e-Business Adoption by Manufacturing SMEs in Regional Australia

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Abstract

Using the Internet for electronic business has become an area of action for the Australian Government, and programs have focussed on raising the awareness of small and medium sized enterprises (SMEs) to the opportunities offered by doing business on-line. As the manufacturing industry in Australia has experienced productivity improvements, the outlook is strong and Australian manufacturing SMEs are ideally placed to gain a competitive advantage in global trade. The results of this research indicate that while most manufacturing SMEs in regional Australia use computers, with a majority using email, only a small percentage utilise the Internet for transaction processing. Major barriers to becoming involved in electronic business are identified as concern about security and privacy of transactions, cost of consultants, and lack of IT expertise of staff. Examination of planned IT staff training methods reveal that employing people with appropriate knowledge has been added to current methods such as on-the-job training. Results from two regional areas are compared.

Keywords: e-business, e-commerce, manufacturing SMEs

1.   Introduction

The evolution of the Internet as a commercial tool for conducting business has led to an increase in the use of on-line services by organisations. E-commerce has emerged as a whole of business strategy offering a range of services and

opportunities for electronic trading in the global marketplace. The use of information and communication technologies enables organisations to improve business processes and communication within the organisation and with trading partners.

The way business is conducted is experiencing change worldwide, and is clearly evident in Australia. Globally, e-business revenue is estimated to reach US$6.8 trillion by 2004 representing 8.6% of the world-wide sale of goods and services [26]. The use of information technology, the Internet and the move to electronic commerce have generated considerable interest in recent years. Consequently, the Australian government asserts that electronic commerce will provide many new opportunities to expand exports and create thousands of new jobs, and so enhance economic growth [18]. Certainly, the media have portrayed the image that business will predominantly be conducted on-line in the future, and organisations that do not embrace the new technologies will be left behind. As pointed out by Roseberg [22] diffusion of new technology can take decades, and involves more than simply reproducing and distributing the technology. Indeed, making full use of the new technologies will rely on the IT skills of staff within organisations.

Electronic Commerce in Australia

In January 1999 the Australian Government released its vision for Australia in the information age, with electronic commerce as one of the areas for action. Senator Alston, Minister for Communications, Information Technology and the Arts believes that industry will be uncompetitive without electronic commerce. The Australian Government is partnering with industry in the On-line Australia Year to establish "a range of initiatives that ensure a balanced and predictable legal and regulatory environment for e-commerce" [2]. A priority is to target barriers and to encourage the use of business-to-business electronic commerce. Technical barriers of bandwidth capacity and incompatible IT systems are currently under investigation.

Electronic commerce has been defined as the process of conducting all forms of business activity using electronic methods, ie, electronic mail, electronic catalogues, electronic banking, processing transactions [1, 28]. The use of these paperless methods of exchanging business information recognises that paper based systems increase cost without adding value. The argument that businesses can adopt electronic commerce to make better use of information and computer technology, and to leverage these technologies to improve business processes and the exchange of information is strong, particularly when confronted with the need to reduce production costs and lead times [16]. Electronic commerce has moved from being a technology issue to a core business issue, both in Australia and internationally [2]. A majority of small and medium sized enterprises (SMEs) have Internet access in Europe and United Kingdom (70%), and in the United States (80%) [26]. Internet access does not, however, equate with e-business practices, but is the first step along path to being involved in doing business on-line.

Small and Medium Sized Enterprises

This notion of a new way of doing business raises many issues particularly for SMEs in Australia. This new way of doing business requires staff with expertise in the new technologies, ie, Internet Web Page design and electronic commerce. SMEs will not necessarily have dedicated IT staff to enable them to gain the necessary competitive advantage in the global marketplace. While the advantages of electronic commerce to large organisations can be justified, particularly if the organisation has specialised IT staff, SMEs may have difficulties firstly in meeting the initial costs and then the on-going expenses of maintaining the operation [21]. Government programs focus on raising the awareness of SMEs to the trading opportunities offered by electronic commerce, however SMEs are not conducting business on-line as quickly as larger companies [18]. Factors that contribute to SMEs not becoming involved in doing business on-line include: less expertise in IT than larger organisations; fewer resources available to initiate new ways of doing business; and, suspicion held by owner/managers about who benefits from new technologies [14].

