Electronic archiving applications and their adoption in Finnish accounting firms

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**Title of thesis:**

Electronic archiving applications and their adoption in Finnish accounting firms

**Abstract:**

The main objective of this study was to explore the factors affecting the adoption of electronic archiving applications in Finnish accounting firms. Following the literature review, ten factors were included in the research model based on the Technology-Organization-Environment (TOE) framework. Empirical data was collected with an e-mail survey conducted in September 2009 with the assistance of Association of Finnish Accounting Firms yielding 226 usable responses and an overall response rate of 25.89%.

Electronic archiving applications had been adopted by 87 (38.5%) organizations, while 139 (61.5%) were non-adopters. However, the extent of electronic archiving usage was still relatively low among adopters. While univariate Mann-Whitney test provided initial support for all ten hypotheses, only three factors (organizational support, competition and trading partner readiness) emerged as significant in multivariate logistic regression. These study findings highlight the importance of organizational support to secure adequate resources for adoption. Small organizations would also seem to defer adoption in the absence of explicitly expressed pressure from business partners or competitors. Overall, adoption would seem more related to the internal and external environment of the organization than to the technology itself. Multicollinearity, existence of suppressor variables, inadequate sample size and non-normality of variables were found to limit the validity and significance of the results.

**Keywords:**

electronic archiving, electronic archiving applications, accounting firm, SMEs, diffusion of innovations, TOE framework, electronic financial management
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1 INTRODUCTION

This chapter provides background on the research and introduces the research objectives and the empirical methods used. Finally the structure of the thesis is outlined at the end of the chapter.

1.1 Research background

Over the years organizations and other institutions have invested heavily in different technologies to increase business process efficiency thereby aiming to improve organizational performance. Information technology development has also initiated major changes in financial management over the last few years leading to its electronization. For example electronic invoicing is being implemented at an increasing rate, as its adoption brings cost and time efficiencies, improved access to documents and electronic archiving capabilities (Vallenius, 2005:40).

This study concentrates on one aspect of electronic financial management, namely electronic archiving. Archives, in general, are used for storing and maintaining material to enable access in reasonable time (Pieskä, 1990:11). The main problem in archiving, both in paper and electronic format, is often how to minimize the archived material to a sufficient level (Rekola-Nieminen, 2006:34). It has even been estimated that nearly 90 per cent of archived documents are only retrieved when they are destroyed (Raynes, 2002:304). Ideally archives are set up to preserve information with lasting value to the organization (Pieskä, 1990:11). Increases in information supply and demand, information technology developments and office automation have increased the wealth of information to be archived making the management and upkeep of traditional paper archives more difficult and the implementation of electronic archiving solutions more desirable (Pieskä, 1990:3).

There are numerous technological solutions available for electronic archiving and their IT infrastructure integration. In his diploma work Lähdesmäki (2009) distinguished four primary methods of organizing the electronic archiving of accounting material. Electronic archiving can be realized without any electronic archiving applications either by using optical disk archiving or by acquiring archiving services. Electronic archiving applications, on the other hand, are roughly divisible into general document
management systems and into more specific accounting related applications. In addition to dedicated archiving applications, archiving functionalities may also be integrated into accounting information systems (TIEKE, 2009). This study specifically concentrates on the use of electronic archiving applications, but also briefly reviews the issues related to optical disk archiving.

The use of electronic data media in financial accounting was legitimized in Finland by the Accounting Act in 1997, whereby all accounting material except the annual balance sheet may be created and stored in digital format (AA 2:8 §). Normative regulations on electronic archiving could be seen to determine the minimum level for long-time preservation and these permanent archives are usually complemented with active archives during the financial period. As electronic archiving penetrates all financial management processes, active archives are maintained for each different process, or integrated by using, for example, an electronic document management system, EDMS (Lahti & Salminen, 2008:169-170). Consequently, implementing electronic archiving requires decision-making related to all financial management processes and for this reason paper and electronic archiving still usually coexist.

1.2. **Electronic archiving in Finnish accounting firms**

Accounting firms offer professional services in the field of financial management (Välimäki, 2006:25). In 2007 financial management and auditing services were provided in 4,868 places of business with nearly 13,000 employees (Metsä-Tokila, 2009:10). According to the European Commission (2003) recommendation, small and medium-sized enterprises, SMEs, employ fewer than 250 persons, while within the SME category small enterprises employ less than 50 persons and microenterprises fewer than ten persons. Accounting firms can be categorized as SMEs, because they are predominantly very small with nearly 90 per cent of them employing less than 5 employees. Majority of these organizations are also microenterprises relying solely on the entrepreneur’s work contribution. (Lith, 2005:20-21.)

Basic services offered by accounting firms include accounting, closing of accounts, salary accounting and other financial management services to meet regulatory requirements. Financial management is often perceived as a support function whose outsourcing releases resources for core competence development. Especially small
organizations benefit from economies of scale as accounting firms can provide services and systems otherwise financially unfeasible. (Granlund & Malmi, 2004:23-24; Lahti & Salminen, 2008:180) About 80 to 90 % of Finnish companies have been estimated to be using accounting firm services (Gullkvist, 2003:538).

E-business (EB) entails conducting business transactions electronically, which includes not only the buying and selling of goods and services but also customer services, business partner collaboration and conducting internal transactions (Turban, King, McKay, Marshall, Lee & Viehland, 2008:4). Electronic archiving is closely linked with improving organizational processes (Gullkvist, 2003:536) and thereby it contributes to successful e-business. The situation is even more pronounced with accounting firms, where financial management electronization changes the method for producing organizations’ core business i.e. accounting services.

Electronic financial management is transforming the accounting firm sector as business processes and financial information flow become increasingly automated (Dahlberg, 2004:35). Consequently, service offerings are expanding to include management accounting services and consultation for managerial decision-making. Accounting firms will gradually become value-adding service providers with strategic value for their customers. (Granlund & Malmi, 2004:14-15) Large organizations are also expected to outsource their financial management to a greater degree in the future and firms with higher degree of automation are then more likely to meet these increasing demands. Larger accounting firms are, therefore, more likely to benefit from these developments and the sector is projected to polarize significantly causing problems to micro firms. (Metsä-Tokila, 2009: 10, 41-42)

The readiness to provide electronic services varies quite significantly among accounting firms. According to Lahti and Salminen (2008: 26) over 90 per cent of accounting firms offer no electronic services. The efficient and innovative use of electronic services can therefore still be seen as a source of competitive advantage, but the readiness to offer electronic services will eventually become a necessity for accounting firms. (Launonen, 2007:23-24) Slow diffusion of electronic financial management has been contributed for example to lack of standards, inadequate data security and lack of resources in accounting firms (Mäkelä, 2005:28-29). Customer capabilities and attitudes have also been found to significantly hinder business electronization (Katajamäki, 2005:16).
1.3. Research objectives

Despite the potential benefits, adoption of electronic archiving applications has been slower than expected in the Finnish accounting firm sector. This study is designed to provide general information on the diffusion of electronic archiving practices and applications. More importantly this study attempts to identify the factors affecting the adoption of electronic archiving applications in Finnish accounting firms. The primary research question is the following:

*What factors contribute to the adoption of electronic archiving applications in Finnish accounting firms?*

Electronic archiving is studied in this research from the viewpoint of electronic archiving applications and the aim is not to determine factors relating to the adoption of optical disk archiving.

1.4. Empirical method

Williams, Dwidedi, Lal and Schwarz (2009) conducted a systematic review of 345 academic papers on IT adoption and diffusion published in 19 academic peer-reviewed journals between 1985 and 2007. Clear trends were observed in this body of work and this study follows these well-established research patterns. This study conforms to the positivism paradigm with an empirical research methodology. According to Williams et al. (2009:7), quantitative approach has dominated adoption and diffusion research within the IS/IT field. Out of the 345 reviewed papers 64.8% had utilized the quantitative approach and majority of the studies (57.5%) had used survey methods to gather their research data.

The data for this study was collected with the beneficial assistance of the Association of Finnish Accounting Firms in co-operation with the Real-Time Economy (RTE) programme in the Helsinki School of Economics (HSE). The researcher was kindly requested to participate in a survey sent to the accounting firms and this opportunity largely directed the chosen empirical methodology. The empirical method is discussed with greater detail in the Research methodology part of the thesis.
1.5. **Structure of the thesis**

The theoretical part covers five chapters with *chapter one* reviewing the research background, objectives and research method. Electronic archiving is reviewed in *chapter two* by following the transition from documents to records life cycle and from paper to electronic archiving. Chapter two also includes an overview of the benefits and disadvantages of electronic archiving. *Chapter three* outlines electronic archiving requirements from a regulatory standpoint and includes considerations related to optical disk archiving. *Chapter four* then presents an overview of electronic archiving systems and their components including digitalization technologies and electronic archiving applications. Both Diffusion of Innovations (DOI) theory and the Technology-Organization-Environment (TOE) framework are introduced in *chapter five* as the underlying theoretical background for this study, after which prior research on innovation adoption is presented.

