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Spreadsheet Infusion in Small Audit Firms in Thailand

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ABSTRACT

For decades, spreadsheets have been one of the most commonly used computer applications by auditors. However, the use of spreadsheets varies considerably from one firm to another. Successful spreadsheet implementation can be viewed as occurring when spreadsheets are diffused to all auditors within an organization and are used to the fullest potential. This study aims to identify factors that contribute to the different levels of spreadsheet use among audit firms to help auditors use spreadsheets to their fullest potential (infusion). Using a series of case studies, this study found infrastructure flexibility and training to be critical infusion enablers at an early implementation stage. At later stages, support from IT champion, certain psychological factors such as staff self-efficacy, and social networks were found to be more important. Therefore, audit partners should focus on particular enablers at the right time in order to encourage auditors to use technology to its fullest potential.

Keywords (Required)

IT infusion, spreadsheet use, computer audit, small business, IT enablers

INTRODUCTION

Auditors use information technology (IT) to assist them with many audit tasks such as financial ratio analysis and the preparation of electronic work papers (Janvrin, Bierstaker, and Lowe, 2008). Spreadsheets are one of the most common applications used by auditors to assist in these tasks. However, the use of spreadsheets varies from one firm to another. Some firms use spreadsheets as only analytical tools, while others use them in a more advanced fashion as decision aids. This study attempts to identify factors that contribute to the different levels of spreadsheet use in the context of small audit firms in Thailand.

Sullivan (1985) originally defined IT infusion as the degree to which IT had penetrated firms in terms of importance and impact. In practice, IT infusion focuses on how an organization uses IT to the fullest potential to support their work. Prior studies have tried to find IT infusion enablers; however, they have rarely yielded statistically significant findings. A possible explanation for these statistically insignificant results is that previous studies (e.g. Cooper and Zmud, 1990; Zmud and Apple, 1992) have tested IT diffusion enablers instead of IT infusion enablers. The current study aimed to identify enablers of IT infusion, with a focus on spreadsheet use in small audit firms. IT infusion was viewed as a process which IT has infused into an organization (Cooper and Zmud, 1990). The process approach was used for studying and mapping IT infusion enablers to different infusion levels.

This paper begins with a review of the literature on IT used in small audit firms and IT infusion enablers. The study's research objective is shown in section three. The fourth section outlines the research methodology and how case firms were selected. This is followed by findings from the pilot case study and results from seven case firms. The last section outlines the major conclusions and future research plans.

LITERATURE REVIEW

Small Audit Firms and Technology

Presently, IT is used extensively to facilitate audit procedures, resulting in significantly improved audit productivity (Banker, Hsui, and Yi-Ching, 2002). Even though small firms were claimed to have limited resources, they do implement the latest technology when they believe that the technology can improve effectiveness and efficiency.

Small audit firms usually adopt off-the-shelf software instead of developing their own software. Off-the-shelf software includes generalized audit software (GAS) such as Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA), industry-specific audit software, high-level languages, and utility software. In addition, auditors (especially in small audit firms) have adapted MS-Office tools in their audit procedures. Microsoft Office, such as Excel and Access, were used as much as general audit software such as ACL and IDEA. While the Office suite dominates half of the audit automation, internally developed software and Teammate dominate the other half. Besides being used as a data extraction and analysis tool, MS-Excel has also been used as a risk analysis tool (Steven, 2003).

Auditors use IT in a wide range of audit tasks from audit planning, audit testing, writing reports, and managing the firm. Financial analysis tools, sampling, audit report writing, and electronic work papers were reported as the most common area into which IT had been integrated (Janvrin et al., 2008). Prior studies of IT use in audit firms (Curtis and Payne, 2008; Janvrin et al., 2008) focused on how IT can be used, adoption by auditors (diffusion), and the frequency of use, but none of these studies investigate IT infusion and its enablers.

IT Infusion

Manson, McCartney, and Sherer (1997, 2001) and Janvrin et al. (2008) investigated how audit firms implemented and used IT. Manson et al. (1997) found that while large audit firms seem to use an integrating approach for implementing IT, small firms use a tool box (piecemeal) approach. Kwon and Zmud (1987) proposed that an innovation process reaches its conclusion when it has been incorporated into the organization’s work processes (routinization) and is used to its fullest potential (infusion) (Figure 1).