SMEs constitute 94-96% of commercial organisations in Australia [5] and therefore play a major role in the Australian economy, as well as contributing to private sector employment. Australian Bureau of Statistics defines manufacturing SMEs as organisations with less than 200 employees, and annual turnover less than $20 million. Gessin [23] found that 90-95% of Australian SMEs are using computers. How the computers are used for business and in particular the role of the Internet are emerging issues. However, small organisations will not take up new technologies unless they perceive an advantage to do so, or an immediate disadvantage in not taking them up [13]. Likely benefits to an organisation using the Internet include saving in communication costs and potential business opportunities [31].

The Centre for Electronic Commerce [11] found that SMEs have only superficial knowledge of the emerging global business communications and information infrastructure. The idea of electronic commerce is even less understood, and in general, SMEs do not believe that electronic commerce will substantially assist them with their primary concerns of staying in business, making a profit and getting ahead of competitors. This study suggests that using email and access to information via the World Wide Web are starting points for moving into electronic commerce.

A target of the Getting Business On-line Project by the Department of Industry, Science and Tourism is to ensure the Australian business sector is regarded as a front-runner in the adoption of on-line technologies at the global level within five years, and a leader in the ASEAN region [19]. Certainly, predictions are that profit margins will reduce due to global competition [34]. How this will impact on the cost of participating is not clear. Organisations will need to think about their relationships with customers and suppliers, as well as issues such as information for potential customers, and after sales support [3].

Barriers to Electronic Commerce

Barriers to doing business on line can be categorised as having a technical or a social perspective. Technical barriers include inadequacy of telecommunications infrastructure and security of transactions [33]. Social barriers range from generally not trusting information technology [17]; lack of knowledge about conducting business on-line and lack of IT skill of staff [14, 30, 17]; through to lack of awareness about possible uses of the Internet [33]. Telstra [32] conducted a survey of Australian SMEs and found that the major barrier was lack of personal contact between the organisation and the customer. The viewpoint that customers were not ready to do business on-line was also rated highly as a barrier. Interestingly only 5% of respondents felt security was a barrier to implementation. Further, the Australian Industry Group's report highlighted reasons for not obtaining an Internet connection as cost of access, and lack of IT skill [7]. Barriers to European SMEs not becoming involved in using the Internet have been identified as lack of time (46%), lack of information (31%), and lack of training (30%) [26].

The use of computers by Australian SMEs has been reported at 76%, with 35% having an Internet connection, and 12% a web page [32]. The Australian Industry Group reported that 78% of its members had an Internet connection [7]. A study conducted in Tasmania revealed that 77% of respondents used computers, with 37% having an Internet connection, and 23% a web page [12]. Further, 23% of respondents to the Tasmanian study indicated plans for a web page within the next year. In Queensland, AIG found that 60.5% of members had an Internet connection [8]. US SMEs with Internet access is 80% [26], however, only 32% of American manufacturers had a web page [10].

Considering that electronic commerce is in its beginning phase, Australia is viewed as a world leader in electronic commerce initiatives by the OECD, which rates Australia ahead of most of its 29 member countries. Australia is ranked third in the world (behind Finland and the US) in Internet use. Levels of electronic commerce in Australia have been estimated at 0.1% of total sales [2]. A newly formed organisation, Australian Electronic Business Network (AeB.N) has been established, as a joint venture of the federal and state governments and the business sector, to promote electronic commerce to SMEs in Australia [24]. Its objective is to increase the number of SMEs doing business on-line. AeB.N's leadership role includes contributing to policy and regulation decisions, and networking organisations.

Manufacturing Industry SMEs

Current literature in the area of electronic commerce has produced success stories for SMEs, but not usually within the manufacturing industry. The manufacturing sector in Australia achieved substantial productivity improvements over the past decade, with output increasing by 21.8% from 1987 to 1997, and an employment increase of 0.5% [20]. The outlook for manufacturing is strong in terms of economic growth. An Internet presence for manufacturing organisations would see the geographical distances that historically have isolated Australia from global trade

broken down. The Innovate Australia initiative encourages manufacturers to join together to conduct trade internationally via the Internet, and points out that the two-year period usually associated with getting into the international market can be reduced to a few months [9].

