

Electronic Commerce Adoption Approaches by SMMEs Western Cape, South Africa

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ABSTRACT

E-commerce improves value chain integration, enables customisation and also provides smaller companies opportunity to reach customers worldwide. However the approach to e-commerce adoption poses small businesses management with many challenges, one of which is the choice of an approach to adopt e-commerce. One option is an "adoption ladder" approach proposed by a number of researchers depicting e-commerce adoption as a "step-by-step" process, from simple email to a virtual integrated business. The other option is a "managed strategic adoption" approach where proponents of this approach argue that reaching e-commerce is a result of a management decision to move directly to e-commerce, based on business goals and requirements. This approach does not follow a stepped approach. Although the literature reports on a number of aspects of e-commerce adoption, no clear guidelines are apparent to determine how Small Medium Micro Enterprises (SMMEs) should progress, or move into e-commerce. This paper investigates two e-commerce adoption approaches and reports on the approaches followed by a sample of SMMEs in the Western Cape of South Africa. In addition a conceptual model on e-commerce adoption approaches is proposed and theoretical guidelines explored to assist SMMEs to choose between the two approaches.

Keywords: E-commerce adoption, adoption ladder, managed strategic adoption, SMME

1. INTRODUCTION

A significant opportunity and challenge for businesses in the next few years will be how to deploy e-commerce initiatives. E-commerce activity improves value chain integration, enables customisation and also provides smaller companies opportunity to reach customers worldwide (Da Silveira 2003:201). An increasing number of businesses are using the Internet to trade online but not many are generating profits. This poses management with challenges to identify where e-commerce profitability lies, how it is reached and how it could be sustained (Willcocks & Sauer, 2000:7). Despite these challenges Jones, Hecker and Holland (2003:287) argue that there is limited research available on how to effectively, implement e-commerce into SMME operations. Many of these challenges could either be resolved, or at least be identified, in order to follow the most appropriate e-commerce adoption path. This needs to be done at the outset of the e-commerce adoption initiatives. Although a number of local and International studies report on e-commerce adoption paths, these do not provide clear guidelines to determine how SMMEs should progress or move into e-commerce.

Several e-commerce definitions exist but no consensus has been reached on the extent or essential parameters (Kowtha & Choon, 2001:238). In this paper, e-commerce is referred to as digitally enabled commercial transactions between organisations and individuals. Commercial transactions involve the exchange of value, for example, funds across organisational or individual boundaries in return for products and services (Laudon & Traver, 2003).

The definition of a Small Medium Enterprise (SME) varies from country to country. Da Costa (2001:3-4) finds that in the United States of America (USA) SMEs are defined as firms having fewer than 500 employees, whereas in Europe SMEs are firms with fewer than 250 employees. In Japan SMEs are firms with fewer than 100 employees. In South Africa Small Medium Micro Enterprises (SMMEs)

are defined as companies having the number of employees ranging between 5 and 2000. In addition, SMMEs are classified as companies with a total turnover between 0.2 million and 64 million Rand and a gross asset value ranging from 0.1 million to 23 million Rand (South Africa, 1996; South Africa, 2003). In this paper, SMME refers to the South African definition whereas SME refers to the international definitions.

The aim of this paper is to investigate e-commerce adoption approaches and to present findings of the approaches followed by some SMMEs in the Western Cape. In addition propose a conceptual model on e-commerce adoption approaches and theoretical guidelines explored to assist SMMEs to choose between the approaches.

2. BACKGROUND

The focus of this investigation is confined to the Western Cape of South Africa that accounts for 15% of the country's GDP and where 10% of the South African population resides (Wesgro 2005). In addition the Western Cape is the second most productive province, after the Gauteng province. The Western Cape's strong economy can be attributed to its unique balance of economic activities that range from agriculture, fishing and forestry in the primary sector to clothing and textiles in the secondary sector. Other sectors include automotive components, marine services and manufacture, agri-business, vibrant tourism and an increasing array of future-orientated service industries (Wesgro 2005).

