USE OF ICT FOR E-PROCUREMENT IN THE UK CONSTRUCTION INDUSTRY: A SURVEY OF SMES READINESS

C.H. Wong[1], B. Sloan[2]

[1, 2] *School of the Built Environment, Napier University, 10 Colinton Rd., Edinburgh EH10 5DT, UK*

The UK construction industry has been criticised for poor initial uptake of Information Communication Technology (ICT) and integrated IT systems to support their mainstream activities. In the context of the extent of deployment to the implementation domain and user types, ICT uptake has yet to be recognized by the industry as a whole, when compared to retail, manufacturing and financial service sectors. In addition, there is a considerable amount of ICT deployment in large construction firms who have the ability to invest and maximize the ICT uptake advantage, whilst similar deployment in small to medium sized (SMEs) construction firms- the followers, has been limited. Therefore, the current state of ICT implementation and deployment in the UK construction industry embraces a number of contrasting characteristics: firms who own ICT systems with a wide range of sophisticated applications and (small) organizations who pilot their embryonic, ad-hoc and fragmented ICT practices. Recognizing this, the paper investigates the current state of ICT readiness for use in electronic procurement (e-procurement) among UK construction SMEs, and to identify their enthusiasm and commitment to improve business performance through ICT uptake. A structured questionnaire survey was conducted among 220 randomly selected construction SMEs in UK. The results indicate that the majority of the surveyed SMEs are not yet ready for ICT implementation to support routine e-procurement activities.

Keywords: E-procurement, Information Technology Communication (ICT), Small and medium-sized Enterprises (SMEs)

INTRODUCTION

ICT is being used, to some extent and in varying degrees by construction firms and a number of practitioners (Whyte, et al. 2002). However, a comparison with other sectors (e.g. manufacturing, retail and finance services) shows a significant reticence in construction to make ICT an integral part (as opposed to a supportive role) for the construction process (Ng, et al. 2001). Previous studies on ICT deployment have shown that large construction firms often had established ICT infrastructures compared to SMEs (e.g. Ng , et al. 2001, Love, et al. 2000), where SMEs ICT investments were often driven by large construction firms (Walker and Rowlinson, 2000). Small and medium firms have been described as not being willing to integrate ICT into their business more intensively, unlike larger enterprises (Ng, et al. 2001). Recent studies showed ICT uptake in the SMEs tended to concentrate on basic functionalities. Such as, using electronic mail (e-mail) for documents transfer and web pages for establishing a marketing presence and promoting their services and products (Tam, 1999; Walker and Rowlinson, 2000; Love, et al. 2001). Such applications have

[1] e9671210@yahoo.ac.uk

Wong, C H and Sloan, B (2004) Use of ICT for e-procurement in the UK construction industry: a survey of smes readiness. *In:* Khosrowshahi, F (Ed.), *20th Annual ARCOM Conference*, 1-3 September 2004, Heriot Watt University. Association of Researchers in Construction Management, Vol. 1, 620-8.

been identified as a traditional mode of ICT transition in the construction industry (Love, et al. 2000), which attributed the blame for slow progress in the integration of ICT business processes (Cheng, et al. 2001). This seems to be the common trend of ICT penetration in construction SMEs. Essentially, the evaluation of the ICT investment has been a difficult and time-consuming task for all the construction players (Love, et al. 2001).