This paper reports on a research project which forms part of an integrated study of e-Business in Australia. the project will focus on manufacturing SMEs in South East (SE) Melbourne. A previous study in South West Sydney will be used for comparative purposes [29]. South East Melbourne was selected by industry associations as having a significant manufacturing base, and as being equivalent to South West Sydney in manufacturing terms. Specific aims are to:

- *identify specific and planned use of the Internet for electronic business;*
- *identify barriers to using the Internet;*
- *determine the organisation's satisfaction with level of IT skills of staff; and*
- *compare results with similar study in South West Sydney.*

Models of the stages that an organisation moves through when embracing electronic commerce have been developed [15, 25, 4]. The Internet E-Commerce Staged Model [15] will be used to evaluate the level of maturity of e-commerce for organisations in the study. This model was developed from existing models to reflect the modular adoption process for the manufacturing industry. The model was tested internationally to evaluate level of maturity of manufacturing organisations with a web presence. In 1998 most organisations began with an uncomplicated web page and added modules for functionality and complexity. This study will examine if manufacturing has progressed in their approach to web presence since 1998.

2.   The Study

Manufacturing organisations located in the SE Melbourne region that have an entry in the 1999 Australian Industry Group (AIG) Yearbook [6] comprised the population-sampling frame. Seven hundred and eighty eight organisations were identified as meeting the Australian Bureau of Statistics definition. From this group a sample of 394 was selected and the survey mailed to the principal officer (managing director, director, etc) as set out in the AIG Yearbook. Seventy two surveys were returned as left address or no longer in manufacturing. From the final sample of 322, 126 organisations completed the survey, representing 39.13% of the sample. The final page of the survey was a separate detachable page for the respondent to indicate their interest in the project by participating in an on-site interview. In addition to the survey, six case study interviews were conducted. From responses to the survey a profile of specific and planned use of the Internet for business was established, and related to the Internet E-commerce Staged Model [15]. Similarities and differences in results of this study and the South West (SW) Sydney study are identified.

Demographics

Table 1 shows the Manufacturing Industry segments as defined by the Australian Bureau of Statistics [5]. Table 2 shows the sample broken down by small and medium sized enterprises as defined by the ABS [5]. Figure 1 illustrates the sample by Industry Segment and Size of Organisation. Figure 2 shows the Internet Staged Model [15] used to ascertain the organisations' level of maturity in using the Internet for business.

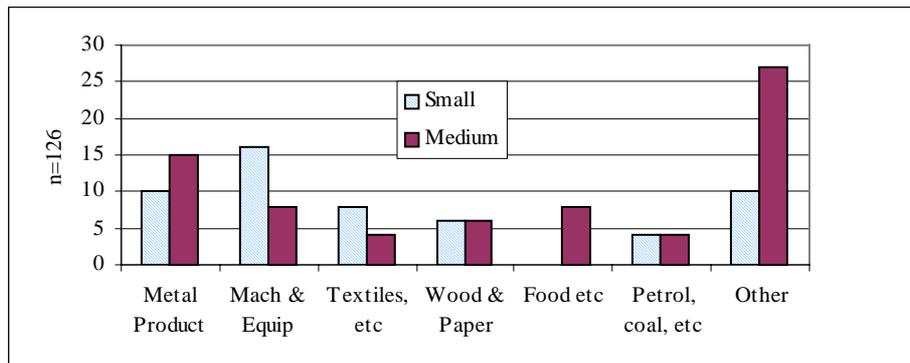| Segment *	N	%
Metal product manufacturing	25	19.8
Machinery & equipment manufacturing	24	19.0
Textiles, clothing, footwear & leather	12	9.5
Wood & Paper product manufacturing	12	9.5
Food, beverage, tobacco	8	6.3
Petroleum, coal, chemical	8	6.3
Other manufacturing	37	29.4
	126	100.0

*Segments as defined by Australian Bureau of Statistics
Table 1: *Manufacturing Industry Segments*

Small/Medium *	N	%
Small: less than 20 employees	54	42.9
Medium: 20-200 employees	72	57.1
	126	100.0

* Size as defined by Australian Bureau of Statistics
Table 2: *Size of Organisation*