Small business play a vital role in most economies throughout the world and their ability to adopt and utilise the Internet and conduct e-commerce is of prime importance to ensure that SMEs are included in the new economy (Quayle, 2002:1158-1159, Stansfield & Grant, 2003:15). For example, SMEs in the USA accounted for 51% of the private gross domestic product during the period 1990-1995. However, less than 20% were selling products and services online (Reimenschneider, Harrison & Mykytyn, 2003:270). A similar view is expressed in Grandon and Pearson (2004:82) who state that although SMEs in the USA employ more than half of the work force, few had adopted e-commerce by the end of 2003. In Australia approximately 65% of SMEs have access to the Internet, with only 15% of these actually supporting websites (Pease & Rowe 2003:2). According to Viviers and Soontiens (1998:2), South African SMMEs contributed 46% to the total economic activity. Current estimates are that businesses with less than 50 employees contribute between 39% and 45% of the GDP (South Africa, 2004a), Whilst SMMEs are reported to contribute 30% to GDP (South Africa, 2004b). Despite these contributions, the use of the Internet and related technologies has not been deployed to the extent that would be necessary for survival in a rapidly changing environment (Cloete, Courtney and Fintz, 2002:1).

2.1 E-Commerce Adoption Approaches

From the literature, it is evident that there are two possible approaches for a business to adopt e-commerce. The one approach is an "adoption ladder" proposed by a number of researchers and is a "step-by-step" process. These steps start at email and then follow to a static website, e-commerce, e-business and finally e-enterprise (Van Akkeren and Cavaye 1999; Hoque 2000; Willcocks & Sauer 2000; Parish, Kibblewhite, Woodley & Richardson 2002; Jones *et al.* 2003; Vosloo 2003; and Teo and Pian 2004).

An alternative approach is a “managed strategic adoption” where these proponents argue that reaching the e-commerce adoption stage is a result of management decisions. In this case, a business would prefer to directly adopt email, a static website, e-commerce, e-business or an e-enterprise and not follow a stepped approach. This would depend on the strategic requirements of the business (Angehrn, 1997; Blackburn & Athayde 2000; Southern & Tilley 2000; Martin & Matlay, 2001; Foley and Ram 2002; Chau & Turner, 2003; Levy and Powell 2003; Rao, Metts & Monge 2003).

2.2.1 Adoption Ladder Approach to E-Commerce

An “Adoption ladder” approach requires that businesses start on the bottom rung of the ladder and progresses upwards. Van Akkren and Cavaye (1999:4) state that e-commerce adoption is a progression and sophisticated technologies are unlikely to be implemented before entry-level activities are used more readily. An example of the e-commerce “adoption ladder” is Cisco’s adoption ladder model given in Figure 1. This model is selected from other possibilities due its clarity in illustrating the “step-by-step” stages of e-commerce adoption

E-mail acts as a starting point from which more sophisticated e-commerce activities flows. Tagliavini *et al.* (2001:215-220) state that effective use of e-mail could assist SMEs to gain new customers, establish relationships and create brand loyalty by enhancing information interchange with current and potential customers as well as to carry out market research. At the second level an effective website widens the market by increasing company visibility, promoting company image, improving the quality of customer service and carrying out market research based on customer needs thus differentiating SMEs. Leong, Stanners and Huang (1998:1257) add that the three most important website objectives are to enhance the corporate image, increase brand or product awareness and to provide better customer service. A website that offers online processing facilities allows orders to be automatically forwarded and processed more quickly. Since customers are demanding more speedy service, reduction of waiting times represents a competitive advantage. Online payment processing optimizes business resources whilst increasing customer satisfaction is achieved by allowing the customer to conclude the transaction online (Tagliavani, *et al.* 2001:220). Kowtha and Choon (2001:239) confer that a website with online processing facilities requires significant dedicated investments, skill acquisition and management commitment. However, Chau and Turner (2003:4) argue that an “adoption ladder” approach is less advantageous as the potential benefit of using e-commerce increases as SMEs embark on later stages on the e-commerce adoption path, therefore suggest a non-stepped “managed strategic approach”.