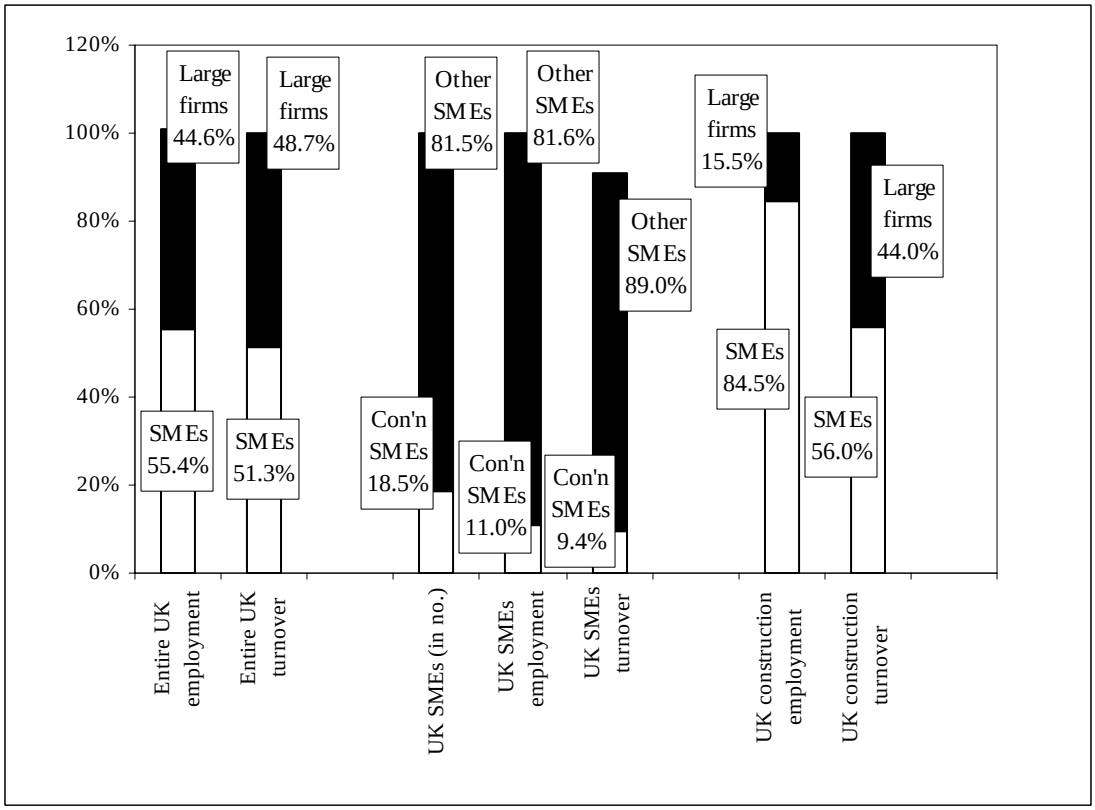
Love, et al (2000) found that construction firms might lose competitiveness or risk losing contracts if they did not recognize the potential of ICT. Meanwhile, suppliers and small construction firms who adopted ICT to establish partnering alliances with larger construction firms were more likely to have competitive advantage compared to SMEs who had not implement ICT (Walker and Rowlinson, 2000). Subsequent investigation conducted by Love, et al (2001) has shown that justification of ICT investment was a difficult task for many construction firms. This paper provides the facts of ICT uptake among randomly selected UK construction SMEs. It investigates the ICT readiness of the UK construction firms from the perception of SMEs on the e-procurement strategies and how SMEs may benefit from ICT deployment.

AN OVERVIEW OF UK CONSTRUCTION SMES

According to UK Small Business Service 2001 statistics (SBS, 2002a), there were more than 3.7 million active business SMEs in the UK. They contributed 55.4% (12.5 million) of employment and 51.4% (1.1 trillion) annual turnover of the entire UK industries (see Figure 1). In the construction sector, SMEs represented 18.5% of the entire SMEs enterprises, which contributed 11% (1.4 million) employment and 9.4% (0.1 trillion) annual turnover of the entire UK SMEs (See Figure 1). Unlike other industries (e.g. finance and manufacturing) the construction industry is largely made up of SMEs. Construction SMEs are indeed a ‘big’ business industry. It is estimated that construction SMEs contributed 84.5% of the employment and 56% annual turnover of the entire UK construction industry (SBS, 2002a). However, recent studies have revealed that productivity of UK’s SMEs lagged behind compared to other major industrialized countries, such as USA, France and Germany (SBS, 2002b). Small Business Service advocated that raising SMEs’ productivity is the key challenge to improved competitiveness (SBS, 2002a). Nevertheless, the current level of ICT innovations in construction SMEs is inadequate to trigger such a change. There is a difficulty in improving productivity with innovation initiatives, particularly, the use of technological innovation among SMEs. In order to compete, survive and grow, SMEs have to remove less productive working methods, whilst maximizing their assets and re-engineering their business processes through ICT uptake.

Dixon, et al. (2002) highlighted some significant impediments of ICT uptake in UK SMEs. Lack of research and awareness of the potential of ICT, expertise, high initial set-up cost and security are some of the fundamental barriers to technological innovation among the SMEs. In the construction sector, its heterogeneous nature (e.g. diversity in sizes and trades, capacity, and geographical spread) has been additional hindrances to ICT uptake compared to other SME industries. Given the unique character of the construction industry, in sequence uptake of ICT in construction SMEs could be a difficult and challenging task. It may take many years before ICT uptake in SMEs operates at a nation wide level and, to integrate its full potential of ICT applications into construction processes.