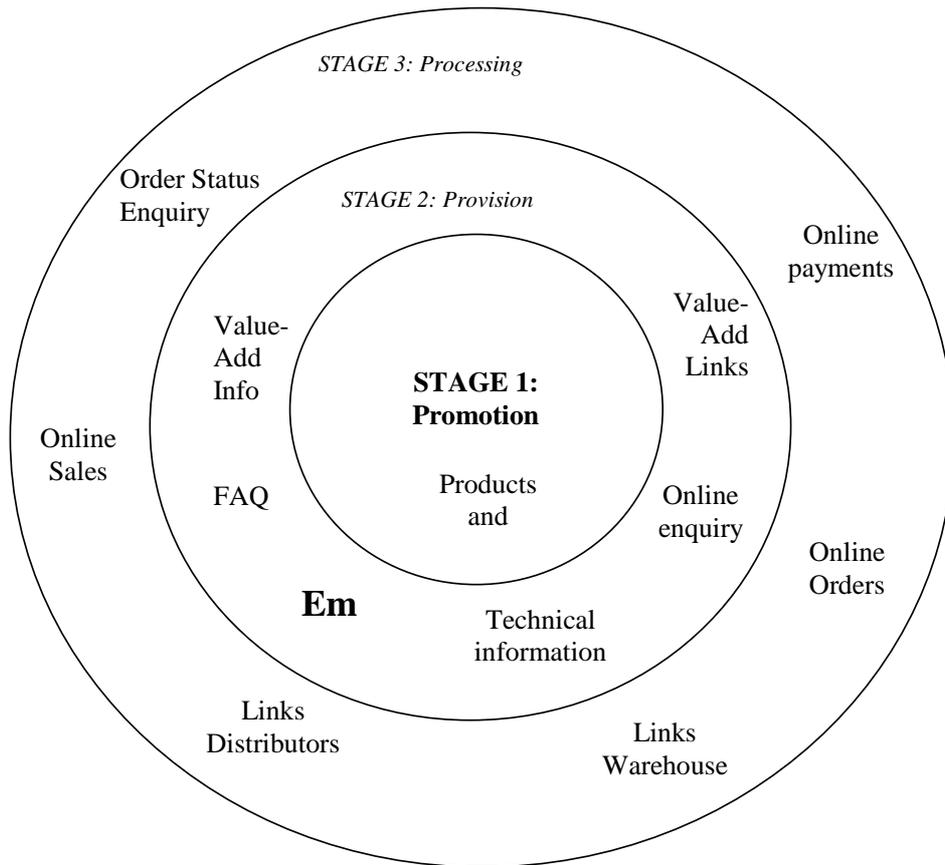**Figure 1:** *Industry Segments by Small or Medium organisations*

Figure 2: *Internet Staged Model (Cooper and Burgess, [15])*

3.   Results of South East Melbourne Study

Demographic data for the survey revealed the mean age of the sample was 43.04 years, with a total of 108 males and 16 females. Position of the respondent was divided into executive (managing directors, CEOs, etc) and non-executive (general managers). The executive group consisted of 56 males and 2 female (mean age 45.43 years), and non-executive group consisted of 52 males and 14 females (mean age 41.05 years). Based on T-Test analysis, there were no significant differences in survey responses based on age, gender or position held. Six males participated in the case study interviews, with the mean age group of 30-39 years.

Respondents generally agreed that the important issues facing the organisation this year were trying to make a profit (88.9%) and staying ahead of the competition (84.1%). This was consistent with respondents to the SW Sydney study at 90.9% and 90.0%. Results of the SE Melbourne study based on the aims of the project are set out below.

The extent that manufacturing SMEs are using IT for business (96.8% in SE Melbourne, 98.8% in SW Sydney) demonstrates an acceptance of computers, with some organisations moving to doing business on-line. From the organisations that took part in this study, a majority have indicated their plans to move to transaction processing via the Internet within five years. Certainly, the main use of the Internet for those with an Internet connection is email as a communication tool.

Actual and Planned Use of the Internet

Table 3 shows the stage that the 57 organisations with a web page had reached with their use of the Internet for business, and also where the 126 organisations planned to be within the next five years. Although 88.9% indicated that they had an Internet connection, it was mostly used for communication via email (81%). The organisations shown at Stage 3: Processing also utilise the functions of Stage 2 and Stage 1. Organisations shown at Stage 2: Provision also utilise the functions of Stage 1.

	Actual Use		Planned next 5 yrs	
m,mm,	**n**	**%**	**n**	**%**
STAGE 1: Promotion	3	2.3	9	7.1
STAGE 2: Provision	36	28.6	43	34.2
STAGE 3: Processing	18	14.3	74	58.7
	57 *	45.2%	126 **	100.0%

* 57 respondents indicated a Web Page

** 126 total respondents

Table 3: *Internet use related to the Internet E-Commerce Staged Model*

Almost half (45.2%) of the organisations indicated that they had a Web Page, with 14.3% of respondents (31.6% of organisations with a Web page) at Stage 3: Processing. However, a majority of the surveyed organisations (92.9%) planned to be at Stage 2 or Stage 3 within five years, with some positive attitudes towards moving in this direction:

> *"When dealing with larger companies, it will become essential. The majority of people will eventually shop/enquire on line (maybe 5-10 years), so business will have to move with technology. Long term, we expect that at least 50% of our business will have some exposure to an Internet site that we are on, either our own or one of our customers' sites." (Managing Director, male, 45 years, small organisation in Metal product manufacturing, SE Melbourne)*