2.2.2 “Managed Strategic” Approach to E-Commerce Adoption

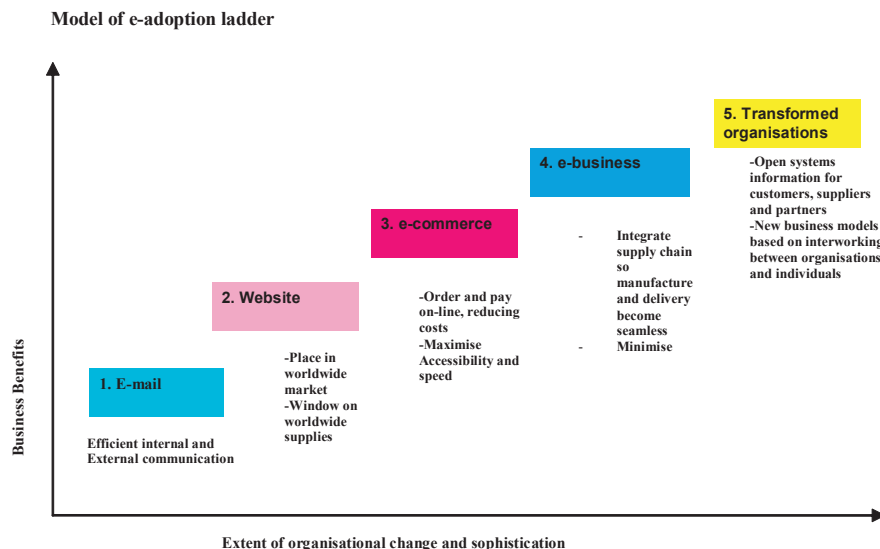
Hackbarth and Kettinger (2004: 273) argue that whilst some companies follow the “adoption ladder” approach with gradual business process improvements, others aspire to rapidly achieve business innovation with a leapfrogging strategy. According to Hackbarth and Kettinger (2004:273,281) companies adopt leapfrogging strategies when faced with more severe external competitive pressures. Businesses should scan their environment to evaluate barriers to entry, customer power, supplier power and new entrants to the market. To adopt this kind of strategy businesses must ensure internal user involvement. This includes to assess the availability of in-house IT expertise (or appreciation of IT expertise in cases of deciding when and what to outsource) and a cultural capacity to change. In addition, they should exhibit a level of comfort with new technologies and availability of resources to adopt e-commerce related technologies. Such businesses exhibit leadership in terms of senior management commitment and willingness to make an impact on people. The businesses demonstrate an accommodating business structure that accepts paradigm shifts and allows cross-functional decision making.

The two diverging approaches discussed above may lead to a point where management of SMMEs may need to pre-select an e-commerce adoption approach before embarking on the e-commerce adoption initiatives. To shed light on this problem, knowledge is required to answer some questions by learning from successful businesses that adopted e-commerce. This includes what approaches they followed, what they did right and what lessons were learned. Furthermore, propose a simple model that would assist SMMEs to choose between the “adoption ladder” and “managed strategic adoption” approach to e-commerce adoption.

3. RESEARCH METHOD

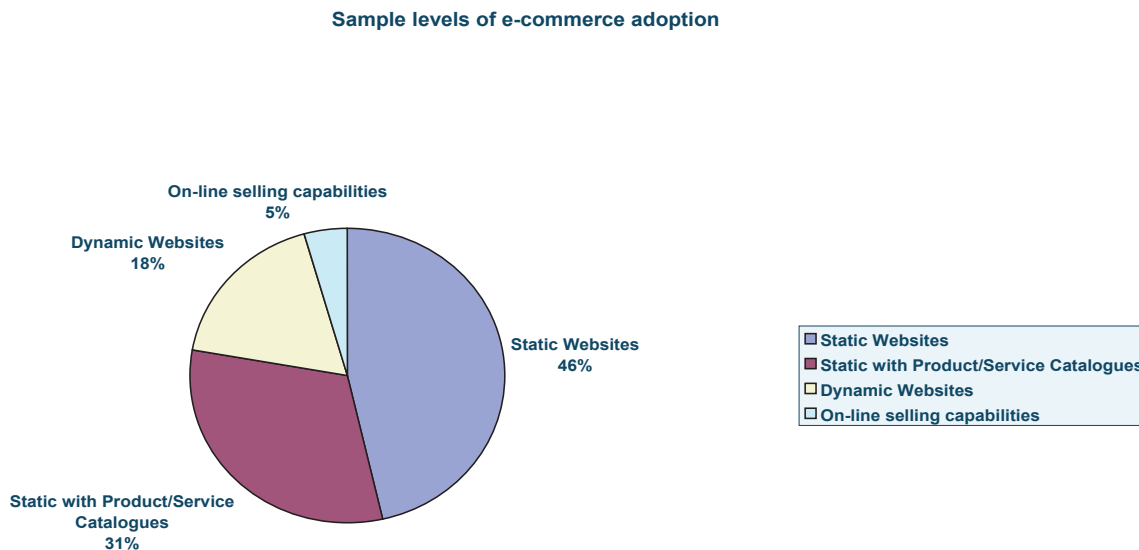
Qualitative analysis using in-depth interviews and double sampling techniques was used to gather information to determine e-commerce adoption stages and which path SMMEs used for e-commerce adoption. To determine the e-commerce adoption stage of companies, a period of three months was required, from April to June 2005. A list of 4,500 businesses registered with the Cape Town Regional Chamber of Commerce and Industry’s (Chamber) website was downloaded and stored in a Microsoft Word document. There were approximately 1 000 companies that had websites. The next step was to find the Universal Resource Locator (URL) of each business to determine which of these had an active e-commerce website. Not all websites could be viewed as some websites could not be accessed. Reasons for failure ranged from File Server error, Unified Resource Locator not found, suspended websites, gateway timeouts or permission was required to access the website. The companies with more than 250 employees were deleted from the sample as well as websites with domains for sale and websites that loaded incor-