Figure 1: UK SMEs' Statistics (SBS 2002a)



Cost effective, real-time processing and reliable computer networking communications among project partners have been the impetus of ICT deployment. Types of ICT communications can be varied with different stages of a procurement process. E-mailing for exchanging business information for instance, has become common practice in the construction sector. The latest figures from the Department of Trade and Industry (DTI) indicated that there were 1.9 million SMEs connected to Internet. This figure has already been exceeded the targeted 1.5 million SMEs business in the DTI White Paper (titled: *Opportunity for All in a World of Change 2000*) (Dixon, et al. 2002). Nevertheless, these figures highlight the whole UK SMEs online business trading in general but not in construction sector in particular. Small construction firms may be less likely to be included in the DTI statistics, which seems to lag behind other retail and manufacturing business. One of the objectives of this study is to investigate how common is Internet connectivity. For instance, the use of e-mail for business communications among the respondents.

The current usage of ICT is already well documented in the UK construction industry for generic applications. Such applications include creating organizational databases for administration and management; using spreadsheet for budgeting, estimating and cost control; and project management software for scheduling and monitoring work progress (e.g. Futcher, 2000; Thomas, 1999, Marosszeky, et al. 2000). Over recent years, the application of ICT in construction is increasingly becoming the focus of academia, industry and government agencies. The urge for strategic ICT applications in SMEs have been encouraged by the UK government and orgnisations, such as Small Business Service (www.sbs.gov.uk), UK Online for Business (http://www.ukonlineforbusiness.gov.uk), IT Construction Best Practice (www.itcbp.org.uk), and DTI (www.dti.gov.uk/construction/). Current advancement in ICT deployment for construction processes has yet to be well established in SMEs

(Goodwin, 2001; CPA, 2001). This is due to the fact that most view ICT as an enhancement to traditional business processes and thus less focus is put on ICT applications in e-procurement strategies for organizing and operating robust business processes in construction SMEs.

EMPIRICAL SURVEY

There were 220 questionnaires sent to UK construction SMEs. The samples were taken randomly from the FAME (Financial Analyses Made Easy) electronic database. This database contains detailed information of the UK companies for research and marketing. Its Internet (electronic) version allows users to make advanced searches for compiling a specific sample population. In this investigation, the samples were selected based on the information of number of employees, annual turnover, types of works, and geographical spread. In order to define the SMEs sizes and activities, the DTI's definition of SMEs was used in this study. That is, number of employee less than 250 and annual turnover not more than £25 million of a firm (DTI, 2002). The investigation was piloted on a group of selected construction firms with the aim of improving the questionnaire contents before sending to the targeted sample for the final survey.

The empirical survey consists of nominal and ordinal data for measuring respondents' opinions of ICT deployment. To ensure a good response, the questionnaire was designed in a simple and easily answered manner. For instance, ranks (1 to 5) were used as a means for measuring the levels of respondents' perceptions on ICT deployment agreement and policies. Having received returned questionnaires, telephone interviews were conducted among the respondents. The interviews aimed to confirm the accuracy of information obtained and also to rectify some missing and ambiguous data. In addition to this, comments and feedbacks were also recorded and summarized in this study. There were forty-eight completed questionnaires returned, making the total response rate 22% (see Table 1). The sample consisted of four specialised trade groups ranging from: structural (e.g. concreters, frames and trusses, scaffolding, and bricklayers); services (e.g. plumbers, electricians, heating and mechanics); finishers (e.g. painters, joiners, and tiling); and consultants (e.g. structural engineers and surveyors).