The empirical part of the thesis consists of three chapters. *Chapter six* introduces the research methodology including the formation of research hypotheses and subsequent research model, sample and data collection procedures. Structure of the questionnaire is also outlined in this chapter. The empirical results are presented in *chapter seven* using both descriptive and inferential statistics. This chapter also summarizes the hypothesis testing results. *Chapter eight* offers conclusions, evaluates the validity, reliability and generalizability of this research and proposes suggestions for further research.
2 ELECTRONIC ARCHIVING

Electronic financial management has been defined in various ways. Lahti and Salminen (2008: 19) describe it as 'automation and handling in electronic format of all data flows and financial management procedures'. This financial management electronization is related to efficiency improvements in financial management by utilizing software applications, internet, integration and electronic services. Electronic archiving penetrates all financial management processes and constitutes the backbone of electronic financial management. (Lahti & Salminen, 2008:16, 21)

2.1. From documents to records

The wealth of information stored electronically or in paper format is growing at an increasing rate and in organizations majority of this information is contained in documents (Tyrväinen, 2003:4). Documents have been described as ‘recorded information structured for human consumption’ (Anttila, 2001:1). The widely used and internationally accepted ISO 15489-1 standard further defines document as ‘recorded information or object which can be treated as a unit’. Transferability, storage and handling of documents as a unit are therefore central to the concept (Löwnertz, 1998:12-14). Documents fitting these definitions exist in many forms including contracts, reports, manuals, video clips and photographs (Meier & Sprague, 1996:54).

For the purposes of this paper it is important to highlight the difference between documents and records. The ISO 15489-1 standard offers a widely used and internationally accepted definition of a record and is a good starting point among the wealth of definitions available. According to the ISO 15489-1 standard a record is:

Information created, received and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business.

Records are therefore distinguishable from documents by their connection with actions and their consequent evidential value. For example official resolutions do not merely document decision making, but represent the resolution thereby instigating certain legal ramifications (Lybeck et al., 2006:13). The evidential value of records is central and preserving this evidence requires records retention (Borglund, 2008:22). Records’
evidential value also reaches beyond fulfilling legal obligations to providing evidence for scientific, especially historical, research (Lybeck et al., 2006:13).

Preserving evidential value requires retaining records’ content, context and structure (Lybeck et al., 2006:16). According to Lybeck et al. (2006:16) records differ from documents by the importance of context, whose preservation is vital for records’ future understanding and probative value. Context provides the connections between different records and information on the process whereby records were created (Borglund, 2008:22). In traditional archiving context information is partly derivable from records’ physical location within archival entities, whereas with electronic records metadata is required to preserve context (Lybeck et al., 2006:16).

2.2. Records life cycle

Records life cycle is a central concept in records management and basis for its principles and practices (Valtonen, 2005:39). Kilkki (2006:14) identifies two internationally used models for portraying records life cycle management: life cycle and records continuum model. Life cycle model depicts records’ existence as distinct sequential phases from creation, through use, maintenance and temporary storage to its elimination or permanent retention. The model has been criticized for its portrayal of separate phases with no connection between current and archived records.

Instead of distinguishing separate phases, the Records Continuum Model (Figure 1) identifies and determines four dimensions and vectors used to represent records management procedures. At creation documents are produced as traces of individual actors’ transactions. Some of these documents are then captured as records for evidence of units’ activities. By utilizing categorization schemes these sometimes disparate records are then organized into archives representing organizations’ corporate or individual memory. Finally records transcend their original context and become part of national cultural heritage and collective memory to ensure societal continuity. (Kilkki, 2006:15-16) The Records Continuum model perceives records as continuously changing with no definitive end and therefore characteristically unstable (Borglund, 2008:24). In principle records remain always current and all ‘phases’ are intertwined (Lybeck et al., 2006:21). As Kilkki (2006:14) notes the records continuum model more adequately depicts records’ existence in a digital environment.
In addition to the two models more simplified data lifelines have also been utilized to depict the phases records pass through their lifetime. Rastas (1994:53) divides records life cycle into active, passive and historical phases. In the active phase records fulfill their primary functions and can be used in executing other business transactions. During the active phase records are stored at the office in so called hand archives. In the passive phase records are no longer used in their primary functions but to fulfill other obligations (Lybeck et al., 2006:22). This kind of semiactive data no longer participates in other transactions through changes or creation, but is still expected to be referenced or needed for its financial or legal value (Olson, 2009:13). Passive archives are usually maintained near office spaces in so called near archives. Most records are usually disposed of after the passive phase and not stored permanently in archival institutions or central archives. Records reaching the historical phase are maintained for research and cultural purposes and stored in so called destination archives. (Lybeck et al., 2006:22, 93)
2.3. From paper to electronic archiving

Based on storage media archiving methods are divisible into paper, microfilm and electronic archiving. From an archival perspective paper possesses many valuable qualities such as durability and readability. However, increases in information supply and demand, information technology developments and office automation have increased archivable material to the extent, where the management and upkeep of traditional paper archives is becoming increasingly difficult and the implementation of other solutions more desirable. (Pieskä, 1990:3, 11)

Microfilm is an analogue storage format and as such is often considered inconvenient, hard to read and difficult to search and access. Microfilm archiving has therefore been mainly used for preserving non-current material. (Pieskä, 1990:11-12) The main option for paper archiving today is electronic archiving, which has been defined in numerous ways. In 1990 Pieskä (13) defined it as ‘storing documents on a computer utilizing either magnetic or optical storage media’. Permanent electronic storage of accounting material is governed by the Accounting Act and Ordinance issued 30.12.1997. Further regulations are provided in directives issued by the Finnish Ministry of Trade and Industry (MTI) (26.1.1998) and by the Accounting Board (AB) in 2000. Although these regulatory guidelines do not implicitly employ the term ‘electronic archiving’, their regulations have been used in determining electronic archiving as storing documents to permanent machine-readable data records.

The term electronic archive is often used incorrectly when discussing for example distribution systems, as these systems do not necessarily support long-term electronic preservation (Palonen, 2008). Valtonen et al. (2009) also strongly argue against defining any active systems as electronic archives beyond short-term preservation. However, following the regulatory guidelines active archives during financial period can also be maintained and electronic archives are then a place for storing and retrieving information from documents in digital format (Lahti & Salminen, 2008:169). The term ‘electronic archiving’ can therefore be expanded to include both aforementioned off-line and on-line archiving. On-line archiving is accomplished utilizing either separate archiving systems or data production systems, where archived electronic data is explicitly separated from operational data. (Laakso, 2005) For example in a sector report published by the Ministry of Employment and the Economy
in 2009, electronic archiving services are seen to include the preservation of electronic documents as well as the applications with search and retrieval functionalities.

Janne Fredman (2010), product manager for software vendor ValueFrame Oy, highlighted in his interview a broader scope for electronic archiving as part of information management. Organizational information management has been depicted with the so called ‘diamond model’, where information management is comprised of two subsystems: social and technological. Documents and information are situated at the interface of these two subsystems. Social subsystem consists of business processes, roles assumed by individuals and information utilized in these processes. Technological subsystem, on the other hand, involves available technological infrastructure like equipment, applications and networks as well as document standards and architectures. Combining these two subsystems is pivotal for effective information management. So even though electronic archiving is traditionally defined from a technological perspective, the social subsystem should also be considered in its implementation and development. (Tyrväinen, 2003:4)

In electronic archiving documents are stored either in coded text format or in uncoded picture format. Stored documents are either born digital or digitized through optical character recognition techniques or through coded text insertion. Pieskä (1990:13-14) differentiates levels of electronic archiving based on which document parts are being archived. Only reference information is digitized in reference archiving, where actual documents remain in paper format. This kind of archiving is useful when more comprehensive digitalization would tie up resources too much and libraries’ reference archives are often cited as prime examples. Electronic text archives contain only documents’ text material, while pictures and graphs are saved separately in databases or in analogue format. Text archiving is best suited for archiving primarily text based material, like newspaper clippings. Finally, document archiving is based on document image processing systems handling complete documents. Information is then usually preserved in picture format and information retrieval is based on separate indexes.

2.4. Evaluating electronic archiving

Electronic archiving benefits are first examined by looking at differences between paper and electronic documents or records. Further benefits stemming from the usage of
Electronic archiving applications are then explored. Sellen (2002:25-27, cited by Nurmi, 2007:7-8) distinguishes three kinds of problems with paper records: financial, functional and symbolic. Traditional financial archiving requires a lot of space incurring “clerical” transactional costs. Transferring from paper to electronic archiving reduces warehouse space and office paper use, thereby being more ecological as well as cost efficient. For example the adoption of CD-ROM archiving in payroll accounting decreased archiving costs by 68 per cent at Itella Oyj (Sähköinen vai perinteinen arkistointi 2008). Electronic archiving has been estimated to reduce storage costs by 25 to 50 per cent and practically minimize retrieval costs (Shipman, 2002:102).