Figure 1. Cisco “adoption ladder” Parish *et al.* (2002)



Adapted from Cisco led Information Age partnership study on e-commerce in small business

Figure 2. Websites e-commerce stages SMMEs Western Cape



rect company profiles. The analysis resulted in a list of SMMEs selling online consisting of a sample size of 38 businesses selling online, spread across 14 different Chamber’s business sectors. In some cases, only one online business was found in a sector. It would have been possible to select one business from each sector, but for richness in data analysis that allows comparison two industry sectors were selected for the study. Of the 4,500 SMMEs registered at the Chamber, 18% had websites ranging from static to dynamic interactive, where the websites offered the facility to receive payment online. Of these, only 5% had interactive websites offering facilities to receive payments online. This would qualify them being e-commerce websites. These results are depicted in figure 2.

From these results the industries selected for further analysis were the Tourism industry and Information and Communication Technology (ICT) sectors respectively. The tourism industry was selected on the basis that the tourism industry historically has been an early adopter of technology supporting inherent features making it suitable for e-commerce adoption (Wynne, Berthon, Pitt, Ewing & Napoli, 2001:421). In contrast, the ICT sector was selected as both Poon and Swartman (1999:4) and Al-Qirim and Corbitt (2002:346) found that IT related businesses were more likely to adopt e-commerce than businesses in other sectors. From these industries, SMMEs were selected for in-depth interviews from sample. The analysis would later reveal the path each SMME followed when adopting e-commerce, why they choose this approach and the benefits these companies were realizing from adopting e-commerce. The selected SMMEs owners or managers in the two industries were contacted and after numerous attempts, five SMMEs agreed to participate in the research study.

4. RESEARCH RESULTS AND DISCUSSION

Analysing the in-depth interviews indicated that SMMEs in the Western Cape are realizing benefits from e-commerce and in some cases; e-commerce was playing a strategic role depending on the owner or manager’s strategic orientation for growth. Quoting one of the participants: “...if you take away the Internet we are out of business”. This is an example of the importance of their e-commerce adoption commitment.

At first the researchers were concerned that these findings may be considered being biased as all five SMMEs had followed an “adoption ladder” path. Instead of going back to select more businesses from other sectors, it was decided to explore the literature again to ascertain what type of businesses would most probably have used the “managed strategic adoption” approach.

According to Warden and Remenyi (2005), 1time Airline operating in the LCA (Low Cost Airline) industry in South Africa followed a “managed strategic adoption” approach as their website was designed for e-commerce at inception. As

far as could be determined, 1time Airline exhibited the necessary conditions to adopt this approach and 1time Airline may be classified as a large business as its asset value exceeds 23 million Rand and also had more than 200 employees by 2005. 1time Airline started trading in 2004 with a few staff members and from day-one, the airline management required that the Internet be the main channel for their ticket sales while selling only a small percentage via a call centre and at airports. Accordingly, 70% of airline tickets are purchased online, 20% via the call centre and 10% at airport kiosks. According to Weaver (2005:231,234) booking online air travel tickets is increasing in South Africa. Furthermore, South African Airways reported an annual increase of 200% for online sales, whilst Kulula.com (another LCA) reported that 75% of its sales are done online and the website processes over 3 million Rand in sales each day.