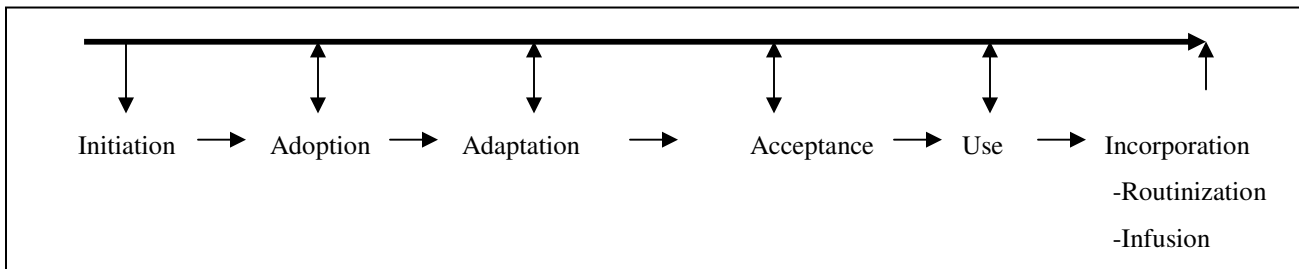


Figure 1. IS implementation process (adapted from Kwon and Zmud, 1987).

Kishore and McLean (1999, 2007) proposed IT infusion as a dimension of organizational implementation success. Infusion is the stage in which the IT is used to its fullest potential. Infusion can also be viewed as a process of reaching the final stage of IT implementation. Saga and Zmud (1994) proposed that at the infusion stage, IT had been integrated to organizational work process (extended use), IT established the work-flow linkages within the work process (integrative use), and IT was used in tasks that could not be performed without IT (emergent use).

IT Infusion Enablers

Most infusion studies have investigated IT implementation enablers. Winston and Dologite (1999) surveyed the IT implementation literature and offered a list of potential IT infusion enablers for small businesses. They classified the enablers into four categories: organizational, end-user, owner, and extra-organizational situation. The following sections discuss IT infusion enablers based on the previous categories. Other factors include innovation’s characteristics, diffusion, and routinization.

Organizational

Organizational refers to organizational structure and experience. While there is no existing literature empirically that has found a relationship between organizational structure and IT infusion, Zmud and Apple (1992) and Eder and Igarria (2001) operationalized the construct as “earliness of adoption” measured by the number of years of the organizations’ experience in IT, and found that organizational experience was positively related to IT infusion.

End-user

End-user refers to individuals’ characteristics that contribute to IT success. It includes experience, training, involvement, and incentives to use the technology. This category also reflects the implementation process which may affect the future use of technology. The end-user factors are consistent with the survey of IT implementation factors conducted by Premkumar (2003). In a more specific study, Saga (1994) found that an individual’s ability to reconceptualize tasks via IT contributed to IT infusion while, Cooper and Zmud (1990) suggested that the individual perspectives, such as self-interest, outweighed organizational considerations.

Owner

Since small business owners usually work on a full-time basis and play a dominant role in most business decisions, their personal abilities and motivation have significant impacts on the business (Walker and Brown, 2004). The study of business owners also includes owner characteristics (e.g. Thong, 1999), owner attitudes and IT-gatekeeper assumption (Davidson and Hart, 1995; Winston and Dologite, 2002). In some case where the owners are separated from the business the study focuses on management support and management involvement.

Extra-organizational

This category captures factors or situations that affect an organization’s innovation process. It includes a set of factors outside the organization such as social network and strategic alliances, and changes in environment

Extra-organizational factors, such as social networks, have not been included in studies of IT. In practice, small businesses can improve use of IT by exchanging knowledge with social network, such as external IT consultants (Cragg and King, 1993; Thong, Yap, and Raman, 1996) and by observing how other organizations use their technology in the same business context. A positive impact on IT infusion can come from the strategic alliance among organizations in the same industry and between the organization and IT consultants. Other pressures may also come from business partners and regulators (Premkumar, 2003).

Innovation’s characteristics

Rogers (2003) suggested that an innovation’s characteristics enable the rate of diffusion (Figure 2). While relative advantage, compatability, trialability, and observability are generalized to be positively related to rate of adoption, complexity is generalized to have negative effects. Empirically, relative advantage, complexity, and compatibility (with tasks) were found to be related to IT diffusion, but not infusion (Cooper and Zmud, 1990). However, innovation compatibility with organizational strategy was found to be related to IT infusion behaviors (Kishore and McLean, 2007).

Relative advantage	is the degree to which an innovation is perceived as better than the idea supersedes.
Compatibility	is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters.
Complexity	is the degree to which an innovation is perceived as difficult to understand and use.
Trialability	is the degree to which an innovation may be experimented with on a limited basis.
Observability	is the degree to which the results of an innovation are visible to others.

Figure 2. Innovations’ characteristics (Rogers, 2003)

Diffusion and Routinization

Cooper and Zmud (1990) and Zmud and Apple (1992) claimed IT diffusion as an antecedent of IT infusion; however, they did not test or report the link between them. Castner and Ferguson (2000) and Eder and Igbaria (2001) provided some empirical evidence on the association between IT diffusion and infusion. However, the relationship remains unclear.