Paper-based documents in business processes are subject to repeated media breaks and allow only one-person-at-a-time access to documents. Electronic documents are not restrained by the tangible nature of paper. They are produced and stored in significantly greater numbers (Chatelain & Garrie, 2007:92), as electronic storage allows for more information to be stored in less space with access usually irrespective of time and place. This improved access to information may lead to an expanded organizational memory resulting in higher productivity especially in paper-intensive industries. Symbolically paper could be perceived as an old-fashioned medium, which may lead to problems if change is initiated without sound business case. (Meier & Sprague, 1998:48-52, 55, 58)

Electronic archiving benefits can also be reviewed by looking at the functionalities provided by electronic archiving applications. These functionalities usually differ based on the system used, but abilities to store, add and retrieve documents are considered the most fundamental ones (Raynes, 2002:304). According to Vahtera and Salmi (1998:141) electronic archiving applications should enable information retrieval using any search criteria or their combinations both inclusive and exclusive. These search functionalities also preferably extend to information associated with the document i.e. metadata (Raynes, 2002:304). In addition to versatile search functionalities electronic archiving systems usually contain linkages between documents enabling for example drilling to voucher level from the balance sheet (Fredman, 2009:29). The ability to transfer retrieved information to another application for further processing should also be considered a basic functionality (Vahtera & Salmi, 1998:141). Electronic archiving also facilitates information distribution to different geographical locations and to different stakeholders such as auditors and clients. For this purpose internet technologies are nowadays widely utilized. (Fredman, 2009: 28)
The Finnish Accounting Act mandates the immutability and readability of accounting material for a predetermined amount of time. This should never be dependent on the electronic archiving system used for example in the case of vendor bankruptcy. Similarly audit trail should always be maintained without systems for example through voucher numbering. (Fredman, 2009:30) In general electronic archiving relies on applications, data media and formats, whose technological durability for the required time span may be inadequate (Chatelain & Garrie, 2007:92). Consequently, for example in 1998 Vahtera and Salmi (143) did not predict suspicions against paperless accounting to be alleviated in the near future.

Electronic documents are, notwithstanding intentional forgery, less immutable than paper documents, as they are easily modified without leaving a visible trace (Chatelain & Garrie, 2007:92). Paperless accounting therefore requires effective information security management including physical security, applications security, operations security and network security (Ilvonen, 2005). Security processes are usually entailed in EDMS to control information access (Raynes, 2002:304) and as part of operations security user names and passwords are widely utilized. Ilvonen (2005:17, cited by Brax, 2006:23) conducted a case study research on information security in twenty knowledge-intensive Finnish SMEs and paper material preservation and email security were identified as the areas with greatest challenges. At the same time electronic information was found well protected in the case companies.

Silo behavior has been cited by Chatelain and Garrie (2007:93-94) as the main cause for electronic archiving implementation failure. For example IT department driven implementations have sometimes been found to result in systems with inadequate features and functionalities. Lack of enterprise-wide thinking may also lead to multiple electronic archiving solutions increasing management costs and complicating information retrieval. Needless to say, the implementation of a uniform electronic archive is highly recommended for efficient document management (Lahti & Salminen, 2008:169). Finally, as with most IS implementations the total cost of ownership (TCO) can be significantly higher than the upfront acquisition and installation costs. According to Chatelain and Garrie (2007:94), high volumes of electronic documents with long preservation periods may translate into high operational costs thereby exceeding any future benefits.
Up until now electronic archiving benefits have been reviewed mainly from the technological viewpoint. However, reaping these benefits requires organizational support. Meier and Sprague (1996:59) distinguish three challenges in obtaining this support: intra- and interorganizational standardization, interdisciplinary cooperation and business process reengineering. First of all, document format and contents standardization is required to establish support for EDM internally and between organizations as well. For example the incompatibility of different electronic invoicing standards has often been cited as having hindered electronic invoicing diffusion (Vallenius, 2005:41). Secondly, establishing successful EDM requires interdisciplinary cooperation across functional departments.

Lastly, Meier and Sprague (1996:59) consider business process reengineering as an opportunity and a prerequisite for EDM. EDM implementations should be preceded by process redesign efforts and not only automate existing paper-based processes. As Gullkvist (2005) concluded in her dissertation, the role of paper and paper-based practices are still strong in accounting firms. Old paper-based practices are merely being transferred to a new environment without business redesign efforts. This mere transfer may hinder the realization of full benefits from electronic financial management diffusion.
3 ELECTRONIC ARCHIVING REQUIREMENTS

This chapter concentrates on reviewing electronic archiving requirements from an institutional standpoint. While the public sector is regulated by the Finnish archival law, obligatory legislation for the private sector is slighter and more fragmented. For example, private organizations are not mandated to retain their records permanently under Finnish law. (Valtonen et al., 2009:37-39) The most prominent regulations governing electronic creation and storage of accounting material are included in the Accounting Act and Accounting Ordinance issued 30.12.1997. Further regulations are provided in directives issued by the Finnish Ministry of Trade and Industry (MTI) (26.1.1998). Furthermore, in 2000 Accounting Board operating under the auspices of the MTI issued general guidelines on the methods to be used in electronic financial management. These guidelines provide additional instructions for putting the aforementioned regulations into practice (AB, 2000:3).

Due to the connection between records and archives established in section 2.1 (From documents to records), the following section concentrates on accounting records i.e vouchers and on their requirements. The regulative environment detailed above is then reviewed as it pertains to accounting verifiability and accounting material storage.

3.1. Accounting vouchers as records of transactions

Following the Accounting Act (2:5§), vouchers are legible records in paper or electronic format verifying business transactions. This corresponds to the widely used ISO 15489-1 standard definition of records presented earlier in section 2.1. Accounting voucher material consists of vouchers, appropriate attachments, related business correspondence and corrective clarifications (AB, 2000:7). Following the Accounting Act (2:5§), all booking entries must be based on dated and numbered vouchers verifying a business transaction. Expenditure vouchers require reference to the products or services received and income vouchers to the products or services rendered. The time of delivery for goods and services is to be identifiable by vouchers or by their accompanying attachments. Money payment vouchers are to be prepared by the recipient of the payment or by the party transferring the payment.
Vouchers can be comprised of multiple, separately stored documents provided that they are combinable through electronic archive’s links or by other means. Order confirmations and delivery notes are only compulsory as attachments, if vouchers themselves do not contain the required information. (AB, 2000:7) In practice organizations have been found to archive these kinds of attachments more than required (Vahtera & Salmi, 1998:136). Same voucher may also be used to validate several business transactions and voucher numbering or date would then provide an audit trail to booking entries (AB, 2000:7)

The Accounting Act (2:5§) stipulates proper confirmation of self-made vouchers. Sales invoices account for the majority of self-made vouchers and this requirement is fulfilled for example by storing duplicate copies in electronic format. For other types of self-made vouchers like memorials this requires utilizing electronic signatures, usage stamps or any other means to indicate vouchers’ creators and acceptors. AB highly recommends implementing this procedure with electronic archiving to ensure good accounting practice. (AB, 2000:11)

Archiving principle determines internal order of records within an archive and this principle is either formal or based on records’ contents. Formal archiving principles include time, alphabetical, number and geographical order. (Lybeck et al., 2006:52-53) Accounting Act (2:4§) stipulates booking transactions in time order for general bookkeeping and in case order for main bookkeeping. In electronic accounting bookings are arranged automatically to time and case order by accounting information systems provided that information required for this sorting has been inserted (AB, 2000:16).

According to the Accounting Act (2:7§), booking entries are always to be made clearly and permanently. In addition to immutability, electronically stored accounting material must be convertible to a readable format irrespective of the storage medium or format used. Readable format here means printing to paper, to computer screen or to another storage medium wherefrom material can be accessed without unnecessary delay. However, the demand on readability does not necessitate preserving vouchers’ original form. (MTI, 1998:2§) Archiving digitalized vouchers without their original colours is allowed and even recommended to reduce archiving costs. With regards to vouchers born digital, there are no demands on their visual appearance and therefore providing
their visual images is optional but advisable. (Arovaara et al., 2001:58-61; MTI, 1998:2§)

3.2. Electronic storage of accounting material

Accounting material consists of vouchers, booking entries and the annual balance sheet. Based on the 1997 Accounting Act (2:8§) all of these except the annual balance sheet can be created and stored in machine readable data media. The 1998 MTI resolution (1:1§) defines machine readable data media very broadly to include all data media except paper format. It therefore covers both electronic data media (e.g. optical and magnetic media) and microfilming. The Act thereby permits paperless accounting and archiving, where paper is secondary as a storage medium. As a result, auditors or tax inspectors are only allowed to request accounting material in paper format under exceptional circumstances and in individual pieces. (Vahtera & Salmi, 1998:130-131)

3.2.1. Temporary and permanent electronic storage

In general, accounting regulations are far more stringent and detailed with electronic storage than with traditional paper archiving. Detailed procedural guidance is provided in the 1998 MTI resolution for both temporary and permanent electronic storage. Temporary storage in paperless accounting refers to the archiving of accounting material during financial period and before the completion of the annual balance sheet. During this time electronic storage is accomplished by storing voucher material into two rewritable data media, whose information content integrity is checked regularly. One of these copies may be the result of a careful and regular backup procedure. (MTI, 1998:1:4§).

