this case the document can be validated by the agent as it drills down the DOM looking for the nodes and data it requires, much as an agent deconstructing a string payload might do. However, XML provides a unique method for automatic validation with the use of Document Type Definitions (DTD's) or via an XML Schema. Built into the Java API's for processing the XML message payload, is the ability to apply a DTD to the message to automatically validate the payload. Listing 3 contains the DTD required to validate the XML message payload of Listing 1.

```
<!ELEMENT CustomerRequest (CustomerName, CreditLimit, Address)>
<!ELEMENT Address(Street)
<!ELEMENT CustomerName (#PCDATA)>
<!ELEMENT CreditLimit (#PCDATA)>
<!ELEMENT Street (#PCDATA)>
```

Listing 3 DTD for CustomerRequest message

The DTD can be included in either the XML message payload itself, or externally in a document supplied to the Java API at parsing. There is very little change in the Java code in Listing 2 to perform DTD validation. With this validation in place, once the message payload is parsed then the document object model not only represents well-formed XML, but also XML conforming to the DTD. As a consequence, the agent can be sure all required tags and elements are present. This then relieves the programmer from further error checking code. If constructed appropriately, then earlier DTD's need not be incompatible with later DTD's representing an expanded form of the message (as in Figure 4). Thus extensibility of the message systems remains unaffected.

Further Work

Further investigation into two consequences of using XML for agent message payloads is warranted. By using XML as the payload specification the size of the message increases with the inclusion of the metadata (or XML tags). While this will increase traffic over any network that agents communicate through, for most agent applications this should not be significant. With increasing bandwidth and computing power, only time critical agents may be affected, but the vast majority of agents operate in a delayed asynchronous environment. However, further studies will need to try and quantify this.

The other main aspect is that of security. With the inclusion of metadata in the payload, context is given to data within the payload itself. How much of a concern this is to the majority of agent systems remains to be seen, but encryption may be needed. Many agent systems may already include encryption of the message payload. If this is done by the messaging system without the intervention of the sending and receiving agents then these agents can remain out of the encryption loop. Otherwise, the agents may need to become part of the loop.

Concluding Remarks

If multi-agent systems are to become widely accepted as a paradigm for large-scale applications, or for networks of cooperating applications over the Internet, then concrete practical methods of implementation will be essential. In particular, the communication issue needs to be addressed. As communication is an essential component for cooperating agents, programmers need to be able to implement a simple, extensible form of communication. The current standards are quite complex, with little attention being given to actual message payload. Many of the papers dealing with communication

are developing logic based languages for intelligent agents, yet the vast majority of agents will not be intelligent and will only need to deal with simple communication.

XML provides us with a means to specify a message payload using a simple hierarchical format. With current research and development pushing XML to be the standard for data transfer on the Web, the development of API's for XML parsing and recognition are well advanced. Utilization of these API's provides the agent programmer with a practical and simple method to implement message payload construction and deconstruction with minimal effort. This also provides us with a way to structure the messages in a format which is flexible and extensible, allowing for future expansion.

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