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E-Commerce Technology Adoption Framework by New Zealand Small to Medium Size Enterprises

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Abstract
This paper attempts to highlight a framework for the adoption of electronic commerce (EC) technologies in New Zealand with specific interest in the small to medium-size enterprise (SME) sector of the economy. The main thrust of the research was to develop the framework for EC adoption by the New Zealand SMEs and hence study the accelerators and impediments to the adoption and diffusion of EC technologies. The paper shows how IS/IT adoption and diffusion theories and practicalities can be explored for developing the proposed EC adoption framework. It is argued that results from research case studies based on the framework are able to identify the factors influencing and leading to the adoption of e-commerce technologies by the New Zealand SMEs.

1 Introduction

E-commerce refers to the conduct of business among firms with the support of networked information and communication technologies (ICT), especially with the Internet. E-Commerce includes Electronic Data Interchange (EDI), EFTPOS, electronic banking, digital cash, and other form of electronic payment systems. The Internet in general and the World Wide Web (WWW) in particular is revolutionising business activities. They are becoming essential tools for organisations in general and for small businesses in specific in gaining competitive advantage by accessing global markets. Recent research has identified two key emerging trends that are making the development and deployment of a global enterprise networks more critical. The first is the evolution of global enterprises and the rise of electronic commerce and the second is the impact of supplier and industry value chain on the business function. Large organisations as well as SMEs use various ICT tools and innovative methodologies to develop and deploy virtual enterprises with global access creating the most sophisticated form of e-commerce.

The International Telecommunications Union (ITU) estimated business-to-business (B2B) e-commerce in 2001-02 in a range from $100 billion to $400 billion, and business-to-consumer (B2C) from $25 billion to $90 billion. It was estimated that the market for global electronic commerce would grow to US$300 billion by 2001. Another estimate claimed that e-commerce was valued at $37 billion in 1998 and expected to grow to $707 billion in 2003 -a growth rate of 80%. The impact of e-commerce or e-business is taken seriously by the private and public sector enterprises in New Zealand as innovators as well as early adopters of the technology. New Zealand government recognises that e-commerce will benefit in minimising the barriers of time and distance to world markets and efficiency gains in business supply chains [12]. The government has realised the need for formulating policy framework for e-commerce development ensuring consistency across all policy sectors, avoiding duplication of effort, ensuring

comprehensive consideration of electronic commerce issues and certainty in delivery to business and customers.

The universal importance of small to medium-sized enterprises (SMEs) resulted from their main contribution to the overall national economy. Generally, SMEs constitute around 95 percent of enterprises and account for 60 to 70 percent of employment within the countries of the Organisation for Economic Cooperation and Development [13]. In New Zealand, SMEs form a significant component of the economy output (35%), both in terms of the number of firms (96%) and their contribution to employment (41%) [11].

Despite the growing interest about e-commerce [3,1] and SMEs among researchers [8,16] the field of EC is relatively new and research on EC is scarce [1,22]. Most SMEs opted to wait and see the direct benefits of the Internet to their business before adopting it [3,17]. Research on the importance of New Zealand SMEs [5] and on the impact of e-commerce [6] successfully characterised the New Zealand SMEs but little research is available regarding e-commerce adoption by New Zealand SMEs. The available research is dominated by surveys and emphasised the views of executives about EC opportunities within New Zealand and Australia [1,3]. In a recent large EC study conducted by PricewaterhouseCoopers [18] that covered SMEs within the Asia Pacific Economic Cooperation (APEC) countries, New Zealand's participation was limited to 2 percent only. The study demonstrated significant commonalties among the APEC economies in terms of SMEs decision-making and attitudes. The study further highlighted the importance for further research on EC best practices and case studies within SMEs. Studies reveal that although considered among the high Gross National Product (GNP) countries New Zealand's SMEs EC uptake resembled that from countries with lower GNP [6] and low EC capabilities [18]. This ambiguity necessitates further investigation into EC uptake by New Zealand SMEs

This research was interested in tackling Internet related technologies as one approach in detecting EC capabilities within New Zealand SMEs. Particularly, in explaining the following issues pertaining to the technologies: (i) what e-commerce technologies are being adopted and (ii) where those technologies are being used by New Zealand SMEs. Issues arising from (i) and (ii) would highlight various accelerators and/or impediments to the adoption and diffusion of EC. The remaining of the paper is arranged in the following sequence: relevant literature about electronic commerce and SMEs in New Zealand, development of an adoption framework, and finally discussion and conclusion.