Accounting material is to be transferred from temporary to permanent archiving once the balance book is approved by the board of directors (MTI, 1998:1:5§). Permanent archiving requires storing accounting material into two immutable machine-readable data media (MTI, 1998:1:5§), which are preferably stored in separate locations to protect against damages (Vahtera & Salmi, 1998:134). The 1998 MTI resolution (1:5§) advocates verifying their information content integrity before reusing or disabling the data media used in temporary archiving.
Any data medium or format is valid for archiving as long as information immutability can be ascertained. The choice of electronic data media depends for example on the expected response rate, existing hardware environment and required storage period. Fast and capacious magnetic disks are utilized in mainframe environment, while optical disks are employed in microcomputer environment. Records life cycle affects the choice of data media, so that often requested information is usually stored in magnetic disks to ensure fast retrieval. Magnetic tapes and disks are often utilized for short term storage spanning less than two years, whereas optical disks and jukeboxes are more suited for medium term storage (2-10 years). (Haapamäki, 2003:20)

Magnetic data media include magnetic tapes, diskettes, hard disks and Digital Audio Tapes (DAT). Prominent optical disk types are Compact Disks (CD), Digital Versatile Disks (DVD) and Blu-rays with various standards in each category. WORM (Write Once Read Many) disks are especially suitable for electronic archiving for their immutability, good storage capacity and disk transportability. Disks are also not susceptible to mechanical breakage like magnetic disks. (Pieskä, 1990:35-36) Accounting systems’ databases are also considered immutable machine-readable data media, if they are technically locked from alterations and the appropriate copy to another immutable data media is taken. Assuring immutability is also possible by means of verification counts. (AB, 2000:24) For example, Elma Oyj utilizes MD5 algorithm for calculating a checksum on invoices’ PDF images (Salmi, 2003).

As with electronic data media, file formats need to be technically useable for the required storage period. The file format chosen for permanent preservation should therefore be widely used and the existing hardware and software environment should support file format conversion to readable format. (Järvinen, 2009:190, 209-211) AB (2000:26) recommends widely used file formats, which are independent of specific applications and readable using web browsers or text editors. These include for example ASCII files, XML files and commonly used image files (gif, tiff, jpg). File formats requiring a chargeable application for access are usually not recommended for permanent archiving. However, PDF files are still a viable option, as its required application, Acrobat Reader, is widely available and without charge. (Fredman, 2009:30)

In her presentation, Moisio (2000) emphasized the difference between digital and paper archiving with the following quote (reference unknown):
Information recorded on paper is preserved unless it is specifically ordered for destruction, but digital information is lost unless it is specifically ordered for preservation.

The 1998 MTI resolution (1:6§) stipulates random checks during storage period and, if necessary, transfer of information to another medium. In general, migration and emulation are the two strategies available for sustaining information useability. In migration material is converted to appropriate electronic data media and data format in a controlled way. (Valtonen et al., 2009:51) Generally electronic data media conversion is recommended every six to ten years due to the mechanical, chemical and magnetic erosion of media (Rönnberg, 2004:13-14). Past formats and data media remain useable in emulation, where past hardware and software environments are technologically mimicked (Valtonen et al., 2009:51). Even though emulation has its limitations in sustaining so called downward compatibility (Järvinen, 2009:61-62; Valtonen et al., 2009:51-52), both strategies are considered viable for sustaining accounting material for the specified storage period (Arovaara et al., 2001:64).

3.2.2. Storage period

Even though the 1998 MTI resolution includes regulations for permanent storage, the Accounting Act (2:10§) determines minimum storage periods for accounting books and vouchers. Storage period for accounting books is ten years counted from the end of financial period. The same storage period also applies to chart of accounts (2:2§), to balance book and their specifications as well as to combination calculations in consolidated closing of accounts. Six years counted from the end of financial period is then the storage period for vouchers, related business correspondence, balance clarifications and other accounting material not preservable for ten years. The Accounting Act emphasizes sustaining audit trail between booking entries and vouchers throughout storage period. In 2008 PricewaterhouseCoopers issued a study on the Invoicing Directive (2001/115/EC) to the European Commission and recommended implementing a common storage period of seven years for invoices within the European Union. It remains to be seen whether these recommendations are introduced to EU and national legislation.

The 1998 MTI resolution (1:3§) allows linking or otherwise technically combining electronic voucher information with their corresponding booking entries. This enables storing their shared information, like voucher numbers, date and bookings only once.
Additional clarifications and monthly reconciliations of subsidiary accounting are then needed to guarantee full representation of vouchers, transactions and booking entries in main accounting. Vahtera and Salmi (1998:139) consider this opportunity both efficient and reliable as long as appropriate clarifications are carried out. To preserve this interconnection, the longer storage period of ten years is then relevant to both vouchers and booking entries.

Other laws and statutes also contain regulations on accounting and they are primary to the Accounting Act. The longest storage period should then be adhered to in case of multiple claims on storage period. (AB, 2008) For example, the VAT Act (22:209m§) determines the storage period for real estate investment vouchers as 13 years counted from the end of calendar year during which revision period started. Longer storage period may also be imposed by EU legislation or by financial agreement terms. For instance the Association of Finnish Local and Regional Authorities recommend a ten-year storage period for vouchers related to EU funding counted from the last payment. (AB, 2008) The Accounting Board (2008) also lists collection of charges and contractual control as possible justifications for extending storage period beyond these legally imposed minimum requirements.
4 ELECTRONIC ARCHIVING SYSTEMS

The preceding sections have reviewed accounting material archiving from an institutional standpoint mainly determining the minimum level of preservation. This section will concentrate on different ways of organizing electronic archiving and applications used for accessing these archives. Compiling this review on electronic archiving systems has been complicated by the scarcity of source material and the disparate nature of electronic archiving applications. Considering the close connection between archiving and records management, literature on electronic document management systems (EDMS) and electronic records management systems (ERMS) were considered most relevant to this subject.

There are numerous technological solutions available for electronic archiving and their IT infrastructure integration. Electronic archiving structural design should take into account at least archivable material volumes, archives’ expected growth rate, update frequency and compatibility with other information systems. According to Pieskä (1990:38) electronic archiving system is simply the organization-specific compilation of hardware and software used for electronic archiving. These systems are either ready-made commercial systems or custom-built by integrating separately acquired hardware and software. Choice between these two main solutions is driven by acquisition costs, organizational IT expertise and existing hardware and software environment. Electronic archiving is part of office automation and easy access to archives is therefore essential. This is best accomplished by incorporating archiving systems into integrated office systems or by employing browser-based systems instead of separate and closed archiving systems. (Pieskä, 1990:38-39; 47)

Existing IT infrastructure affects the design of organization-specific archiving systems, whose components can also be used for other than archiving purposes. Microcomputers are suitable for establishing small, personal archives, while larger archives with multiple users are preferably situated in mainframe computers. Systems may be either independent or connected through Local Area Network (LAN) to organization’s network. Commercial archiving systems, on the other hand, are either exclusively used for archiving or are part of a broader office systems. (Pieskä, 1990:40-45) In larger organizations electronic archiving systems compile information from various sources and their integration is potentially difficult (Pieskä, 1990:40). Records may be 1)
scanned, 2) imported from external and/or internal interfaces or 3) archived from source accounting systems either directly or after modifications (Roos, 2007). The next section concentrates on digitalization, after which electronic archiving applications are reviewed. The section closes with a review on the primary functionalities of archiving applications.

4.1. Conversion of records to digital format

Full advantage from electronic archiving is only achieved once voucher material is received and created electronically. In paperless accounting sales invoices and payment transactions are to an increasing degree created electronically by information systems used (Vahtera & Salmi, 1998:137). The need for memorial verifications has also been predicted to decrease drastically with electronic financial management diffusion, as simple transaction accrual systems and accounting entry corrections become more widely utilized (Vahtera & Salmi, 1997:148). Remaining necessary memorials are then created directly in the accounting application and would include an author stamp verifying the entry (Vahtera & Salmi, 1998:137).

Purchase invoices, however, are to a large degree still received in paper format and for this reason electronic invoicing diffusion plays a pivotal role in obtaining maximum benefits from electronic archiving (Brax, 2006:28). PriceWaterhouseCoopers conducted a survey in the summer of 2005 in ten European countries on e-invoicing and e-archiving penetration. Of the sample 108 organizations 36 % had implemented e-invoicing and half of the organizations with high invoicing volumes had either implemented or were planning to implement within the next 12 months. In Finland roughly 20-30 % of business-to-business invoices were estimated to be electronic invoices in 2008 (Penttinen, 2008:14).