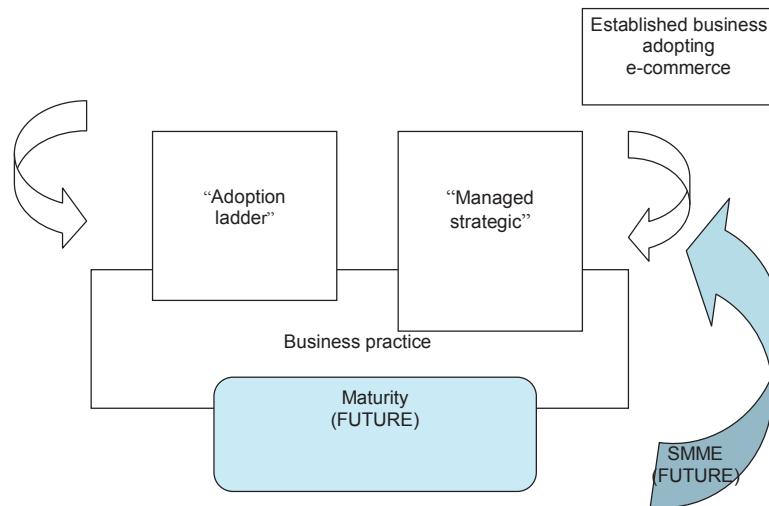
Considering the results from the 1time Airline case study, and reports from other successful airlines, provides an insight and evidence that larger businesses adopt a “managed strategic adoption” approach in preference to following an “adoption ladder” approach.

5. GUIDELINES FOR SELECTING AN E-COMMERCE ADOPTION APPROACH

Potential e-commerce adopters need to choose between an “adoption ladder” and “managed strategic adoption” and using the results reported in Hackback & Kettinger (2002:280) obtained forty firms in the United states that had recently completed an e-business strategy the following guidelines are suggested to assist SMMEs to choose between the “adoption ladder” and “managed strategic adoption”;

- The severity of external pressures evaluated by accessing the SMME market share risk, and the SMMEs customers demand for e-commerce services. If the external pressures are a high a “managed strategic adoption” would be a more suitable approach.
- Internal user involvement may be evaluated by determining the availability of In-house Information technology expertise related to e-commerce and SMME cultural capacity to change which can be assessed by the SMME’ determining if they support maintaining the status quo or actively seeks participatory change. If Internal user involvement is low and the SMME does not have cultural capacity to change an “adoption ladder” approach would be a more appropriate approach to enable the SMME to gradually change and build-in expertise.
- Comfort level with new technologies maybe assessed by examining if the SMME is historically slow to respond or quick to implement new technology. Furthermore determining if IT resources are minimal or abundant to support e-commerce. Comfort level with new technologies is a key requirement for

Figure 3. Proposed model to assist SMME to adopt e-commerce



“managed strategic adoption” hence if such comfort level is non-existent an “adoption ladder” would be a more suited approach.

- Leadership in terms of Senior Management commitment to e-commerce adoption and being actively involved in the e-commerce adoption process. To follow “managed strategic adoption” Senior Management need to be committed to e-commerce adoption and willing to deal with extreme impacts. An “adoption ladder” approach on the other hand entails a modest and gradual impact.
- Accommodating and mature organisational structure, whereby there are cross functional decision making teams. SMME can assess this by examining historical approach to decision making as to whether it is interdepartmentally or cross functionally. In order to adopt “managed strategic adoption” SMMEs need to have a capability to work with cross functional decision making teams.

Figure 3 is a conceptual model showing the two approaches and SMMEs may use the provided theoretical guidelines to select an approach that best suits their organizational needs.

In conclusion, e-commerce is a process that involves various stages, namely e-mail, a static website, e-commerce, e-business and e-enterprise. E-commerce adoption in SMMEs registered with the Chamber in the Western Cape is at an early stage. Awareness campaigns would benefit those SMMEs that have not yet adopted e-commerce. By using the proposed model to explain and walk-through the various e-commerce stages potential SMME e-commerce adopters would be able to decide what the best approach would be to follow. Future empirical research is recommended to expand and add to the conceptual model and provide practical relevance for the guidelines to SMMEs in the Western Cape. This would also track the severity of external pressures for e-commerce adoption in the SMMEs in the various industries.