2 E-commerce in New Zealand

New Zealand companies are rushing to the World Wide WEC to sell their products and services. International Data Corporation [8] estimated that the number of Internet users in New Zealand would reach 561,000 by the end of 1998. This represents just less than 16 percent of the total population. By the year 2002 the expected revenue will reach USD546 million. Although New Zealanders have always been innovators in adopting new technologies and innovations [6] the scenario for the e-commerce sector is apparently lagging other developed countries in terms of the adoption of EC as a business enabler and of EC technologies in general.

Small and medium sized enterprises (SMEs) are viewed in New Zealand as sources of flexibility and innovation, and make a significant contribution to economies, both in terms of the number of SMEs and the proportion of the labour force employed by these firms. The significance of the SME sector in New Zealand is increasing as large firms downsize to compete in the international market, workers face less job security, and more people turn their hands to small businesses at retirement or as a lifestyle choice. With further opportunities presented by globalisation and technological development, the role of SMEs seems more likely to continue to increase than to diminish in the coming years [12]. New Zealand SMEs form a significant component of the economy output (35%), both in terms of the number of firms (96%)

and their contribution to the country's employment level (41%). SMEs generally constitute around 95 percent of enterprises and account for 60 to 70 percent of employment [13].

With the current global hype about the Internet and electronic commerce (EC), there is vital need to conduct research on New Zealand SMEs and the impact of electronic business [6] including the Internet based EC [14] in New Zealand. Earlier research emphasised the views of executives within New Zealand and Australia about EC opportunities and B2B EC opportunities for New Zealand businesses. The findings of a survey conducted by Delloite revealed that although the adoption rates for email and EC presence was high but limited commercial transactions were conducted and the forecasted growth for EC within SME is quite vague.

Findings indicate lack of knowledge among SMEs about EC and its applications [6]. The strategic importance of EC within SMEs was positively viewed but emerged mostly within the larger organisations specifically among the financial services sector. The major perceived barriers for EC implementation were the lack of knowledge highlighted earlier, cost, and lack of organisational direction. Other barriers resembled by the perceived limited benefit of EC, security, and management resistance. The sector needed help mostly in the areas of formulating EC strategies and in providing guidance in technology solutions with other varying needs in the areas of security, marketing, project management, total solutions, and risk assessment respectively.

Table 1 CSFs for E-Commerce Development

♣ start with a needs-based strategy, not a technology solution;
♣ develop an E-commerce strategy that complements the corporate strategy;
♣ aggregate the disparate investments in E-commerce that are likely to be found in any organisation ;
♣ avoid layering costs onto the current distribution network;
♣ choose your partners and skills carefully;
♣ integration across the entire organisation is the key to large efficiency gains;
♣ transparency of implementation and changing process is important, both in terms of acceptance of the change and achieving the expected efficiency gains;
♣ distinguish between striving to win new markets or customers and gaining cost savings from process improvements;
♣ develop a benefits register and measure your achievements against it.

A recent study conducted by PricewaterhouseCoopers/KPMG [18] that covered SMEs within the Asia Pacific Economic Cooperation (APEC) countries identified nine critical success factors (CSFs), as shown in table 1, for e-commerce development. Critical success factors (CSFs) are the small number of easily identifiable operation goals shaped by the industry, the firm, the manager, and the environment that assures the success of an organisation [10]. The same study demonstrated significant commonalties among the APEC economies in terms of SME decision-