Routinization was also claimed as a predecessor of IT infusion even though no studies have provided supporting evidence (e.g. Zmud and Apple (1992) claimed that they did not observe the firm with low routinization). Sundaram, Schwarz, Jones, and Chin (2007) reported an association between routinization and infusion. They focused on an individual level of analysis rather than infusion at the firm level.

RESEARCH OBJECTIVE AND METHODOLOGY

The current study aimed to identify factors that influenced IT infusion in small audit firms. It also aimed to improve the understanding of the organizational infusion process. The study focuses on independent audit firms that regularly use IT to assist their work. The preliminary interviews conducted in New Zealand (NZ) showed that most small NZ audit firms were small. They were not aware of sophisticated use of IT. Thai audit firms provided services to both small and large organizations. They also provided a rich content of IT uses that fit the objective of this study. The following two-phase approach was adopted:

- Phase 1: A pilot case study was used to initially identify possible audit tasks into which IT (including spreadsheets) could be integrated. Then the pilot case was used to identify factors that would help and advance the use of IT. Respondents were asked how they currently used IT and what had helped them to reach the current stage of IT use and to advance their IT use.
- Phase 2: The result from the pilot case study was used to develop an interview protocol (Appendix A). The case firms were chosen using a maximum-variation-cases approach based on information-oriented criteria (Flyvbjerg, 2006). This approach allows us to study various factors at different IT infusion levels. A series of case studies were conducted. The total number of case firms was determined by successively selecting and analyzing case studies until the addition of a new case did not yield new insights.

The use of the pilot case in this study allowed a rigorous approach in conducting positivist case research (Dube and Pare, 2003). Multiple-case studies were used as the primary research methodology. Semi-structured, in-depth interviews were used as the main data gathering technique. Part of this involved respondents demonstrating how they used spreadsheets. In addition, some spreadsheets were collected and examined for data triangulation purposes (Yin, 2003). Replication logic (Yin, 2003), variable matrices (Miles and Huberman, 1994), and content analysis (Neuendorf, 2002) were used as case analysis techniques.

THE PILOT CASE

The pilot firm was a medium-sized audit firm with 220 staff. Although the firm had been allied with an international firm, the firm did not seek benefits in the form of knowledge transfer and development. However, the firm actively participated in a small audit firm network. The firm provided services to approximately 1,000 clients ranging from small to large clients which were listed in the stock exchange of Thailand (SET). The firm had no internal IT support. MS-Excel (a spreadsheet application) and ACL were two main applications used for performing most audit tasks. The IT used in the pilot firm was mapped to the major audit process as shown in Figure 3. The firm was also engaging in developing a spreadsheet-based risk-assessment application with its local alliance.

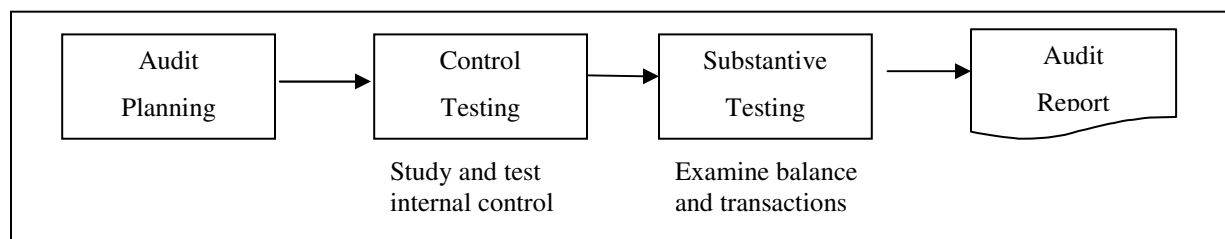


Figure 3. Major steps in auditing (adapted from Konrath, 2002)

IT infusion enablers and inhibitors in the pilot firm

For a newly adopted technology, ACL, basic training and support were claimed to be key enablers for advancing the use of ACL to a higher level. However, the firm did not invest in any of these enablers. Meanwhile, major inhibitors include the software complexity and lack of management support in the form of resources and time. On the other hand, the complexity of ACL, which is considered a substitute approach, acts as an IT infusion enabler for spreadsheets.

The spreadsheets' relative advantage was a key enabler. Once auditors realized the advantages, they kept exploring how to use spreadsheets. The observability and complexity of the ACL was also stated as important spreadsheet enablers. ACL which was designed specifically for audit works gave auditors ideas how audit tasks could be performed electronically. Therefore, the auditors learned to reconceptualize audit tasks via IT from ACL. The management claimed that they fully supported IT use; however, they rarely got involved. They revealed their attitudes through the fact that they might not follow

the results of the risk-assessment application that they were developing. Since some high-level audit tasks were only done by the management, the spreadsheets will not be able to reach infusion without solving the management skills and attitude issues.