In the mean time conversion from paper to electronic format is required in purchase invoice handling. Main steps in this digitalization are material selection and preparation, scanning and metadata insertion (Lybeck et al., 2006:160-162). Digitalization can be organized internally or outsourced to scanning service bureaus like Itella or Xerox (Lahti & Salminen, 2008:56). Internally organized conversion can be arranged either manually or automatically. Manual conversion entails scanning only invoice images and separately inserting invoice information manually. (Lahti &
Salminen, 2008:56) In automatic paper conversion, a separate document imaging system or an imaging subsystem is implemented composed of for example scanners, image capture software, image processing or clean-up software and optical character recognition software (OCR) (Bielawski & Boyle, 1996:98).

In general, digitalization requires additional resources and is therefore to be looked upon as an overhead expense to be minimized whenever possible (Bielawski & Boyle, 1996:92). However, sometimes signatures in original documents carry significant importance and scanning those documents is justified. The diffusion of electronic signatures is expected to decrease scanning for these purposes. Some purchase receipts also pose difficulties for digitalization, so paper archiving might be justifiable for example with travel expense receipts. (Vahtera & Salmi, 1998:134-135) Adding attachments to electronic invoices has also posed problems, because the current bank infrastructure does not support attachment transfer. This problem has been solved by either using alternative electronic means of delivery or reversing to paper invoicing. (Fredman, 2009:29) Paper invoices can be destroyed almost directly after scanning, although usually invoices are retained for a certain safety period to allow for corrections (Lahti & Salminen, 2008:57).

4.2. Electronic archiving solutions

Previously electronic archiving system was defined as the collection of hardware and software utilized in electronic archiving. Some sources (e.g Chatelain & Garrie, 2007; Fredman, 2009; Tyrväinen, 2006) have used the term more specifically to denote a specific software application, which as defined by Chatelain and Garrie (2007:91) ‘captures, stores, indexes, retrieves, protects and manages the retention of all electronic information produced and consumed by an enterprise’. These software applications have also been referred to as archiving programs (Lähdesmäki, 2009) and archiving management systems (Vahtera & Salmi, 1998). At least in this case electronic archiving terminology seems as yet unestablished, which might be an indication of the area’s relative newness.

Valtonen et al. (2009:50) strongly oppose to any active or operational systems being referred to as archives. Operational systems’ archiving functionalities are not sufficient for long-time preservation, as systems’ lifespan is limited and archiving should strive
for IT independence. On the other hand, document management in the active phase and electronic archiving are moving closer together (Anttila, 2006:18). Laakso (2005) also recognizes the possibility of utilizing data production systems in on-line archiving as long as electronic data is explicitly marked as archived. For example in the widely used Tikon accounting software accounting material is converted to immutable HTML format for electronic archiving and is therefore independent from the actual operational system (Fredman, 2010). These objections against referring to any operational systems as archives are fully recognized by the author. Nevertheless, electronic document management systems and other related software applications are referred to in this paper as electronic archiving applications due to the term’s widespread use by software vendors and lack of a substitute.

In his diploma work Lähdesmäki (2009) reviewed different solutions for implementing electronic archiving of accounting material. Although he hints at the multitude of solutions available, his review concentrates on four specific cases representing different methods. Electronic archiving can be realized without any electronic archiving applications either by using optical disk archiving or by acquiring archiving services. Electronic archiving applications, on the other hand, are roughly divisible into general document management systems and into more specific accounting related applications. In addition to dedicated archiving applications, archiving functionalities may also be integrated into accounting information systems (TIEKE, 2009). Most of the line-of-business applications used by accounting firms incorporate document management system functionalities within the application, although these are frequently not able to accommodate all required documents (Bailey, 2009).

Electronic document management systems, EDMS, are defined by ARMA International (2004, cited by Gunnlaugsdottir, 2006:27) as ‘electronic management of electronic documents contained in an information technology system, using computer equipment and software to manage, control, locate and retrieve information in the electronic system’. EDMS support document life cycle management and comprise of various technologies including digital imaging, document management, workflow and optical storage (The Georgia Archives, 2008). Electronic records management systems, ERMS, on the other hand, are designed to capture and manage records in both paper and electronic formats according to accepted principles and practices of records management (ARMA International, 2004:4, cited by Gunnlaugsdottir, 2006:27). Table
adapted by Gunnlaugsdottir (2006:28) from MoReq specifications summarizes the differences between these two systems:

Table 1  Comparison between EDMS and ERMS

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>EDM &amp; EDMS</th>
<th>ERM &amp; ERMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who controls?</td>
<td>Owner/user controlled</td>
<td>Company controlled and completed</td>
</tr>
<tr>
<td>Version control</td>
<td>Documents can be edited or altered and exist in several versions</td>
<td>Prevents records from edition or alteration</td>
</tr>
<tr>
<td>Disposal control</td>
<td>Allows document deletion by their owners/users</td>
<td>Prevents records being deleted other than in controlled circumstances</td>
</tr>
<tr>
<td>Retention control</td>
<td>May include retention controls</td>
<td>Includes rigorous retention controls, including historical logging, archive transfer and destruction</td>
</tr>
<tr>
<td>Comprehensiveness</td>
<td>May contain paper or other physical documents after conversion to digital data without identifying them as ‘retained in paper’</td>
<td>Is able to register physical files under the same classification structure as the electronic records and able to manage these ‘hybrid’ archives</td>
</tr>
<tr>
<td>RM structure</td>
<td>May include a defined document storage structure that may be under the control of owners/users</td>
<td>Includes a rigorous RM structure that is maintained by the administrator</td>
</tr>
<tr>
<td>Functional value vs. evidence value</td>
<td>Is aimed at supporting day-to-day use of documents and their on-going business use</td>
<td>Is aimed at securing repository for business records that support as evidence the documentation of the business processes</td>
</tr>
</tbody>
</table>

EDMS are often implemented in a ‘looser’ framework than ERMS and are more widely used in the private sector. The concept of records itself is neither widespread nor commonly used within the SME sector (Borglund, 2008:31). ERMS, on the other hand, have been designed to support records control and accountability and are therefore more extensively utilized by public organizations. (Gunnlaugsdottir, 2006:28)

In practice electronic records are created and managed in a wide variety of systems besides ERMS including office applications, business information systems and different web-based technologies. Business information systems (e.g. finance or human resource systems) are usually transaction-based and designed to support specific business processes and often also current needs for information. However, these systems may
only possess limited ability to manage records and may retain insufficient business context for preserving evidential value. Similarly the many information management solutions including EDMS, content management systems and workflow systems may support information-based business processes without possessing adequate recordkeeping functionalities to assure sufficient control over business records. The differences and interrelations between EDMS, ERMS and business information systems are exhibited in Figure 2. (Valtonen et al., 2010:25-28)

![Figure 2](image_url)

**Figure 2** The relationship between different business information systems (National archives of Australia, 2006:36)

These various systems used for managing records are categorizable into platform, horizontal and vertical systems. Platform systems such as relational database management systems require application development work to attain usability. Horizontal systems like EDMS are general purpose systems for a wide audience offering common functionalities. (Tyrväinen, 2006:4-6) During the past few years EDMS vendors have attempted to move archiving closer to document management by introducing records management functionalities in their products. Electronic purchase invoice handling and circulation systems are a prime example of this development, as they usually contain electronic archiving capabilities. (Anttila, 2005:5) These kinds of vertical systems have been designed to support specific business processes and can be targeted to specific business sectors (Tyrväinen, 2006:4-6).

Lahti and Salminen (2008:170) distinguish between active and permanent archives following the distinction made in the Accounting Act. Active archives are utilized for retrieving information required in daily work and would normally preserve accounting
material from previous and current financial periods. Active archives are typically
dispersed into separate accounting applications so that for example purchase invoices
are managed and archived in purchase invoice handling systems and travel invoices in
travel invoice handling systems. This situation is depicted in Figure 3. (Lahti &

Maintaining disparate systems for specific purposes is characteristic to the first phase
of document management, whereas in the second phase a centralized solution replaces
these ‘silo’ systems. This centralized solution is either a fully integrated system or
various subsystems are integrated to appear as a unified system for example through a
common web-based interface. (Anttila, 2006:16-17) Even though archiving may be
dispersed into different systems during the active phase, both Lahti and Salminen
(2008:169) and Olson (2009:134) stress the importance of implementing an extensive
archiving application containing organizations’ all accounting material. Olson
(2009:129-135) further instigates archive independence from operational systems, so
that archive systems are only dependent on one system, one data structure, one data
format and one access application.
4.3. **Applications’ technology**

Applications used for electronic archiving are a very heterogeneous group of applications ranging from specific accounting systems to general electronic document management systems. EDMS itself is an umbrella term covering various technologies including digital imaging and workflow and as a result there are considerable variations in their operating principles, IT architecture and technology in general (Anttila, 2001:97). This section provides a general overview on EDMS technology.