Table 1: Survey Response and Geographical Spread

Location/Area	No. of Responders	Response rate
England	27	12.3%
N. Ireland	3	1.4%
Scotland	11	5.0%
Wales	7	3.2%
Total:	48	22%

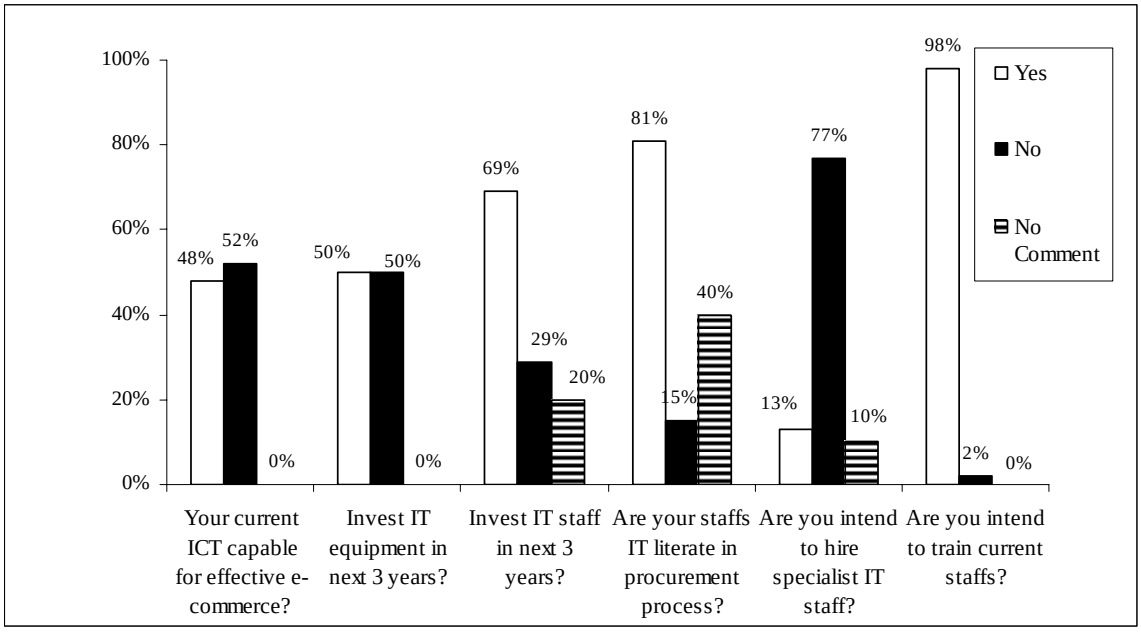
Note: 220 questionnaires were dispatched.

CONSTRUCTION SMES E-COMMERCE SCENARIOS

48% of the respondents indicted that in their current capability they were able to conduct e-commerce effectively. The remainders of the respondents (52%) indicated that their existing ICT infrastructure is not ready for effective e-commerce business. These figures show that not all the respondents have the existing ICT infrastructures in order to conduct e-commerce effectively (See Figure 2). However, in order to improve the situation, 50% and 69% of the respondents indicated that they will invest in ICT infrastructures and employ specialist IT staff respectively, within the next three years. A large number of respondents (81%) indicated that their staff who are involved

in construction procurement are IT literate. Interestingly, 98% of the respondents indicated that they preferred to train their current staffs to gain IT skills. This is in contrast to the number of respondents who advocate hiring specialist IT staff, where only 13% of the respondents preferred to outsource IT specialists for their companies.

Figure 2: Construction SMEs E-Commerce Scenarios



E-PROCUREMENT STRATEGY

While reaping the benefits of ICT uptake, the changing pattern in construction business in adoption of existing technologies, such as the use of e-procurement, has been a constant challenge of UK construction SMEs. According to the present survey, one of the most prominent criteria that would benefit in adopting e-procurement strategy is gaining competitive advantage. It represents the highest ranked criterion indicated by the respondents that could benefits from e-procurement strategy. Other factors ranked in descending order of importance are: reduce procurement costs; profitability, supply chain efficiency; company image; cycle times; and marketing of services (See Figure 3). The indication is clear; competitiveness is looked upon by the respondents as the greatest benefits of e-procurement. Perhaps, this is due to the perception of both tangible and intangible benefits that could result from an e-procurement strategy. This is despite ICT infrastructure and applications not being fully proven or mature among the respondents.

BUSINESS COMMUNICATIONS

Communication has always been a challenge for the construction industry. The emergence of ICT applications facilitates today's construction process. It is worth noting that use of ICT is improving communication for construction businesses. However, its role in creating an integral part of business strategy remains a challenge, although the majority of the respondents' perceived ICT uptake as having a significant impact on e-procurement strategy. For example, the use of electronic e-mail for business communication. The majority of the respondents believed that e-procurement offers opportunities for their business to communicate more effectively, particularly with the *supply chain* and *improve efficiency in the tender process* (see Figure 4).