Developing case study protocol from the pilot case findings

The pilot case showed a wide range of computer applications being applied to audit tasks. ACL gave auditors ideas show sophisticated the spreadsheets can be used in audit tasks. The results also help us develop an interview protocol for the case studies. A measure of IT infusion developed by Pongpatrachai, Cragg, and Fisher (2008) was used for mapping IT infusion levels in the case firms. The measure is a formative indicator of IT infusion basing on three dimensions of use: extended, integrative, and emergent use (Appendix B). Extended use was measured from 0-16 depending on the level of task complexity into which spreadsheets were integrated. Links between tasks were counted to form integrative use score, ranging from 0-15. Emergent use score was measured by determining to what extent spreadsheets were integrated into the business strategy and ranged from 0-4.

FINDINGS FROM THE CASE FIRMS

The Case Firms

Seven case firms were selected from a pool of small audit firms in Thailand. The firms share some common characteristics such as tasks performed and the business environment. These shared characteristics help control some factors. The case firms were chosen to vary in size, IT infrastructure, IT support, and other factors as prior studies indicated that these factors were likely to affect organizational innovation processes (and IT infusion). The different cases were expected to yield a range of IT infusion levels. Table 1 provides some descriptive data for the case firms.

	Firm size (Staff, Annual income)	Service provided Clients' characteristics	Firm structure	IT infrastructure/ Availability of IT support	External communication Alliances
Firm A	Staff: 30 Income: Baht 20 millions	Auditing, Accounting, and other related services No SET listed clients	Flat, No clear-cut division	Necessary infrastructure provided. External support	Informal contacts with other firms' partners
Firm B	Staff: 50 Income: Baht 50 millions	Auditing Both SET listed and non-listed clients	Clear-cut profit-centered divisions	All infrastructures provided Internal and external support	Informal contacts with other firms' partners
Firm C	Staff: 26 Income: Baht 16 millions	Auditing and other assurance services Both SET listed and non-listed clients	Flat, No clear-cut division Part-time staff	Some infrastructures provided. Internal support	Informal contacts with other firms' partners
Firm D	Staff: 100 Income: Baht 40 millions	Auditing and other assurance services Both SET listed and non-listed clients	Formal structure with 3 clear-cut divisions	Some infrastructures provides No IT support	Formal - 75CPE* Informal contacts with other firms' partners

Table 1. The Case Firms' Profile

*75CPE is a name of the local audit social network

	Firm size (Staff, Annual income)	Service provided Clients' characteristics	Firm structure	IT infrastructure/ Availability of IT support	External communication Alliances
Firm E	Staff: 80 Income: Baht 30 millions	Auditing, accounting, payroll, consultant, and legal services Both SET listed and non-listed clients	Formal structure with 3 clear-cut divisions	Necessary infrastructure provided. Internal and external support	Formal - 75CPE* A member of an international firm Informal contacts with other firms' partners
Firm F	Staff: 40 Income: Baht 15 millions	Auditing, accounting, and other assurance services No SET listed clients	Flat, No clear-cut division	Necessary infrastructure provided. External support provided	Informal contacts with other firms' partners
Firm G	Staff: 80 Income: Baht 50 millions	Auditing and other assurance services Both SET listed and non-listed clients	Formal structure with 4 clear-cut division	Necessary infrastructure provided. No technical support	Formal: A member of an international firm Informal contacts with other firms' partners

Table 1. The Case Firms' Profile (Continued)

Spreadsheet Infusion Enablers and the Firms' Level of Spreadsheet Infusion

This section reports IT infusion enablers and inhibitors directly claimed by respondents in the case firms. The respondents were asked to identify major factors which could or would help them to reach a higher level of use of spreadsheets and use them to their fullest potential. Then, they were asked to identify any inhibitors that hindered their use of spreadsheets. The results are summarized in Table 2. The table presents the results in ascending order of the case firms' infusion scores, based on Pongpattrachai et al. (2008).