Table 2 E-commerce technologies used by AUS/NZ enterprises

Mostly used E-Commerce Technologies	Less used E-Commerce Technologies
High ↑	↓ *Low*
Electronic mail (Internet)	Intranet
WWW access	Electronic Data Interchange (EDI)
E-mail(non-Internet)	DECit/Cradit cards
Electronic Funds Transfer (EFT)	EFT at Point of sale (EFTPOS)
Company WWW site	Extranet
Firewalls	Certification Authority (digital signatures)
	Interactive Voice Response (IVR)
	Automated Teller machine (ATM)
	Electronic Kiosk
	Electronic Cash
	Smart cards

making and attitudes which could be extended to include New Zealand although its participation in that study was very low. Delloite's [6] and PricewaterhouseCoopers' [18] studies reveal that although New Zealand is considered among the higher per capita gross net profit (GNP) countries New Zealand's SMEs' dominated the overall results of economies with higher GNP. Table 2 summarises the he KPMG findings regarding the degree of use of the e-commerce technologies by the surveyed enterprises.

3 The Adoption Framework

Some recent studies [17,21] looked into the essential influencing factors and factors leading to adoption of IS/IT by SMEs. Table 3 highlights the findings from these studies. The studies explored the information systems/information technology adoption and diffusion models for SMEs and identified the essential influencing factors and factors leading to the adoption of these technologies by the SMEs.

It is critical for the SMEs to decide on an appropriate framework for supporting and enforcing a competitive, predictable, consistent, market and technology driven approach towards the adoption and diffusion of electronic commerce technologies in this market. A lack of understanding of the proper adoption framework may very well hinder the rapid development of electronic commerce in New Zealand. Further, the above studies have identified various research gaps that would complement EC uptake by SMEs including EC best practices and case studies, and EC use by SMEs in specific industry sectors.

Table 3: IS/IT adoption by SMEs based on IT adoption models

Study	Technologies/Applications explored	Essential influencing factors	Factors leading to adoption
Thong and Yap (1995)	Accounting, Inventory control, sales, purchasing, personnel and payroll, CAD/CAM, EDI, MRP, and others	Size CEO's innovativeness CEO's IT knowledge CEO's attitude	Size

		towards adoption of IT	
Thong and Yap (1996)	Accounting, Inventory control, sales, purchasing, personnel and payroll, CAD/CAM, EDI, MRP, and others	Size CEO's innovativeness Employee's IT knowledge Attitude towards IT	Employee's IT knowledge Information intensity
Thong (1999)	Accounting, Inventory control, sales, purchasing, personnel and payroll, CAD/CAM, EDI, MRP, and others	CEO's innovativeness CEO's IS knowledge Relative advantage Compatibility Complexity Employee's IS knowledge Size	Organisational characteristics in general and size specifically
Premkumar & Roberts(1999)	Email, Online data access, Internet access and EDI	Relative advantage Top management support Size Competitive pressure	Relative advantage

The IT adoption models in SMEs have helped in identifying the contexts that would influence EC adoption by the SMEs. These are the technological, organisational, environmental and individual contexts. However, issues concerning what contexts or variables to test or what factors have the greatest impact on EC adoption are yet to be determined. Thus the framework should be based on the insight gained on EC studies that would assist in enriching the IT adoption models highlighted earlier with appropriate EC variables. While research revealed various commonalties among the factors it remains to determine whether the adoption of the Internet correlated positively with business size, the CEO's characteristics, and the competitive pressure on EC adoption. The framework should be able to identify the factors that influence the adoption and use of the EC ultimately lead to their adoption. Based on Rogers [19] and Tornatzky and Klein [20] we select five technological (innovation) factors for the framework. Following Kwon and Zmud [9] and others [17,21] five organisational factors were selected for testing the framework. Poon and Swatman [16] emphasised the importance of the CEO's role on EC adoption and diffusion. Individual characteristics of the CEO such as education, age, experience, and psychological traits have been found to strongly influence innovation adoption [19]. Individual characteristics represented by the chief executive officer is an essential part in IT adoption within SMEs [21]. They found that CEO's innovativeness and IT knowledge has positive effect on IT adoption. The framework, therefore, includes CEO's innovativeness and IT knowledge factors grouped under the individual factors. The external environment would play a significant role in the adoption of new technologies but was not included in many IT empirical studies. Thong found competition insignificantly influencing IT adoption in small businesses while Premkumar and Roberts found that competitive pressure was the only factor influencing IT adoption. They found vertical linkages were tightly correlated with son-parent type organisations and negatively associated with the Internet adoption. However, they found external support (from consultants, vendors) to be insignificant. Following these considerations the framework includes four environmental factors for the study.