7. REFERENCES

- Al-Qirim, N.A.Y. & Corbitt, B. J. 2002. “An empirical investigation of an e-commerce adoption model in small medium-sized enterprises in New Zealand “. Paper delivered at PACIS (Pacific Asia Conference on Information Systems) 2002 conference Tokyo, Japan 2-4 September.
- Angehrn, A. 1997. “Designing mature Internet business strategies: the ICDT Model». *European Management Journal*, 15(4):361-369.
- Blackburn, R. & Athayde, R. 2000. «Making the connection : the effectiveness of Internet training in small business». *Education and Training*, 42(4/5): 289-298.
- Chau, S. & Turner, P. 2003. «An analysis of factors that influence the ability of SMMEs to derive benefit in four phases of electronic Commerce: 34 Australian case Studies». In Gingrich, A. (ed). *Managing IT in government, business & communities*. Idea Group Hershey, PA: 97-110
- Cloete, E. Courtney, S. & Fintz, J. 2002. “Small businesses’ acceptance and adoption of e-commerce in the Western Cape Province of South Africa». *The Electronic Journal of Information Systems in Developing Countries*, 10(4):1-13.
- Da Costa, E. 2001. “Global e-commerce strategies for small businesses». Cambridge, MA: Massachusetts Institute of Technology Press.
- Da Silveira, G. 2003. “Towards a framework for operations management in e-commerce». *International Journal of Operations and Production Management*, 23(2):200-212.
- Foley, P. & Ram, M. 2002. “The use of online technology by ethnic minority business: a comparative study of the West Midlands and UK». [Online]. Available WWW: http://www.sbs.gov.uk/content/analytical/research/EMB_IT.pdf (Accessed 19 November 2004).
- Grandon, E. & Pearson, M. J. 2004. “E-commerce adoption: perceptions of managers/owners of small and medium sized firms in Chile». *Communications of the Association for Information Systems*, 13(8):81-102.
- Hackbarth, G. & Kettinger, W. J. 2004. “Strategic aspirations for net-enabled business». *European Journal of Information Systems*, 13(4):273-285
- Hartley, P. & Worthington-Smith, R. 2004. «The e-business handbook: the 2004 review of innovation at work in South African businesses». Cape Town: Trialogue.
- Hoque, F. 2000. «E-enterprise business models, architecture and components». Cambridge: Cambridge University Press.
- Jones, C., Hecker, R. & Holland, P. 2003. «Small firm Internet adoption: opportunities forgone, a journey not begun». *Journal of Small Business and Enterprise Development*, 10(3):287-297.
- Kowtha, N. R. & Choon, T. W. I. 2001. «Determinants of website development: a study of electronic commerce in Singapore». *Information and Management*, 39(3):227-242.
- Laudon, K. & Traver, C. 2003. «E-Commerce business technology society». New York: Pearson Addison Wesley.
- Leong, E.K.F., Stanners, P. J. & Huang, X. 1998. «Website objectives: perspectives from Western Australian companies». ANZMAC 1998 Conference, Dunedin, New Zealand November 30 – December 2. http://pandora.nla.gov.au/pan/25410/20020805/130.195.95.71_8081/www/ANZMAC1998/ANZMAC98.html (10/07/05).
- Levy, M. & Powell, P. 2003. “Exploring SME Internet adoption: towards a contingent mode”1. *Electronic markets*, 13(2)173-181.
- Martin, L. & Matlay, H. 2001. “Blanket approaches to promoting ICT in small firms: some lessons from the DTI ladder adoption model in the UK». *Internet Research: Electronic Networking Applications and Policy*, 11(5):399-410.