Firm (extended/integrative/ emergent use score)	Enablers	Inhibitors
Firm G (4/0/0) Infusion = 4	1. Staff IT competence 2. Training 3. Routinization	1. Relative advantage 2. Lack of knowledge/skills
Firm A (5/1/0) Infusion = 6	1. Training 2. Clients requiring extensive audit procedures	Not stated
Firm D (7/1/0) Infusion = 8	1. Availability of infrastructure 2. Staff IT competency 3. Staff attitudes 4. Staff self-efficacy	Management attitude toward technology
Firm C (7/1/1) Infusion = 9	1. Relative advantage 2. Staff IT competency 3. Staff turnover 4. Observability 5. Variety of clients	1. Staff turnover 2. Clients' willingness to give out soft data

Table 2. IT infusion enablers and inhibitors of the case firms

Firm (extended/integrative/ emergent use score)	Enablers	Inhibitors
Firm F (9/1/1) Infusion = 11	<ol style="list-style-type: none"> 1. Staff IT competency 2. Staff self-efficacy (self-study) 3. Relative advantage 4. Availability of resources (self-study) 5. Observability 6. IT Champion 	Management involvement
Firm B (12/2/1) Infusion = 15	<ol style="list-style-type: none"> 1. Training 2. Staff self-efficacy 3. Availability of materials 4. Support from professional and academic institutes 5. IT champion 	<ol style="list-style-type: none"> 1. Lack of management support 2. Regulators 3. Complexity of the application
Firm E (11/4/2) Infusion = 17	<ol style="list-style-type: none"> 1. The management involvement 2. Staff turnover 3. Lower IT cost 4. Improvement of audit procedures 5. Regulators 6. IT champion 	Availability of alternative software

Table 2. IT infusion enablers and inhibitors of the case firms (continued)

CROSS-CASE ANALYSIS AND DISCUSSION OF RESEARCH RESULTS

The most important contribution of the study is that it identified IT infusion enablers and mapped them to the organizational IT infusion process. We found that organizations go through a similar infusion process. In particular, the case studies showed that IT infusion enablers were different from IT diffusion enablers. The following enablers were important during various stages of infusion.

Enablers vary by level of IT infusion. For example, some enablers contribute to infusion at an early stage while others contribute to a higher stage of infusion. The results show that all enablers which exhibit a lower-level are fundamentally present in the firms which exhibit a higher-level of infusion. Figure 4 shows the hierarchy of spreadsheet infusion enablers in the case firms.

An early stage of infusion (Level 1 or 2)

At an early stage of infusion, staff knowledge and skill are the most important in integrating IT into business tasks. Staff knowledge, skill, and ability are defined as staff competency (Blancero, Boroski, and Dyer, 1996). Firms with low level of infusion (Firms A and G) relied on individual staff to apply the technology in their work because the management does not know how to use the technology or know what help staff need. However, basic training is necessary; especially during the early phase because it increases users’ perception of system quality and intention toward using IT (Bedard, Jackson, Ettredge, and Johnstone, 2003). The training can be done through an external party or through staff formal education. In addition, necessary IT infrastructure must be provided. As Venkatesh, Brown, Maruping and Bala (2008) claimed: no matter how competent (e.g., self-efficacy, knowledge) an individual is in using a system, if the organization does not have adequate resources (e.g., technology infrastructure) to support system use, the individual’s behavioral expectation to use that system will be lowered.