Summing up the four contexts along with their factors would depict the EC adoption framework shown in figure 1. The framework portrays the various factors and their effect on the adoption decision for EC as a

first level. Whether such relationships would lead to EC adoption would depict a second level of effects. Thus, the first level would depict how the potential adopters generally viewed EC. On the other hand, the second level would depict an adoption criterion that is salient to each SME and hence would emphasise certain factors more than the others. The proposed framework is expected to highlight the impact of the various contexts and their factors on EC adoption at the two levels.

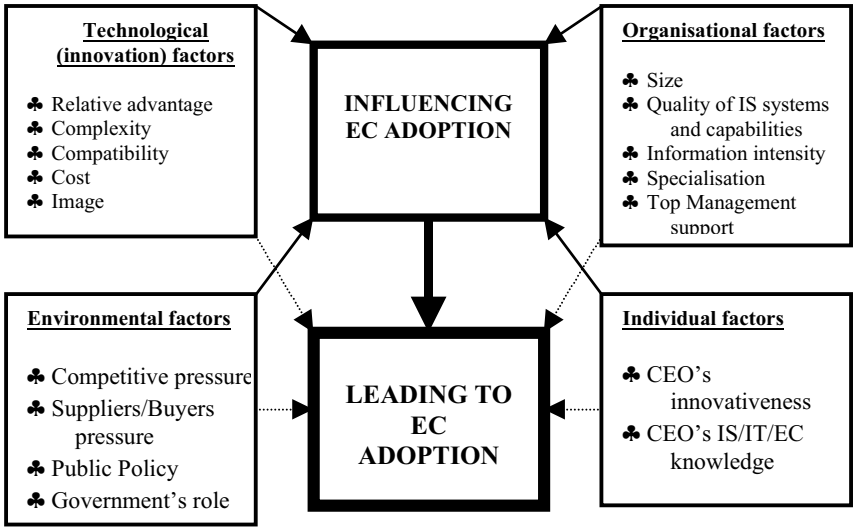

Figure 1 A framework for EC technology adoption by SMEs

4 Discussion and Conclusion

At New Zealand's SMEs level, identifying sector or an adoption and diffusion influencers and inhibitors and pinpointing the most critical ones within a justified industry will help that sector in better planning for its EC uptake. Being an ideal sector or industry would provide a good exemplar to other SMEs within New Zealand. At the outset this research will assist legislators, policy makers and technology providers in understanding EC adoption criteria within SMEs and in devising best means and approaches in encouraging EC uptake among SMEs.

At the theoretical level, this research attempts to utilise IS/IT adoption and diffusion theories in identifying essential influencing factors on EC adoption and diffusion within New Zealand's SMEs. It is contended that the adoption decision for any technological innovation like EC is an organisational one and hence, a link between the innovation and the organisational factors will provide an essential insight into the adoption criteria for EC within New Zealand's SMEs. This should not contradict with the importance of other influencing factors like the effect of the environment. It may be argued that the diffusion of EC (if adopted) within SMEs will depend among other factors on the same factors that would influence its adoption.

The overall objective of identifying the impact of contexts and factors on EC adoption and whether such impacts lead to EC adoption within New Zealand SMEs can be realised by applying the proposed theoretical framework extended from IT innovation theories with particular focus on New Zealand SMEs.

Empirical research will be required to validate the proposed adoption framework. Case studies from among the representative SMEs are being designed to obtain answers to the questions: how the SMEs viewed the various contexts and the corresponding factors in terms of their impact on EC adoption and what factors and contexts lead to EC adoption. The case outcomes will show (i) whether the factors influence adoption positively/negatively, (ii) whether the factors positively lead to adoption or irrelevant and (iii) ranking of the positively leading factors. Finally it will be possible to rank the four contexts on EC adoption across the cases. It is expected that the developed framework would guide SMEs in their potential EC technology adoption.