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- Parish, A., Kibblewhite, G., Woodley, M. & Richardson, J. 2002. "A study of the adoption of e-commerce". [Online]. Available WWW: http://www.intellectuk.org/publications/reports/A_Study_of_E-Commerce_Adoption_in_the_UK.pdf (Accessed 26 November 2004).
- Pease, W & Rowe, M 2003, "Issues Faced by Small and Medium Enterprises (SMEs) and Their Take-Up of Ecommerce in Australian Regional Communities", *4th International We-B Conference 2003 (We-B03)*, Perth, Australia, November 24-25.
- Poon S. & Swatman, P. M. C. 1999. "An Exploratory study of small business Internet commerce issues". *Information & Management*, 35(1):9-18.
- Quayle, M. 2002. E-commerce: the challenges for UK SMEs in the twenty-first century. *International Journal of Operations & Production Management*, 22(10):1148-1161.
- Quayle, M. 2002. "E-commerce: the challenges for UK SMEs in the twenty-first century". *International Journal of Operations & Production Management*, 22(10):1148-1161.
- Rao, M., Metts, G. & Monge, C. 2003. "Electronic commerce development in small and medium sized enterprises a stage model and its implications". *Business Process Management Journal*, 9(1):11-32.
- Reimenschneider, c. K. , Harrison, D. A. & Myykytyn, P. P. 2003. "Understanding it adoption in small business: integrating current theories". *Information & Management*, 40(4):269-285.
- South Africa. 1996. "National Small Business Act". Notice 102 of 1996. *Government Gazette*, 1901:1-17, November 27.
- South Africa. 2003. "National Small Business Amendment Act. Notice 26 of 2003". *Government Gazette*, 461(25763):1-10, November 26.
- South Africa. 2004a. Department of Trade and Industry. "Annual review of small business in South Africa 2004". <http://www.seda.org.za/summit2005/SMME%202004%20Part%20I%20SCREEN%20FINAL.pdf> (Accessed 20 February, 2006).
- South Africa. 2004b. Government Communications. "South African Yearbook 2004/05: Overview". www.gcis.gov.za/docs/publications/yearbook/overview.pdf (Accessed 20 February, 2006).
- Southern, A. & Tilley, F. 2000. "Small firms and information communication technologies (ICTs): toward a typology of ICT usage". *New Technology, Work and Employment*, 15(2):138-154.
- Stansfield, M. & Grant, K. 2003. "An investigation into issues influencing the use of the Internet and electronic commerce among small-medium sized enterprises". *Journal of Electronic Commerce Research*, 4(1):15-33.
- Tagliavani, M., Ravarini, A. & Antonelli, A. 2001. "An Evaluation Model for Electronic Commerce Activities within SMEs". *Information Technology and Management*, 2:211-230.
- Teo, T. & Pian, Y. 2004. "A model for web adoption". *Information and Management*, 41(4):457-468.
- Van Akkren, J. & Cavaye A. 1999. "Factors affecting the adoption of e-commerce technologies by small business in Australia – an empirical study". [Online]. Available WWW: <http://www.acs.org.au/act/events/io1999/akkern.html> (Accessed 24 October 2004).
- Viviers, W. & Soontiens, W. 1998. "South African SMEs: obstacles to export to the Southern African Development Community (SADC)". [Online]. Available WWW: <http://www.sbaer.uca.edu/research/icsb/1998/pdf/77.pdf> (Accessed 07 February 2005).
- Vosloo, G. 2003. "A conceptual framework of critical success factors for organisations to consider as they move towards full-scale B2B e-commerce". MBA study project, University of Stellenbosch.
- Warden, S.C. & Remenyi, D. 2005. "E-commerce in an SME. A case study of a South African low cost or "no frills" airline". Paper delivered at ZA-WWW (World Wide Web) 2005 Conference, Cape Town, South Africa 29 to 31 August.
- Weaver, P. 2005. "Travel". In Paterson, J. (ed.). 2005. *The e-business handbook. The 2005 review of innovation at work in South African business*, 6th edition. Cape Town: ITWeb informatica.
- Wesgro 2005. "Economic overview". [Online]. Available WWW: <http://www.wesgro.co.za/display.asp?id=233&linktype=1> (Accessed 06 October 2005).
- Willcocks, L., & Sauer, C. 2000. "Moving to e-business: an introduction". In Willcocks, L., Sauer, C & Associates (ed.) *Moving to e-business: the ultimate practical guide to effective e-business*. London: Random House : 1- 19.
- Wynne, C., Berthon, P., Pitt, L., Ewing, M. & Napoli, J. 2001. "The impact of the Internet on the distribution value chain the case of South African tourism industry". *International marketing Review*, 18(4):420-431.

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