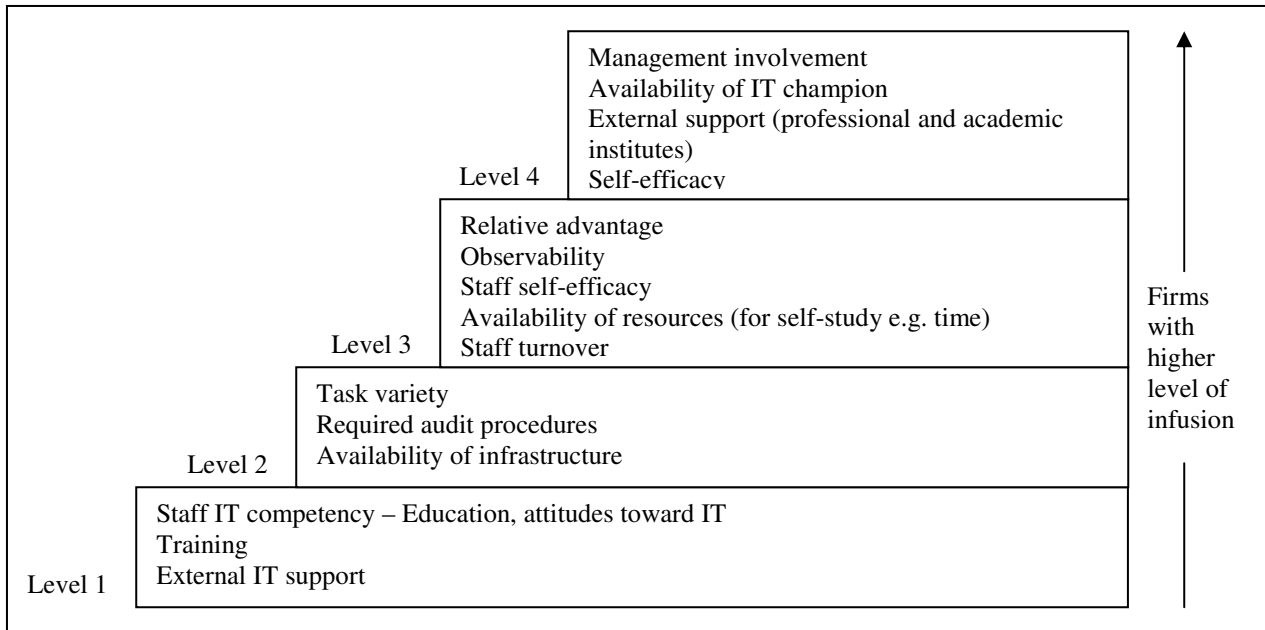


Figure 4. Hierarchy of spreadsheet infusion enablers in the case firms

Later Stages of Infusion (Level 2 or 3)

During the later stages, staff develop their skills and expand their range of tasks (Pentland, 2003). The variety of tasks and job rotations (so that staff can experience task variety) may be used as a managing strategy at this stage. Management support is also needed in forms of available time and resources. Observability from other software used in auditing or how other firms use IT in auditing also help auditors learn new uses. At the firm level, IT was used as a tool for standardizing work processes to avoid relying on individuals to perform audit tasks. Staff turnover, therefore, was identified as a push factor for using IT to its fullest extent. The difference between spreadsheet infusion enablers for the firms in Level 2 and 3 is the shift from organizational-level enablers to individual-level enablers. The firms that exhibit a higher infusion level (Level 3) must not only provide necessary resources but also motivate their staff to investigate and use the spreadsheets.

An Infusion Stage (Level 4)

To achieve this infusion stage, the evidence indicated that audit firms must seek help from external sources. This finding is consistent with those of Vera-Munoz, Ho, and Chow (2006). External sources include other audit firms, professional institutes, and academic institutes. Senior managers and an IT champion also play an important role in bringing in the IT knowledge. The self-efficacy identified by the cases was that of the IT champion. An IT champion acts as an intermediary who acquires external knowledge and promote IT use in the firm (Beath, 1991).

CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

This study adds into the literature on IT infusion enablers, particularly in the small firm context. A series of case studies were conducted that allowed the researchers to map IT enablers onto the IT infusion process. Most of the enablers of IT infusion that were identified by this study were different from prior studies. This may help explain why prior studies rarely yielded significantly statistical results.

Results from the pilot and seven case studies indicated that IT infusion enablers play different roles at various stages of IT infusion. IT infrastructure and training were found to be basic enablers at an early stage. Task variety, resources and time, and other innovation characteristics helped advance the use. However, in order to reach an infusion stage, senior management and an IT champion play an important role in bringing the knowledge from external sources.

As this study was based on seven case firms, all with 100 or less employees, the generalization of the results is limited. However, the identified enablers of IT infusion are different from IT diffusion or implementation enablers. Future research should investigate these IT infusion enablers in larger samples and in different contexts.