Systems supporting document management rely on databases to store and manage document metadata. The actual documents, on the other hand, are usually stored in closed file structures on dedicated file servers. System users are only able to manage these documents through the system with no direct access to the actual files. These systems ensure one-point access control and allow determining intricate access rights for different phases in records life cycle. Document files may also be stored in the same database as metadata and this method has been adopted for example by database vendors Oracle and Microsoft in their document management solutions. This method benefits back-up copying and improves scaling possibilities, but as a downside databases run the risk of becoming too large with high document volumes. (Anttila, 2006:17-18)

Ten years ago most EDMS solutions were based on ‘traditional’ client-server architecture, where access applications reside in client workstation with distributed processing between client and server. Currently the prevalent technical architecture is a specific type of client-server architecture based on web browsers and servers referred to as thin client or three tier architecture. Today most EDM systems with workstation access applications have also been expanded to support web browser interfaces. Browser based systems offer many advantages, as they tie up less resources for installing regular updates, are independent of operating systems and are more easily offered to organizations’ interest groups for use. (Anttila, 2001:102-104) However, browser based systems often have to compromise on some functionalities such as high integration with office applications (Anttila, 2006:17).
4.4. Electronic archiving functionalities

A rudimentary EDM system contains a storage facility and methods for adding, identifying and retrieving documents to and from the storage area. In addition EDM systems provide various ‘value-adding’ functions including metadata management, access control, document search by content and metadata, imaging, workflow and flexible organization of documents into folders. (Raynes, 2002:304) In addition to these typical EDMS functions electronic archiving applications may also incorporate typical records systems characteristics. These may include classification and indexing, arrangement in logical folder structure, registration and metadata insertion. These applications should also protect against unauthorized access, destruction, alteration or removal of records by imposing adequate control measures such as access monitoring, user verification, authorized destruction and security. (ISO 15489-1) Instead of reviewing all of the above mentioned functionalities, this section concentrates on metadata, search capabilities and security.

4.4.1. Metadata

Records exist and interact within a broader technological and social environment and understanding records without this context is virtually impossible. While paper records intrinsically preserve provenance and context through physical location and categorization, digital records need to be explicitly preserved and documented. (Salminen, 2004) Metadata therefore plays an integral part in ERM and archiving, as metadata describes records’ context, content and structure as well as their management throughout records life cycle (ISO 15489-1). Metadata is simply defined as data about data and also referred to as document properties, search criteria or document identification data (Anttila, 2001:20).

Metadata is divisible into three main categories: descriptive, structural and administrative metadata. Descriptive metadata provides information on records’ content and consequently facilitates their subsequent identification and search. Typical descriptive metadata elements include title, creator, subject and description. Structural metadata indicates relationships between records’ explicit parts, while administrative metadata is required for managing records. Administrative metadata covers information on technical details, access rights, and long-term preservation. Typical
administrative metadata elements include publisher, date, type, format and rights. (Salminen, 2004:4)

All in all, metadata management is an integral part of records management, as it supports records’ evidential value, availability and useability throughout records life cycle (Valtonen et al., 2009:16). Metadata facilitates effective information retrieval and is therefore pivotal to electronic archiving applications, where document search is one of the most important and widely used functions (Anttila, 2003:10). The importance of metadata is heightened in long-term preservation, where records become increasingly detached from their original context. Metadata then compensates for loss of contextual information. (Lybeck et al., 2006:74)

Metadata may be stored either internally within documents or externally. Both Palonen (2004) and Salminen (2004) promote the separation of metadata from actual archival files, which is the prevalent method in EDMS technology. Some metadata is created automatically, while others require user selection or manual insertion (Anttila, 2001:20). According to Palonen (2004:8) technical metadata insertion should be primarily automatic due to the sheer volume of required technical metadata and possible errors in manual insertion. Descriptive metadata, on the other hand, is more dependent on human expertise, although OCR solutions are used to minimize the need for manual insertion. This manual insertion requires additional resources, but at least according to Lybeck et al. (2006:73) metadata benefits far exceeds any required extra work. (Anttila, 2001:20-21) Metadata insertion should never be confined to the archiving phase itself, but accumulated from creation onwards (Salminen, 2004:6).

4.4.2. Information search and retrieval

Archiving by itself is irrelevant without sufficient methods for information retrieval (Pieskä, 1990:37). It is therefore vital that electronic archiving applications offer options for search with the ability to retrieve the required documents. These options should reflect the various ways users search for information under different circumstances. For example search may be initiated to find a specific document or documents with specific content. In addition to metadata, documents are also often searchable by folder structure and content.
Although some applications have fixed folder structure based on metadata, most offer virtual folders where folders are created dynamically based on chosen criteria. Same document is then locatable from different folders, even though stored only once to the system. Generally folders assist information search and retrieval by visualizing how documents are related and form a whole. Folder structure is especially useful for browsing when search is directed towards a specific document group. (Anttila, 2001:23-26, 30-33)

Metadata facilitates precise search and retrieval, as search can be conducted using one, several or all metadata fields simultaneously. Nevertheless, metadata search is often restricted to a specific field, from which document name and number are probably the most typical. (Anttila, 2001:32) Searches are also carried out based on the text content of documents, which requires indexing either manually or automatically by a computer program. For example OCR software recognizes and indexes words on a typed document enabling search mechanisms to look for both individual words and phrases within a document. (Adam, 2008:73) Advances in hardware technology have also enabled increasing use of full text retrieval in EDMS (Zantout & Marir, 1999:472). Content search is considered less precise than metadata search, as it often yields too many irrelevant results. It is therefore best suited to situations where documents mentioning a particular thing are being retrieved. (Anttila, 2001:32-33)

4.4.3. Application information security

Digital information is very fragile by nature, as it is easily rendered unuseable by hardware and software failures and data corruption (Sulonen, 2004:27). Information security therefore aims to ensure information confidentiality, integrity and availability by protecting them against these failures and natural disasters as well as from threats and damages posed by accidental, negligent or malicious actions (Valtonen et al., 2009:34). Generally, people and organization-wide information security policies are central to establishing adequate information security (Anttila, 2001:147). This section reviews some issues related to electronic archiving applications’ security including access rights, back-up copying and controlled disposal as well as network security.

EDMS usually control information access (Raynes, 2002:304) with user authentication mechanisms based on something the user knows, has or is (Pfleeger & Pfleeger,
Traditionally EDMS employ personal user names and passwords to verify individual’s access rights. These rights may be defined separately for each document, each document folder or each document type. (Anttila, 2001:35) Access rights determine who may have knowledge of documents and who may review, approve and delete them. Rights can also vary depending on records life cycle. (Anttila, 2003:10).

Organizational back-up procedures also need to be designed and executed carefully. With electronic archiving applications, back-up copying relates not only to document files and metadata but also to organization-specific system settings and to the actual application files (Anttila, 2001:150). ISO 15489-1 also states the importance of implementing systematic and routine procedures for removing records from operations systems and these procedures are preferably firmly integrated into normal business processes. Systematic and routine procedures are also required for document destruction procedures, which following ISO 15489-1 should always be authorized and performed so as to preserve the confidentiality of information.

Electronic archiving applications are increasingly browser-based and accessed from outside the perimeters of a controlled limited area network (LAN). Applications are also acquired as ASP solutions over the internet with applications and required hardware residing in the premises of ASP providers (Lahti & Salminen, 2008:42-43). Messages transmitted over the internet are exposed for example to interception, modification and blockage (Pfleeger & Pfleeger, 2007:219). Encryption is probably the most important and versatile tool for implementing network security control and with network applications it is applicable either between two hosts (i.e. link encryption) or between two applications (i.e. end-to-end encryption). Electronic archiving applications may also be accessed through extranets, which are protected by firewalls filtering traffic between secure or ‘inside’ network and a less trustworthy or ‘outside’ network. The SSL (Secure Sockets Layer) communication protocol is also widely used to protect communication between web browsers and their servers on the internet. (Anttila, 2001:150; Pfleeger & Pfleeger, 2007:449, 453-454, 474) Document management in general necessitates adequate virus protection, as the majority of current viruses are embedded within formatted documents. Anttila (2001:153), therefore, recommends installing virus protection to the archiving server and individual workstations as well as scanning all documents for viruses before entering them to the system.
5 THEORETICAL FRAMEWORK

Rogers (2003:12) defines innovation as ‘an idea, practice or object that is perceived as new by an individual or other unit of adoption’. The novelty of an innovation is therefore solely dependent on the adopter’s perception and can be either objectively or subjectively novel. By definition innovations are not confined to the technological domain, but also refer to renewal of thought and action. However, as Rogers (2003:12-13) points out most innovation diffusion research has been carried out on technological innovations.

5.1. Electronic archiving as an innovation

Many factors have been identified as possible determinants of organizational innovation adoption. The formulation of a unifying theory of innovation diffusion has been questioned by several researchers, as there are fundamental differences between types of innovations. (Thong, 1999:191) For example according to Fichman and Kemerer (1993, cited by Thong, 1999:191) the variations in innovations and in their adoption contexts are simply too great for a set of unified factors to be developed. As a result the classical innovation theories need to be tailored to the specific adoption context and type of innovation. This section examines electronic archiving as an innovation based on a categorization of innovations used by Mäkelä (2005) in her thesis on electronic financial management diffusion in Finnish accounting firms. The categorization has been adapted from Harisalo (1984) and Lemola & Lovio (1984).