However, despite e-mail being perceived as an effective tool for business communications by the respondents (57%), only 19% of the respondents totally agreed it has been effectively used in the construction process (See Figure 5).

Figure 3: Criteria that E-Procurement Strategies Would Benefit

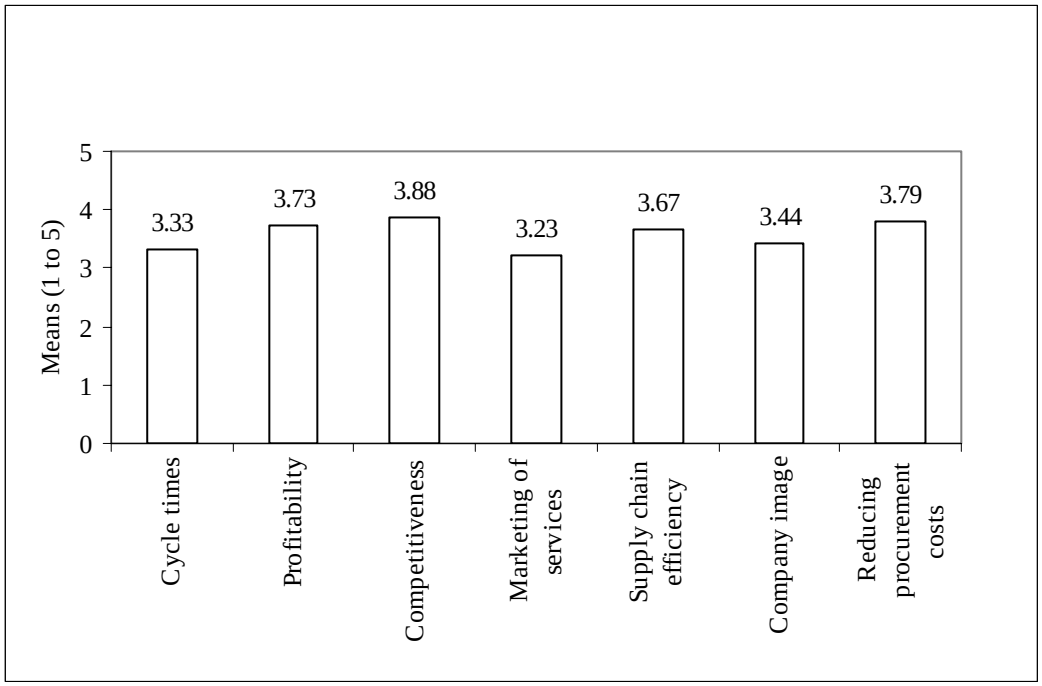


Figure 4: Communication Potentials in E-Procurement Strategies

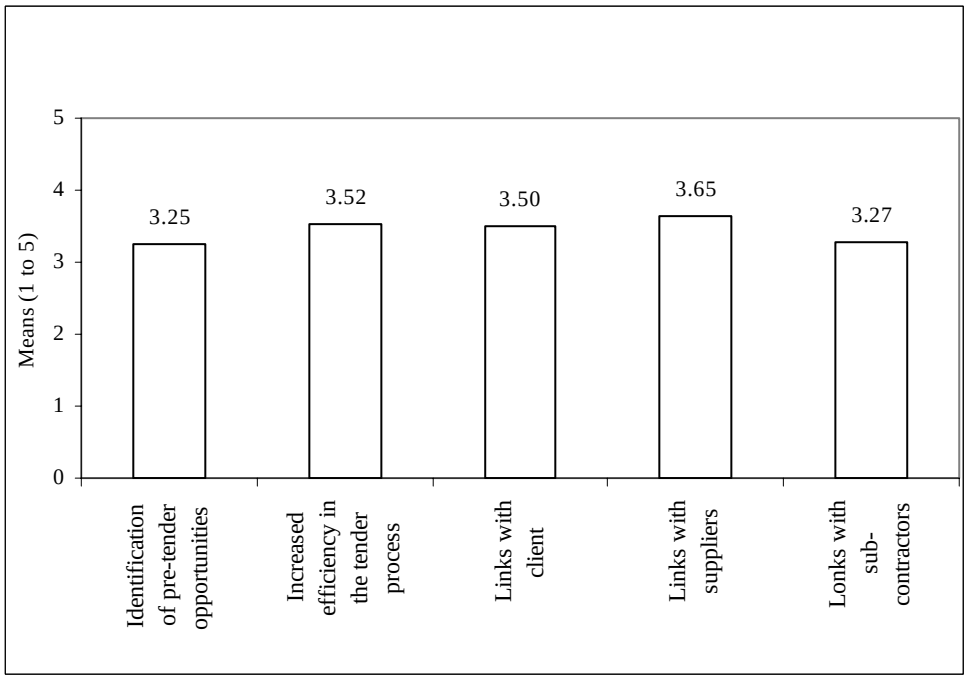
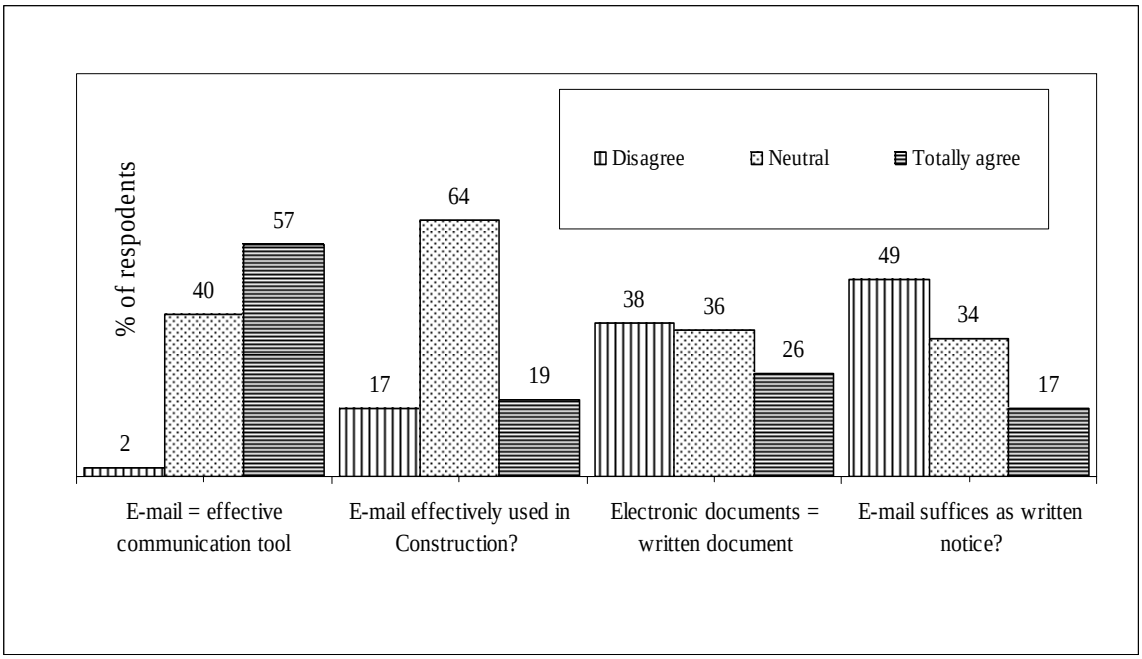


Figure 5: E-Mail as an Effective Communication Tool



With regard to the admission of electronic documents as written document proof during the construction process, only 26% of the respondents totally agreed, compared to 38% who disagreed. Not surprisingly, when asking whether e-mail suffices as a written notice, only 17% of the respondents totally agreed and about half of the respondents disagreed. This could imply that most respondents stand to gain the most of e-mail for construction business but on the other hand majority of the respondents were not yet ready to recognize the benefit of e-mail for more efficient and the legal validity of electronic information exchange.

DISCUSSION

The fact that ICT up-take can be beneficial to e-procurement is well justified by the respondents. Results from the survey show that gaining competitive advantage, reducing procurement costs and profitability are among the most important benefits that an e-procurement strategy would bring. The most probable explanation could be the increased competition among construction SMEs. Another perception from the respondents could be that e-procurement offers exciting new opportunities to widen their marketplace whilst saving substantial operational costs on ICT deployments. This perception has been identified in Tetteh and Burn (2001) study. Tetteh and Burn (2001) recommend SMEs can achieve global competitiveness without necessarily increasing physical infrastructures (significantly) of the company, but through the expansion of 'virtual' assets such as IT skill, expertise and e-business knowledge. 81% of the respondents to the current survey indicate that staff who are involved in the procurement process are IT literate. However, lack of ICT infrastructure has been the major obstacle for effective e-procurement among the respondents. This can be seen from less than 50% of the respondents having adequate ICT infrastructure for conducting e-procurement effectively.