Of the 30.2% of organisations in the SW Sydney study with a web page, 53.8% (15.9% of organisations with a Web Page) were at Stage 3: Processing. A majority of the respondents (88.7%) planned to be at Stage 2 or Stage 3 within five years. Positive attitudes were also expressed:

> *"Expect high % growth in business when our web site offers Internet ordering and payment in near future" (Co.Secretary, male, 40 years, medium organisation in Other manufacturing, SW Sydney)*

The assertion, that SMEs will not take up new technologies unless they perceive an advantage to do so, or an immediate disadvantage in not taking them up [13], is supported by the following comments:

> *"The whole 'net' thing is too abstract for most 'conventional' businesses to absorb. When it is finally put into a 'what it will do for you' format – without the YOU BEAUT extras, it will change." (Managing Director, male, 45 years, small organisation in Metal product manufacturing, SE Melbourne)*

In SE Melbourne, case study organisations used their Internet connection to send email (both internal and external to the organisation), to do their banking, and to download files (eg drawings). All organisations were in various stages of planning and upgrading their web sites.

Organisational web sites included Stage 1 with some elements of Stage 2, or Stage 2 with some elements of Stage 3 of the Internet Staged Model. Active planning was well under way for the next one to five years, with on-line ordering, and order status enquiry being viewed as important features for the evolution of the web site. The results of the survey, and case study discussions suggest that the Internet Staged Model needs modification, particularly with regard to the boundary between Stage 1 and Stage 2. Certainly, organisations were planning for interactivity on their web site as an initial step. Case study organisations planned for business expansion as a result of their web site development. Depending on the product lines this included within Australia, overseas, or a combination of Australia and overseas.

The trend in the survey towards Stage 3 is also reflected in discussions with the case study organisations. In SW Sydney, case study organisations raised the issue of needing to conduct parallel business processes, for their on-line customers, and for their customers who do not use technology. They also highlighted that the manufacturing industry has organisations (particularly small organisations) that do not use technology. In addition, it was indicated that business-to-business transactions in manufacturing were generally carried out in person or by phone. Moving to on-line transactions will involve a change in this traditional approach.

Results indicate a progressive trend in adoption of e-business consistent with the Internet Staged Model. However, some revision to the barrier between Stage 1 and Stage 2 is warranted to reflect current thinking that an initial web page would include Stage 1 plus elements of Stage 2.

As a group, the case study organisations in SE Melbourne and SW Sydney were very aware of the benefits and risks associated with conducting business on-line.

Benefits included:

- Marketing Tool where customers could access information as many times as necessary.

- Better communication and closter interaction with customers via an email link on the web site, which had the potential to reduce turnaround times.

- Improved Business Practices as reduced lead times was viewed as critical in manufacturing.
- Increased Business as the organisation would be more widely known, particularly internationally.

Risks included:

- Cost of implementing and maintaining the web site was viewed as a risk, but in contrast, organisations believed that, in the longer term, reduced costs related to electronic transactions would flow to the organisation.
- Loss of knowledge, firstly, of the on-line transaction in constrast to the usual face-to-face interaction, and secondly, possible loss of knowledge of the product if only covered by an Australian patent.
- The notion that a web site does not necessarily create a positive Corporate Image was raised as a risk. Getting the design and navigation right for different levels of customers was an issue to be considered. Constant monitoring of these aspects was viewed as necessary as the more educated the customer becomes in using the Internet, then the web site will be measured against other sites and what is available. It is a two-edge sword, firstly, efficiency in responding to customers electronically, and secondly, to have a web site that reflects current trends about design and navigation.

In SE Melbourne, case study organisations were well into their planning and development phase of their web sites, ie integrating current systems for interactivity, and getting the design right with easy navigation. In contrast, SW Sydney organisations were more focussed on security, loss of data, reduced human contact, and competitor's accessing their site and stealing ideas about their products.

Barriers to Internet Use

Based on the 126 organisations in SE Melbourne that responded to the Survey, Table 4 shows the top four (of 12 listed) barriers to the organisation becoming involved in electronic commerce. Respondents were asked to indicate their agreement with statements by circling a number on the Likert scale *(1=Strongly disagree to 5=Strongly agree)*. The four barriers shown returned a mean higher than 3. South West Sydney had five barriers with a mean higher than 3.