REFERENCES

1. Banker, R.D., Hsui, C., and Yi-ching, K. "Impact of Information Technology on Public Accounting Firm Productivity," *Journal of Information Systems* (16:2), Fall 2002, pp 209-222.
2. Beath, C.M. "Supporting the Information Technology Champion," *MIS Quarterly* (15:3) 1991, p 355-372.
3. Bedard, J.C., Jackson, C., Ettredge, M.L., and Johnstone, K.M. "The effect of training on auditors' acceptance of an electronic work system," *International Journal of Accounting Information Systems* (4:4), 2003/12 2003, pp 227-250.
4. Blancero, D., Boroski, J., and Dyer, L. "Key Competencies for a Transformed Human Resource Organization: Results of a Field Study," *Human Resource Management* (35:3) 1996, p 383-403.
5. Castner, G., and Ferguson, C. "The Effect of Transaction Costs on the Decision to Replace 'Off-the-shelf' Software: the Role of Software Diffusion and Infusion," *Information Systems Journal* (10) 2000, pp 65-83.
6. Cooper, R.B., and Zmud, R.W. "Information Technology Implementation Research: A Technological Diffusion Approach," *Management Science* (36:2) 1990, p 123-139.
7. Cragg, P.B., and King, M. "Small-firm computing: Motivators and inhibitors," *MIS Quarterly* (17:1) 1993, p 47-61.
8. Curtis, M.B., and Payne, E.A. "An examination of contextual factors and individual characteristics affecting technology implementation decisions in auditing," *International Journal of Accounting Information Systems* (9:2) 2008, p 104-121.
9. Davidson, R.A., and Hart, S.D. "Managing the adoption of new technologies: Does personality affect the acceptance of new audit technologies?," *Revue Canadienne des Sciences de l'Administration* (12:4) 1995, p 268-281.
10. Dube, L., and Pare, G. "Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations," *MIS Quarterly* (27:4) 2003, p 597-636.
11. Eder, L.B., and Igbaria, M. "Determinants of Intranet diffusion and infusion," *Omega* (29:3) 2001, p 233-242.
12. Flyvbjerg, B. "Five misunderstandings about case-study research," *Qualitative Inquiry* (12:2), Apr 2006, pp 219-245.
13. Janvrin, D., Bierstaker, J., and Lowe, D.J. "An Examination of Audit Information Technology Use and Perceived Importance," *Accounting Horizons* (22:1) 2008, p 1-21.
14. Kishore, R., and McLean, E.R. "Diffusion and Infusion: Two Dimensions of "Success of Adoption" of IS Innovations," Fourth Americas Conference of the Association on Information Systems (AMCIS 1998), Baltimore, Maryland, 1998, pp. 731-733.
15. Kishore, A., and McLean, E.R. "Reconceptualizing Innovation Compatibility as Organizational Alignment in Secondary IT Adoption Contexts: An Investigation of Software Reuse Infusion," *IEEE Transactions on Engineering Management* (54:4) 2007, p 756-776.
16. Konrath, L.F. *Auditing: A Risk Analysis Approach* South-Western, Cincinnati, OH, 2002.
17. Kwon, T.H., and Zmud, R.W. "Unifying the fragmented models of information systems implementation," in: *Critical Issues in Information Systems Research*, R.J.B. Jr. and R.A. Hirschheim (eds.), John Wiley & Sons Ltd., Wiltshire, 1987, pp. 227-251.
18. Manson, S., McCartney, S., and Sherer, M. "Audit Automation: The Use Of Information Technology in the Planning, Controlling and Recording of Audit Work," Institute of Chartered Accountants of Scotland, Edinburgh. 1997.
19. Manson, S., McCartney, S., and Sherer, M. "Audit automation as control within audit firms," *Accounting, Auditing & Accountability Journal* (14:1) 2001, p 109-130.
20. Miles, M.B., and Huberman, A.M. *Qualitative Data Analysis: A Sourcebook of New Methods*, (2nd ed.) Sage Publication, Inc., Thousand Oaks, CA, 1994.
21. Neuendorf, K.A. *The Content Analysis Guidebook* Sage Publication, Inc., Thousand Oaks, CA, 2002, p. 301.
22. Pongpatrachai, D., Cragg, P., and Fisher, R. "Measuring IT Infusion through the Concept of Audit Task Complexity," Fourth Asia/Pacific Research Symposium on Accounting Information Systems, Auckland, New Zealand, 2008.
23. Premkumar, G. "A Meta-Analysis of Research on Information Technology Implementation in Small Business," *Journal of Organizational Computing and Electronic Commerce* (13:2) 2003, pp 91-121.
24. Rogers, E.M. *Diffusion of Innovations*, (5th ed.) Free Press, New York, NY, 2003.

25. Saga, V.L. "The Nature and Determinants of Information Technology Infusion: An Organizational Level of Analysis," The Florida State University, United States -- Florida, 1994.
26. Saga, V.L., and Zmud, R.W. "The Nature and Determinants of IT Acceptance, Routinization, and Infusion," The IFIP TC8 Working Conference on Diffusion, Transfer and Implementation of Information Technology, Elsevier Science, Pittsburgh, PA, USA, 1994, pp. 67-86.
27. Stevens, M.G. "Paperless audits weigh in," *The Practical Accountant* (36:2), Feb 2003, p 32-35.
28. Sullivan, C.H. "Systems planning in the information age," *Sloan Management Review (pre-1986)* (26:2) 1985, p 3-13.
29. Sundaram, S., Schwarz, A., Jones, E., and Chin, W.W. "Technology use on the front line: how information technology enhances individual performance," *Academy of Marketing Science. Journal* (35:1) 2007, p 101-112.
30. Thong, J.Y.L. "An integrated model of information systems adoption in small businesses," *Journal of Management Information Systems* (15:4) 1999, p 187-214.
31. Thong, J.Y.L., Yap, C.-S., and Raman, K.S. "Top management support, external expertise and information systems implementation in small businesses," *Information Systems Research* (7:2) 1996, p 248-267.
32. Venkatesh, V., Brown, S.A., Maruping, L.M., and Bala, H. "Predicting Different Conceptualizations of System Use: The Competing Roles of Behavioral Intention, Facilitating Conditions, and Behavioral Expectation," *MIS Quarterly* (32:3) 2008, p 483-502.
33. Vera-Munoz, S.C., Ho, J.L., and Chow, C.W. "Enhancing Knowledge Sharing in Public Accounting Firms," *Accounting Horizons* (20:2) 2006, p 133-155.
34. Walker, E., and Brown, A. "What Success Factors are Important to Small Business Owners?," *International Small Business Journal* (22:6) 2004, p 577-594.
35. Winston, E.R., and Dologite, D.G. "Achieving IT Infusion: A Conceptual Model for Small Businesses," *Information Resources Management Journal* (12:1) 1999, p 26-38.
36. Winston, E.R., and Dologite, D. "How does Attitude Impact IT Implementation: A Study of Small Business Owners," *Journal of End User Computing* (14:2) 2002, p 16-29.
37. Yin, R.K. *Case Study Research Design and Methods*, (3rd ed.) Sage Publication, Inc., Thousand Oaks, CA, 2003.
38. Zmud, R.W., and Apple, L.E. "Measuring Technology Incorporation/Infusion," *The Journal of Product Innovation Management* (9:2) 1992, p 148-155.