Based on their nature, innovations can be divided into technological, social and administrative innovations. Damanpour (1987:677) distinguishes only between technological and administrative innovations and considers their distinction as the most fundamental one for studies of organizational innovations. Technological innovations facilitate change in organizations by introducing changes in technology. Technological innovations affect organizations’ production processes, whereas administrative innovations are more closely related to management and administrative processes. Electronic financial management as a whole could be classified as a technological innovation, because it fundamentally changes the way services are rendered (Mäkelä, 2005:33).
Innovations can be further distinguished by their type. Process innovations improve organizations’ production processes by introducing new methods, machines or production systems. Process innovations are not confined to production systems but also relate to data processing, distribution and services. Service or product innovations, on the other hand, are related to the development and improvement of new goods or services. (Thong, 1999:190) Electronic archiving can be perceived as a process innovation, as it fundamentally affects the way documents are managed. At the same time electronic archiving provides new methods and tools for developing novel product or service innovations.

With regards to type, innovations can also be classified as either basic or improvement innovations. Like with nearly 90 per cent of all innovations, electronic archiving can be classified as an improvement innovation. Thong (1999:190) also differentiates between radical and incremental innovations. Electronic archiving is dependent on the overall adoption of electronic financial management and especially on electronic invoicing. Gullkvist has described the transition towards electronic financial management rather as an evolution than a revolution emphasizing its incremental nature. New systems and work practices are being implemented gradually ‘half step at a time’. (Katajamäki, 2005:16)

Decisions on innovation adoption can be made either independently by the adopter or imposed by an authority. Electronic archiving is regulated but not mandated by the Finnish Accounting Act, so its adoption is voluntary and to be initiated by the adopting organization. Thong (1999:190-191) further distinguishes between technology-push and market-pull innovations. Technology-push innovations are initiated by system providers whilst market-pull innovations by perceived market demand. Accounting firm clients are generally considered reluctant in demanding new electronic services, so electronic archiving might be perceived more technology-push than market-pull.

5.2. Diffusion of Innovations

Numerous theories have been proposed to explain innovation adoption at the individual, organizational or economy level. The Rogers’ (2003) diffusion of innovations (DOI) theory concentrates on the continued use of an innovation instead of the initial adoption decision as studied for example by the technology acceptance model
(TAM). As posited by the DOI theory, diffusion is considered to revolve around four elements, as it is a process by which 1) an innovation 2) is communicated through certain channels 3) over time 4) among members of a social system (Rogers, 2003:36).

Communication is the process by which participants create and share information with one another to reach mutual understanding. A communication channel is the means by which messages are transmitted between individuals. Mass media channels have been found efficient in building awareness, whilst interpersonal channels are more important in the later stages of innovation decision process. This reliance on informal channels in knowledge diffusion highlights the importance of being able to share experiences with earlier adopters. (Rogers, 2003:18-19)

Time dimension is involved in diffusion in three ways. Firstly, the innovation-decision process is conceptualized as a time-ordered sequence of knowledge, persuasion, decision, implementation and confirmation. Undergoing this mental process leads either to adoption or rejection by the unit of adoption. Innovativeness is the degree to which an individual or other unit adopts new ideas before other members of a social system. Based on innovativeness the members of a social system can be classified into five adopter categories: innovators, early adopters, early majority, late majority and laggards. The measure of innovativeness and classification into adopter categories are based on the relative time at which an innovation is adopted. Finally, the rate of adoption is the relative speed at which an innovation is adopted by members of a social system. It is usually presented as an S-shaped curve spreading slowly at first and eventually reaching saturation after acceleration. (Rogers, 2003:20-23)

Finally, the fourth element of innovation diffusion, social system, is defined by Rogers (2003:23) as a ‘set of interrelated units that are engaged in joint problem-solving to accomplish a common goal’. These units may be individuals, informal groups, organizations or other subsystems and the resulting social system constitutes a boundary for innovation diffusion. For example electronic archiving diffusion could be studied at organizational, sector or country level.

Innovation’s rate of adoption has been found to accelerate once critical mass is achieved. Critical mass occurs when enough individuals in a system have adopted an innovation for innovation’s further rate of adoption to become self-sustaining. Gaining critical mass is particularly important in the diffusion of interactive innovations, where
each additional adopter increases the utility of adopting the innovation for all adopters. (Rogers, 2003:343,363) Of the five adopter categories, early adopters possess the highest degree of opinion leadership and play a significant role in obtaining critical mass. In general the critical mass point has been estimated between 10 % and 20 % rate of adoption. (Rogers, 2003:283)

Rogers (2003:222) posits five groups of variables affecting the rate of adoption including perceived attributes of innovations, innovation-decision type, communication channels, nature of social system and extent of change agents’ promotion efforts. As noted by Parker and Castleman (2009:173), e-business research has mainly applied the DOI innovation characteristics: relative advantage, compatibility, complexity, trialability and observability. These characteristics of an innovation, as perceived by the members of a social system, significantly affect its rate of adoption, as according to Rogers (2003:221) they explain most of the variance in the rate of adoption.

5.3. Technology-Organization-Environment (TOE) framework

Rogers’ (2003) DOI theory has found consistent empirical support and has been utilized for studying a variety of information systems innovations (Zhu, Dong, Xu & Kraemer, 2006:602). On the other hand, the possibility of formulating a set of factors explaining innovation adoption in general has been questioned by several researchers, as there are fundamental differences between types of innovations. Factors considered to affect innovation adoption should instead be tailored to meet the specific innovation and its adoption context. (Thong, 1999:191) It is therefore essential to emphasize the context of innovation and the TOE framework serves as an important theoretical perspective for studying contextual factors.

In 1990 Tornatzky and Fleischer conceptualized the Technology-Organization-Environment (TOE) framework by identifying three aspects of a firm’s context that influence the process by which it adopts and implements technological innovations. The technological context represents both existing technologies inside the firm as well as the pool of technologies available for adoption in the market. (Zhu, Kraemer & Xu, 2003:252) The organizational context, on the other hand, is a source of structures, processes and attributes inherent within the firm that either constrain or facilitate
adoption (Scupola, 2003:57). Organizational context is typically defined with descriptive characteristics of the organization including firm size and scope; the quality of its human resources and complexity of firm managerial structure. Finally, the environmental context is the external area in which an organization conducts its business including its dealings with trading partners, competitors and government. (Lin & Lin, 2008:136; Zhu et al., 2006:604)

The TOE framework has consistent empirical support in various IS domains including e-business (e.g. Eze, 2008 and Zhu et al., 2003), EDI (e.g. Chau & Hui, 2001; Kim & Lee, 2008), internet (e.g. Lee, 2004), ERP systems (e.g. Ramdani, Kawalek & Lore, 2009) and information systems or ICT in general (e.g. Premkumar & Roberts, 1999 and Thong, 1999). Jeyaraj, Rottman and Lacity analyzed 99 empirical studies on IT adoption in the individual (48) and organizational (51) level published between 1992 and 2003, which revealed altogether 135 independent variables and eight dependent variables. Organizational IT adoption had been predicted with 100 unique independent variables, out of which 14 had been examined five or more times and 86 were considered experimental. Although not specific to the TOE framework, this analysis highlights the variance in factors considered in previous IT adoption research. Studies based on the TOE framework may similarly identify different factors within its three contexts tailored to meet the context of the specific innovation. Nevertheless, the TOE framework is useful for studying the adoption of IS innovations as a generic theory of technology adoption (Zhu et al., 2003:252).

Some studies explicitly highlight the connections between the DOI theory and the TOE framework. For example Zhu et al. (2006:602) synthesized the innovation characteristics proposed by Rogers with the three TOE contexts in their study of e-business usage and impact. In their conclusions the researchers highlighted the usefulness of combining the DOI theory and the TOE framework to benefit from their ‘combined explanatory power’. Several of the studies reviewed in the next section (e.g. Premkumar & Roberts, 1999; Ramdani et al., 2009; Thong, 1999) have integrated some or all of the innovation characteristics proposed by the DOI theory into the technological context of the TOE framework.
5.4. Prior research

There are numerous technological solutions available for electronic archiving ranging from browser based EDM systems to more traditional accounting information systems. Previous adoption research has, however, been very scarce with electronic document management systems. For example Williams et al. (2009) uncovered only one paper on EDMS in their systematic review of 345 academic papers on IT adoption and diffusion published between 1985 and 2007. In this section previous research relating to IT adoption is presented from other IS domains considered the most relevant to electronic archiving.

According to Gullkvist and Ylinen (2005:109,116) electronic archiving applications represent e-accounting systems, which are inter-organizational systems with strong network interdependencies and capabilities for integrating firms electronically. Zhu and Kraemer (2005:61) define e-business as ‘using the internet to conduct or support business activities along the value chain’ and they recognize that these business activities extend beyond selling and purchasing to areas such as logistics, human resources and finance. The next section therefore provides an overview on e-business research, especially as with accounting firms financial management electronization changes the method for producing organizations’ core business i.e. accounting services. Electronic invoicing diffusion is closely linked with electronic archiving (Brax, 2006:28) and therefore research on its predecessor Electronic Data Interchange, EDI is also presented.