	Mean	Std Dev	n	%
Concern about security, privacy of transactions	3.38	1.17	62	50.0
Cost of consultants	3.29	1.23	59	47.6
Lack of IT expertise of staff	3.04	1.12	46	37.1
Lack of government incentives	3.25	1.12	45	36.3
n=number of organisations				

Table 4: *Barriers to Internet use*

Barriers that have slowed down the adoption of Internet as a viable way of doing business have similarities with other studies. In this study concern about security and privacy of transactions (50.0%) is one of the main obstacles, but less of a barrier than in SW Sydney (59.0%, mean 3.63). Other studies have rated this barrier lower, and barriers such as inadequate speed of transmission, lack of knowledge about conducting business on-line, and lack of IT skill of staff, higher. In contrast to this study, only 5% of respondents to the Telstra survey [32] rated security as a concern. The high level of concern about security may be a characteristic of the manufacturing industry, or the regions.

Cost of consultants was the second highest barrier (third barrier in SW Sydney, 47.7%, mean 3.37). This finding is consistent with an overseas study [27], and was a feature of the discussions with case study organisations both in SW Sydney and SE Melbourne. Lack of IT expertise of staff rated as the third highest barrier in this study (fifth highest in SW Sydney, 38.6% mean 3.07). Lack of government incentives was the fourth highest barrier, and while governments are moving on this issue, perhaps not in practical ways which are relevant to the manufacturing industry. SW Sydney rated this barrier second (47.7%, mean 3.40). The barrier of "Unsure how many people using the Internet" was not evident in this study, however, was rated fourth in SW Sydney (40.9%, mean 3.14).

Case study organisations in SE Melbourne while acknowledging that security and privacy of transactions was a barrier, believed that cost of consultants, integrating current systems, and lack of IT expertise within the organisation were barriers to be overcome in the evolution of conducting business on-line. Getting the right people to set up the web site which looks good, provides functionality and easy navigation, as well as ongoing support was viewed as critical to maintaining a quality assured standard, particularly when considering functions that would be provided at Stage 3.

Experiences of two organisations revealed that cost of consultants vary dramatically, with quotes appearing to offer the same service varying from $1,000 to $10,000. Interestingly, a consultant provided a quote for a web site with particular features at $40,000, and when approached with the same specification the following year, quoted $6,000. These inconsistencies have created an atmosphere of suspicion, with a number of comments, ie:

> *"Not easy to get good IT people who know what they are doing – consultants charge about $120 per hour and are very expensive – quality of their work depends on how well YOU know computers." (Manager, male, 40-49 years, medium organisation in Other manufacturing, SE Melbourne).*

> *"The area is so new, consultants are learning at their customers expense at very high fees – smoke and mirrors effect – IT is a very large field, hard to know it all." (Director, male, 30-39 years, small organisation in Other manufacturing, SE Melbourne).*

All of the respondents to the survey in SW Sydney, and 70% of respondents in SE Melbourne believed that the manufacturing industry has not been made aware of what is available for the move to doing business on-line. This lack of awareness is definitely a barrier to an organisations becoming involved in electronic commerce.

In SW Sydney, not understanding the process was also emphasised as a barrier that overlaps with the need to deal with consultants. The need to go out and research was identified as a problem, not knowing who to trust, and the lack of a central place for information related to doing business on-line for SMEs. The need to work differently was highlighted and to get training for staff was also viewed as a barrier. Currently, within some organisations there was none or very little expertise to maintain the web site, and very little time to allocate to training. In contrast, organisations in SE Melbourne already were in various stages of developing and enhancing their web sites, either by internal people (not necessarily designated IT staff), or were outsourcing the work. Ideas of what is available and possible were evident, with acknowledgement that the cost of consultants was a barrier. As a consequence, more confidence in dealing with consultants was apparent.

Lack of staff IT expertise had led to existing information technology not being used effectively, and a belief by some of the case study organisations that the situation will be exacerbated with the introduction of new web technologies. In SW Sydney, the issue of workload was raised by a number of the case study organisations, which were concerned about the need for parallel systems, and the need to deal with a higher volume of enquiries. Parallel systems would be necessary to enable the organisation to deal with additional or existing customers with on-line capabilities, and to provide for existing customers without technology. One organisation mentioned that some manufacturers do not have a fax machine. Strategies to deal with more enquiries were viewed as important in maintaining a quality assured standard. In SE Melbourne, case study organisations were generally satisfied with the current level of staff IT expertise, and were looking at recruitment practices to ensure new employees were computer literate.