References

1. Abell, W. & Lim, L. (1996). Business use of the Internet in New Zealand: An exploratory study. http://www.scu.edu.au/ausweb96/business/abell/paper.htm

2. Abell, W. & Black, S. (1997). Business use of the Internet in New Zealand: A follow-up study. http://www.scu.edu.au/ausweb96/business/abell/paper.htm

3. Adam, S & Deans, K. (2000) Online Business in Australia and New Zealand: Crossing a Chasm. AusWeb2K-The Sixth Australian World Wide Web Conference, Cairns, 12-17 June 2000

4. Behrendorff, G. & Rahman, S. (1999). Adoption of electronic commerce by small to medium enterprises in Australia. In Tan, F., Corbett, P. & Wong, Y. (Eds.), Information technology diffusion in the Asia Pacific: Perspective on policy, electronic commerce and education. (130-147) Hershey, London: Idea group publishing

5. Deloitte (2000). Deloitte e-business survey: insights and issues facing New Zealand business. http://www.deloitte.co.nz/images/acrobat/survey.pdf

6. Cameron, A. & Massey, C. (1999). Small and medium sized enterprises: A New Zealand Perspective. Auckland: Addison Wesley Longman New Zealand Ltd

7. Infotech Weekly (April 1, 1997) New Zealand Internet Use. http://www.nua.net/surveys/

8. International Data Corporation (IDC) (1998). Ecommerce Booming in New Zealand. Nua Internet Services: http://www.nua.ie/surveys

9. Kwon, T. & Zmud, R. (1987). Unifying the Fragmented Models of Information Systems Implementation. In Borland, R. & Hirschheim, R. (Eds). Critical Issues in Information System Research ,252-257, John Wiley, New York

10. Laudon, K. and Laudon, J. (1998) Management Information systems: New Approaches to Organisation and Technology. Macmillan Publishing Co. Ltd. (5th Ed), USA.

11. MOC (Ministry of Commerce) (1998) Electronic Commerce - The "Freezer Ship" of the 21st Century. html://www.moc.govt.nz/itpg/ecommerce/ecomm.html.

12. Ministry of Commerce (MOC) (2000, January). SMEs in New Zealand: Structure and Dynamics, Firm Capability Team, update Report. http://www.moc.govt.nz/gbl/bus_dev/smes2

13. Organisation for Economic Co-operation and Development (OECD) (1997). Small Business, Job Creation and Growth: Facts, Obstacles and Best Practices. Paris.

14. Patrick, P (2000, January) Promotional Abstract: The New Zealand Internet Commerce Market Outlook 1997-2004. International Data Corporation (IDC), volume 1. http://www.idc.com

15. Poon, S. & Swatman, P. (1995). The Internet for small businesses: An enabling infrastructure for competitiveness. http://inet.nttam.com

16. Poon, S. & Swatman, P. (1999). An exploratory study of small business Internet commerce issues. Information & Management, 35, 9-18.

17. Premkumar, G. & Roberts, M. (1999) Adoption of New Information Technologies in Rural Small Businesses. The International Journal of management Science (OMEGA), 27, 467-484

18. PricewaterhouseCoopers (1999, September 24). SME Electronic Commerce Study (TEL05/97T). http://apec.pwcglobal.com/sme.html

19. Rogers, E. 1995). Diffusion of Innovation. New York: The Free Press

20. Tornatzky, L. & Klein, K. (1982). Innovation Characteristics an Innovation Adoption Implementation: A Meta Analysis of Findings. IEEE Transactions on Engineering management, 29(11), 28-45

21. Thong, J. & Yap, C. (1996). Information Technology Adoption by Small Business: An Empirical Study. In kautz, K. & Pries-Heje, J. (Eds), Diffusion and Adoption of Information Technology (160-15). London, Chapman & Hall

22. Turban, E., Lee, J., King, D., & Chung, H. (2000). Electronic Commerce: A Managerial Perspective. New Jersey: Prentice-Hall Inc.