The decision on training current staffs rather than outsourcing and hiring IT specialists to gain IT skills was overwhelming. Perhaps this reflects the greater flexibility in the demand of in-house IT skills and endeavors to lower costs, which have come along

with ICT infrastructure implementation, customization and operation. This is not surprising as more and more construction SMEs have greater use of computer in administration and finance (e.g. secretarial tasks and payroll) but have little investment in outsourcing IT specialists for innovative and advanced ICT infrastructures for core business.

Findings from the questionnaire responses and subsequent telephone interviews further confirmed that, the most common ICT applications are administrative tasks, company website, internal networking (sharing of computing infrastructures). Respondents indicated that, most of the ICT applications were off-the-shelf systems. This indicates that ICT applications mainly for economic benefits at the preliminary stage of ICT investment. It is believed that small firms tend to focus on general applications (e.g. off-the shelf systems) to enhance internal communications and improve secretarial and managerial tasks whilst exploring ICT to fulfil the generic needs for a small organization. This trend is most obvious for the respondents with less than 50 employees. Another rising concern is the decision on ICT investment and implementation. Feedback from the respondents indicates that there is a prolific choice of ICT applications and solutions. New products and ICT standards are constantly emerging to replace the older version. The latest technologies have proved a good alternative for improving the existing products. However, to select and evaluate the most appropriate one could be a tedious task. This is due to the cost for justifying such benefits often exceeds its true value and could be impractical for small firms. This is not surprising as Irani and Love (2002) and Love, et al (2000) have found IT investment tends to be a major challenge during its evaluation process. Overall, the findings show that SMEs are gaining benefits through the use of ICT that enable them to automate routine and repetitive works. Typical examples of these are tools for administrative tasks, documents and communications at the inter-organisational level, exchange of inter-organisitional documents and business information. The findings advocate lack of commitment to invest in ICT uptake in the future to capture the potential offered by ICT among the respondents. Overall, the adoption and resulting gains from ICT uptake are dependent to the extent, and types of respondents. This is due to the spread of ICT uptake from respondents (i.e. mediums-sized construction firms) who are already engaged with ICT applications, to those small construction firms who are just commencing to use ICT. Successful transformation of business processes through ICT implementation has been achieved incrementally by many large construction firms. Over recent years a significant number of small to medium sized retail and service firms have identified ICT uptake would help their organisations to gain benefits. In future, the late comers to ICT (i.e. particularly small construction firms) may find it hard to survive whilst competing in the same market.

RECOMMENDATIONS

The DTI's target for 1.5 million SMEs to get online for business has been exceeded. However, there is a variance on ICT uptake among those who have just started with ICT (employ for generic applications), and those who already are engaged in using ICT for facilitating and conducting e-procurement for business, in particular construction SMEs. The empirical findings show that the ideas of ICT uptake to leverage construction SMEs business are well known among the respondents. Essentially, there is a gap in construction SMEs who perceive ICT uptake may improve their business process and the actual ICT deployment and investments. Part of the reason could be a lack of a sense of the real impact on how ICT uptake can

benefit their business, which could be due to the result of lack of any precedents in ICT deployments in construction SMEs. Although there is an abundance of successful cases of ICT deployment and research in academia. However, most successful cases were from retail, manufacturing and finance services. Most are based on what the construction commentators and academia perceive as the need for construction SMEs, rather than solutions based on its heterogeneous nature, existing capability and the SMEs perspectives. It is difficult for construction SMEs to capture the actual benefits of ICT deployment and to judge the investment decision. Therefore, future research work may concentrate on the impact of ICT and its fundamental needs for construction SMEs, based on construction's unique and heterogeneous nature, addressing their ICT uptake strategies technologically and working from the perspective of the construction SMEs.