Level of Staff IT Skills and Training

One of the aims of the project is to determine level of satisfaction with IT skills of staff. The lack of IT expertise of staff was identified as one of the barriers to becoming involved in electronic commerce. For this series of tables, respondents were asked to tick as many of the items as applicable to their organisation. Table 5a shows the organisation's satisfaction with the current level of IT skills by staff categories. Table 5b shows the organisation's training methods currently used for the various staff categories. Table 5c shows the IT training methods planned to meet the organisation's business strategies.

	n	%
Management (salaried employees)	91	72.2
Office employees	89	70.6
Factory (award employees)	37	30.9
n=number of organisations		

Table 5a: *Organisation's satisfaction with level of staff IT skills by Staff Category*

	Management		Office		Factory	
	n	**%**	**n**	**%**	**n**	**%**
In-house training with internal people	82	66.1	84	67.7	54	43.5
External training courses	81	65.3	83	66.9	49	39.5
Trained to current level on recruitment	80	64.5	75	60.5	54	43.5
In-house training with external people	72	58.1	80	64.5	44	35.5
Courses provided by product supplier	65	52.4	69	55.6	37	29.8

n=number of organisations

Table 5b: *Organisation's IT training methods used for Staff Category*

	n	**%**
On-the-job training by fellow employees	81	65.3
Employ people with appropriate knowledge	79	63.7
Consultants	75	60.5
Self-taught staff within organisation	74	59.7
Knowledgeable employees	73	58.9
n=number of organisations		

Table 5c: *Organisation's IT training methods planned*

The level of IT skills of staff will affect decisions about moving to doing business on-line, particularly if the level of skill is low, or problems have been experienced in getting staff trained. In these circumstances, lack of IT expertise of staff is viewed as a barrier. Organisations in the SE Melbourne study appear to rely on in-house training with internal people, and plan to continue this trend to meet the organisation's strategic plan for the next five years. Satisfaction with the level of IT skills of management (72.2%) and office employees (70.6%) is much higher than satisfaction with factory employees (30.9%).

Organisations are now looking at employing staff with general computer literacy (not package specific) at the factory level:

> *"I expect computer literacy on recruitment, even from factory staff. There is not a guy here who doesn't touch a keyboard." (Managing Director, male, 40-49 years, small organisation in Textiles, etc., SE Melbourne)*

Case study organisations in SW Sydney, and some case study organisations in SE Melbourne facilitated in-house training by sending one member of staff to an external course and then passes on the knowledge to staff:

> *"Owner/Manager learnt system on external training course and then trained office staff" (Owner, female, 37 years, small organisation in Metal product manufacturing, SW Sydney)*

This approach was extended further by some case study organisations in SE Melbourne. Introductory training (email, Internet) was handled by internal staff, with external courses for more advanced training (Office, MYOB, Photoshop).

However, the acknowledgment that new IT skills are necessary if the organisation is planning to move to doing business on-line is demonstrated by the ranking of "employing people with appropriate knowledge" close to "On-the-job training by fellow employees".

Case study organisations in SE Melbourne raised some interesting issues related to levels of IT expertise of existing staff that needed to be addressed. These issues centre around:

- Top management slow to fully utilise computers in their work. While some were happy to use email and to a lesser extent the Internet, reports were still being hand written.

- *Cost of training and the inevitable staff turnover, leading to feelings of never being completely satisfied with level of skills.*

- *Reluctance of factory and older employees who have had to face the challenge of becoming computer literate.*

- *Need to recruit staff with general (email, word processing) IT skills. Package specific (Outlook, Word) skills were not viewed as being as important as skills related to feeling comfortable using computers.*

Lack of competency of existing staff in specific areas was also discussed. File management was highlighted as an area that needed to be addressed, particularly when considering the complex structure of public folders and files stored on file servers which had started to become a feature of networking and electronic transactions

4. Discussion

The results of the SE Melbourne study support results from the SW Sydney study [29] which found that while almost all organisations use computers, a majority have an Internet connection that they exclusively use for email, and only a small number of organisations are involved in transaction processing. Barriers are mostly non-technical, and planned IT training methods for staff includes employing people with appropriate knowledge to supplement current training methods. Organisations in SE Melbourne appear to be further along the diffusion process, with organisations planning the evolution of their web site and exploring issues related to content and design. While organisations in SW Sydney are planning to move to doing business on-line, their knowledge of the potential benefits offered by involvement in electronic commerce is only superficial. One way to overcome this lack of knowledge would be for industry associations to get closer to the problem, by disseminating information and conducting seminars in a format acceptable to SMEs. This may need a change of focus, as mentioned in this comment:

> *"Industry groups are focussed on government regulations rather than Industry tactics or direction of o/s competitors." (Manager, male, 39,*

> *medium organisation in Machinery and equipment manufacturing, SW Sydney)*

Modification to the Internet Stage Model [15] is recommended for manufacturing SMEs in Australia based on survey results and case study interviews. The barrier between Stage 1 and 2 should appear as a soft barrier indicated by a broken circle. The barrier between Stage 2 and 3 should be strengthened to a hard barrier, as organisations believed that their business practices and other issues needed to be addressed before crossing this barrier. In constrast, having a web presence that encompassed Stage 1 and elements of Stage 2 could be accomplished alongside existing business practices.

The survey in both studies highlighted the need for manufacturing to be made aware of the benefits and risks of SMEs becoming involved in electronic commerce. The case study interviews from both studies provided insight into the role that industry associations could provide, namely:

- *A central information centre of electronic commerce resources specifically for SMEs: newsletters, booklets, where to find programs and seminars;*

- *Liaison with regional associations to provide: seminars, briefings at regional level relevant to manufacturing SMEs;*

- *Globally raising the profile of manufacturing in Australia.*

Raising awareness that can lead to adoption of the new technologies is a priority of the Australian Government, however actually getting education to SMEs needs to be handled at a regional level to overcome barriers associated with doing business on-line. Regional associations could provide a one-stop point for information about electronic commerce.

The process of diffusion identifies three groups that would need to be addressed: early adopters, those who are aware, and those who are not aware. Some subsidy from the industry association was suggested as a way of involving SMEs who are currently not aware of the new technologies. Certainly, without post-adoption support the early adopters group can plateau or move away from the new technologies. Industry associations have a role in the diffusion process of electronic commerce for manufacturing, and more specifically to SMEs without IT personnel and expertise.

The studies revealed a need for a global business focus in manufacturing, and a need for regional networking and education on how to achieve on-line business. The following comment raises the need to support the early adopters, as well as those who have not yet conducted some form of business on-line:

> *"The early adopters have broken the ice, and others will come on board, so the next wave will be quite a big one." (Director, male, 30-39 years, small organisation in Other manufacturing, SE Melbourne)*

Industry associations at national level could focus on providing a central point for resources for SMEs wishing to become involved in electronic commerce, and liaise with regional associations to provide the face-to-face interaction at local level. Almost all case study organisations mentioned that they did receive a lot of paper from their national industry association, which was mostly not read. This

distribution by mail is not meeting the needs of SMEs, and a more timely way of conveying information could be explored. Certainly, targeting early adopters, those who are aware, and those who are not aware, and providing these groups with relevant information would be a step in the right direction.

5. Conclusion

While electronic commerce means conducting business on-line using the paperless methods of electronic mail, electronic catalogues, electronic banking, and on-line services such as transaction processing, there are many Information Technology and non-Information Technology views of electronic commerce. It is certainly not the domain of Computer Science, Information Systems or professional IT associations. Electronic commerce needs a multi-disciplinary approach to the diffusion process. The technology is available, and adoption will rely on how well the diffusion process is handled by government and industry associations.

This research has highlighted four integrated areas in the diffusion process:

- What government and industry association can do:

    provide information to raise awareness adapted to manufacturing SMEs

- What education sector can do:

    provide knowledge and skills in electronic commerce for graduates
        (not just IT-related courses)

- What SMEs can do:

    participate in the diffusion process by liaison with industry associations
    develop strategies for dealing with consultants
    identify and develop strategies about workload issues

- What Consultants can do:

    interact with SMEs to provide quality service

As the diffusion process evolves in the future, the main issue in electronic business will move away from the technology, to a functional and service level. For SMEs, business will be carried out by staff with support from consultants. Issues will continue to be IT expertise of staff and quality of consultants.

The next stage of this research involves exploring what industry associations are offering, and planning to offer SMEs; and what incentives are being offered by the Australian government to encourage participation of SMEs in moving towards conducting business on-line.

The use of the Internet by manufacturing SMEs in regional Australia (45.2% in SE Melbourne, 30.2% in SW Sydney with a web page) is more than comparable with the national average of 23%, and with US manufacturers at 32%. Manufacturing industry associations will have a role to play in supporting SMEs in developing strategies for doing business on-line. The evolution of the diffusion process will rely on awareness and education. This will be the key to moving towards achieving the Australian government's goal of making industry competitive in the global marketplace.

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