APPENDIX A: INTERVIEW PROTOCOL

Firm: _____
 Interviewers: _____
 Interviewees: _____
 Date/Time: _____

1. Introduction of the study

We are currently conducting a study with the intention in finding factors that help organizations achieve a higher level of use of technology in order to support the work.

2. Basic questions

Could you please tell me about your audit firm, profile, services provided, clients, staff, firm structure, IT supports, trainings, etc.?

Follow up:

Could you please tell me about yourself, e.g. your rank, your responsibilities within the firm?

3. Use of spreadsheets and measuring infusion.

3.1 Could you explain how your firm currently uses spreadsheets to support audit work?

Action: Show a picture of broad audit process and ask the interviewees (Figure 3).

Referring to the auditing process, how does your firm use spreadsheets?

3.2 What audit procedures do you think could not be done without spreadsheets? Please give some example. How would you have performed those tasks in the past?

3.3 What else could your firm be using spreadsheets for that your firm does not currently use?

Why? What could have helped your firm to do that?

3.4 What do you see as your next step in your firm's use of spreadsheets? How does your firm plan to do so?

4. Factors/ Inhibitors of IT infusion

4.1 What have been major changes in the use of spreadsheets since it has been introduced? When did this happen? How did this happen?

Probes: If there has been no change, why has it not changed?

4.2 What has helped and/or would help your firm use spreadsheets to their fullest potential *to support audit work*?

Follow up: Based on your discussion a) b) and c) to n) are considered the factors. Of these factors, which of these do you think are the most important?

4.3 What has prevented or hindered your firm from *achieving the higher level of use of spreadsheets in audit work*? And how do you think these barriers would be resolved?

5. Conclusion and end of discussion

5.1 Based on our discussion, if you could change anything, what would you change in order to make better use of spreadsheets?

5.2 Is there anything else that we have not mentioned that you would like to add?

APPENDIX B: MEASURING IT INFUSION (PONGPATTRACHAI ET AL., 2008)

MEASURING EXTENDED USE AND INTEGRATIVE USE.

	Planning	Test of control	Test of balance	Reporting
Applications of spreadsheets to audit tasks sequenced by task complexity	- Recording (1) - Manipulating data (2) - Risk assessment (3) - Making judgment and developing audit program (4)	- Recording (1) - Manipulating data (2) - Risk assessment (3) - Making judgment and developing audit program (4)	- Recording (1) - Manipulating data (2) - Test of balances (3) - Predefined procedures (4)	- Preparing reports (1) - Basic reporting (2) - Advance reporting (3) - Judgment reporting based on audit opinions (4)

Extended use score

- (1) Spreadsheet is used for recording audit evidence or clients’ information without any manipulation. Spreadsheet features are rarely used to assist audit task. Only basic IT skills are needed.
- (2) Spreadsheet is used for simple calculations. Spreadsheet features are used to assist audit work. Audit tasks are mostly structured.
- (3) Spreadsheet is used for testing balance and transactions. DSS may be developed to assist audit tasks. Combination features have been used. Audit works are mostly semi-structured.
- (4) Spreadsheet is used as EUA. Spreadsheet is developed to store knowledge and make inferences, similar to a human expert. Audit works are mostly unstructured.

Integrative use score

The score is counted when users use an output from the previous level/phase as an input to the higher level or next phase.

Measuring emergent use

The emergent use score was based on the following:

Level 0 – technology is used to assist existing works (no emergent use)

Level 1 – technology is used to improve efficiency of existing works

Level 2 – technology offers a new approach/ new idea to the work

Level 3 – technology is used strategically to create competitive advantage for the firm