SUMMARY

The surge in ICT research and development by academia in specific applications related to the construction process has been a catalyst for the increased use of ICT to support various construction processes and communication among project partners. Technologies such as virtual reality, internet-based CAD, real-time communication and information exchange have already been investigated by many academics and construction firms. Despite such explosive growth in the advantages of ICT research and development, constructions SMEs have yet to fully benefit from this advancement. The acceptability of advanced ICT uptake continues to be the main challenge in small firms and the hindrance to the whole construction industry, before the industry can claims a general level of computer literacy. This paper highlights the empirical findings of UK construction SMEs readiness on ICT uptake and what the respondents perceived as the potential of ICT to e-procurement strategy. The findings show that the majority of the respondents were unable to conduct e-procurement effectively and have inadequate investment in ICT infrastructures although there were agreed that e-procurement may improve competitive advantage and profitability of their businesses.

REFERENCES

Cheng, E.W.L., Li, H., Love, P.E.D. and Irani, Z. (2001) An e-business model to support supply chain activities in construction. *Logistics Information Management*, MCB University Press, **14**(1/2), 68-77.

CPA (2001) *E-commerce - Where are we now*? Construction Products Association, special report. http://www.constprod.org.uk/download/specrep/special7.pdf [Viewed at March 2003].

Dixon, T., Thompson, B. and McAllister, P. (2002) *The value of ICT for SMEs in the UK: a critical literature review*. Report for Small Business Service Research Programme, The College of Estate Management, Reading. Also available at: http://www.sbs.gov.uk/content/research/value_of_ICT_for_SMEs_UK.pdf [viewed at May 2003]

DTI (2002) Small and Medium Enterprise (SME)- Definitions. http://www.sbs.gov.uk/ [viewed at March 2003].

Futcher, K.G. (2000) Use of information technology within the Hong Kong construction industry. *International Conference on Construction Information Technology 2000* - INCITE, 17th Jan. Hong Kong Polytechnic University, Hong Kong, ISBN: 962-367-272-1

Goodwin, P (2001) *Effective integration of IT in construction- a partners in innovation project final report. October.* The Building Centre Trust.

Irani, Z. and Love, P.E.D. (2002) Developing a frame of reference for ex-ante IT/IS investment evaluation. *European Journal of Information Systems*, **11**(1), 74-82.

Love, P.E.D., Irani, Z., Li H., Cheng, E.W.L. and Tse, R.Y.C. (2001) An empirical analysis of the barriers to implementing e-commerce in small-medium sized construction contractors in the state of Victoria, Australia. *Construction Innovation*, **1**(1):31-41

Love, P.E.D., Li, H., Tse, R.Y.C. and Cheng, E.W.L. (2000) An empirical analysis of IT/IS evaluation in construction, *The International Journal of Construction Information Technology*, **8**(2), 21-38.

Marosszeky, M., Sauer, C., Johnson, K. Karim,. K. and Yetton, P. (2000) Information technology in the building and construction industry: the Australian experience. *International Conference on Construction Information Technology 2000* - INCITE, 17th Jan. Hong Kong Polytechnic University, Hong Kong, ISBN: 962-367-272-1

Ng, S.T., Chen, S.E., McGeorge, D., Lam, K.C. and Evans, S. (2001) Current state of IT usage by Australian sub-contractors. *Construction Innovation*, **1**(1), 3-13.

SBS (2002a) *Number of enterprises, employment and employees in the whole economy by size of enterprise- 2001*. http://www.sbs.gov.uk/statistics/ [viewed at March 2003]

SBS (2002b) *Small Firms: Big Business. A Review of Small and Medium sized enterprises in the UK*. http://www.sbs.gov.uk/ [viewed at March 2003]

Tam, C.M. (1999) Use of the Internet to enhance construction communication: total information transfer system, *International Journal of Project Management*, **17**(2), 107-111.

Tetteh, E. and Burn, J. (2001) Global strategies for SMe-business: applying the SMALL framework. *Logistics Information Management*, MCB University Press, **14**(1/2), 171-180.

Thomas, K. (1999) A study of the use of information technology in the republic of Ireland construction sector. *International Journal of Construction Information Technology*, **7**(1), 21-34.

Walker, D.H.T. and Rowlinson, S.M. (2000) A construction industry perspective o the use of the web for establishing a marketing presence. *The International Journal of Construction Information Technology*, **8**(1), 93-112.

Whyte, J., Bouchlaghem, D. and Thorpe, T (2002) IT implementation in the construction organization *Engineering, Construction and Architectural Management*, **5**(6), 371-377.