In addition to internet-based ICT research, the next section overviews studies conducted on ERP systems, collaboration and data warehouse technology and on information systems in general. The chosen study on enterprise systems highlights factors for SMEs, while collaboration and data warehouse technologies are concerned with information sharing similar to electronic archiving.

5.4.1. Prior research on innovation adoption

E-Business research
Zhu et al. (2003) investigated e-business adoption across eight European countries including Finland. Research institution Empirica conducted a large scale decision maker survey in 1999 and the resulting database ECaTT was used as the data source for this study. Out of the 4000 observations 3103 were considered valid for this research and they represent both large and small organizations. Binary logistic regression analysis was performed to differentiate significant e-business adoption predictors. The study posited six adoption predictors within the TOE framework, out of which technology competence, firm scope and size, consumer readiness and competitive pressure were found significant at the level of 0.001 and lack of trading partner readiness at the 0.05 level. Based on a non-hierarchical cluster analysis, the eight countries were further split into two subsamples of high and low EB-intensity countries. Finland was positioned in the high EB-intensity cluster and in their subsample consumer readiness and lack of trading partner readiness were not significant predictors of e-business adoption. In their findings the researchers highlighted the diminished impact of firm size on e-business adoption in high EB-intensive countries suggesting that ‘e-business is no longer a phenomenon dominated by large firms’. Finally organizations in high EB-intensity countries were considered more cautious in their adoption possibly due to the organizations’ better understanding of e-business benefits, costs and risks.

Wang and Cheung (2004) explored SMEs intentions to develop e-business by conducting a survey among Taiwanese travel agencies with 137 respondents (out of 500 questionnaires sent). Intention to adopt was found to be significantly linked with perceived advantage, innovation orientation, IT resources and organization size. However, most of the hypothesized organizational factors (financial slack, CEO risk taking, firm age and type) showed insignificant linkages and none of the environmental factors (customer orientation and institutional and competitive pressure) were considered significant. Organizations with a high level of innovation orientation were considered to possess a long-term concern about fulfilling the latent needs of their customers and were therefore focused on introducing innovative services and products. As hypothesized by Wang and Cheung (2004) those organizations with higher levels of innovation orientation were significantly more prone to adopt e-business.

Teo, Lin and Lai (2009) studied the factors driving e-procurement adoption in Singaporean large organizations with a sample size of 141 organizations and a response rate of 22.5%. Binary logistic regression results provided evidence for the significance
of perceived indirect benefits, firm size, top management support and business partner influence. The study also posited a positive relation between information sharing culture and e-procurement adoption, as information sharing between and within organizations was considered indispensable with internet-enabled procurement. The findings supported this hypothesis marginally at a 0.10 significance level. No apparent influence was discovered between e-procurement adoption and perceived costs or direct benefits. Interestingly indirect benefits were found to be an important factor instead of direct benefits and the researchers attributed this to the strategic importance of e-procurement perceived by larger organizations.

**Internet/EDI research**

Premkumar and Roberts (1999) investigated the adoption of various information technologies (online data access, e-mail, EDI and internet) in 78 rural small businesses by conducting face-to-face interviews with their respondent organizations. Their study combined the TOE framework with the DOI by considering appropriate innovation characteristics in the technological context. Discriminant analysis was performed on all four groups of information technologies and relative advantage emerged as the only significant factor in all groups. In addition to relative advantage, size and external support were considered significant with EDI adoption. Top management support, size and competitive pressure were found to be important determinants for three of the four communications technologies, while cost, compatibility, complexity, IT expertise and external support were only considered significant for one of the studied communications technologies.

Chau and Hui (2001) conducted one of the first studies on EDI adoption within SMEs. Altogether 627 Hong Kong based organizations (overall response rate 22 %) participated in the study, which yielded strong support for perceived direct benefits, business partner influence, prior EDI experience, perceived vendor support and perceived costs. Out of these prior EDI experience and business partner influence were found to exhibit the strongest positive and negative influence on EDI adoption respectively. No apparent impact, however, were ascertained between EDI adoption and perceived indirect benefits or government influence. Kuan and Chau (2001) also reported on a similar study with a sample of 575 Hong Kong based SMEs with a response rate of 25.7 %. Consistent with the findings from Chau and Hui (2001) EDI adoption was most significantly and negatively linked with industry pressure.
suggesting that non-adopters feel higher pressures to adopt and adopters have based their adoption decisions on other factors. Perceived financial cost also exhibited significant negative connection with EDI adoption, while perceived direct benefits, perceived technical competence and perceived government pressure were positively related to EDI adoption.

Tan, Chong, Lin and Eze (2009) utilized an extended DOI framework to investigate antecedents of internet-based ICT adoption. Based on a study sample of 406 Malaysian SMEs, internet-based ICT adoption was found positively related to ICT security/confidentiality, relative advantage, compatibility and observability. Complexity also had a significant negative impact on adoption, while the positive effect of trialability and negative effect of ICT cost on ICT adoption were found statistically insignificant. All in all the researchers concluded that the presence of innovation characteristics leads to quicker ICT adoption.

Other IS domains

In 1999 Thong proposed the integrated model of IS adoption in small businesses based on the DOI theory and the TOE framework complemented with a fourth category (CEO characteristics). The proposed model was intended to predict both likelihood and extent of IS adoption. CEO's were selected as the main informants for this study and 166 valid responses were received from the 1200 questionnaires sent to Singaporean SMEs. IS adoption was significantly associated with both CEO characteristics (CEO's innovativeness and IS knowledge), IS characteristics (relative advantage, compatibility and complexity of IS) and with two out of the three organizational characteristics (business size and employees' IS knowledge). Information intensity and the environmental characteristic (competition) were found to be insignificant, but possibly affecting adoption through their positive correlation with relative advantage and compatibility of IS. According to Thong (1999:205) IS characteristics had a major effect on the decision to adopt and therefore provided support for the Rogers’ DOI theory in the small business context.

Ramdani, Kawalek and Lorenzo (2009) aimed to distinguish the factors predicting SMEs' adoption of enterprise systems (i.e. ERP, CRM, SCM and e-procurement) and therefore conducted 102 face-to-face interviews in England. The research framework combined DOI and TOE by examining Rogers’ innovation characteristics in the
technological context. The study findings identified relative advantage, top management support and organizational readiness as significant positive predictors, while trialability and firm size influenced adoption intentions negatively. All in all, SMEs were found to be more influenced by technological and organizational factors than environmental factors with top management support being the most important factor. It is interesting to note that even though the study focused on four different set of systems it failed to differentiate between factors that influence these systems separately. With regards to the insignificance of environmental characteristics, the researchers suggested that the overwhelming influence of some factors may have paled the influence of other variables.

Data warehouses (DW) are subject-oriented and integrated collections of data where historical and summarized data is stored to facilitate business decision making. Ramamurthy, Sen and Sinha (2008) explored the determinants of data warehouse adoption by administering a survey to 2948 large US organizations yielding 196 respondents (response rate 8%). The research concentrated on organizational and technological factors and binary logistic regression identified organizational commitment, organizational size and data warehouses’ relative advantage as significant positive antecedents of adoption. Data warehouses’ complexity, on the other hand, was perceived as a significant inhibitor to adoption. In addition to this direct effects model, the researchers also utilized structural modeling and concluded that organizational size affects organizations’ absorptive capacity, organizational scope for DW and organizational data environment. These in turn impact data warehouses’ perceived relative advantage and complexity, which directly contribute to organizational commitment and consequently to data warehouse adoption. The alternative structural model provides a more complex explanation on the relationships among the factors and the dependent variable and as a result demonstrates the shortcomings of the direct effects model.

5.4.2. Previous research on electronic archiving in accounting firms

The readiness to provide electronic services varies quite significantly among accounting firms. Gullkvist and Ylinen (2005) studied e-accounting systems diffusion in accounting agencies in one region of Finland. Altogether 89 responses from 333 sent questionnaires were received yielding a response rate of 26%. Critical mass point in the
study was estimated at 16 per cent rate of adoption. From all the e-accounting systems studied, critical mass had only been achieved in e-letters, electronic bank statements and electronic reporting to authorities and customers. At the same time, innovators i.e. the first 2.5% of adopters had already adopted all e-accounting systems studied.

By the time of the study, innovators had already been using electronic storing for ten years. Electronic storing was expected to reach critical mass in the near future, as its rate of adoption in 2005 was 15 per cent. Adoption of electronic document management systems, on the other hand, had been much slower with only 5 per cent rate of adoption. Mäkelä (2005:19) also reports on the findings of Toivonen (2003:56-59) on e-accounting systems use in accounting firms around Tavastia Proper and southern Tampere Region. In 2003 electronic archiving was then being used by less than 10 per cent of respondents. This would imply an evident increase in adoption with regards to electronic archiving. Having been unable to obtain the Toivonen (2003:56-59) report, it is unfortunately impossible to ascertain whether electronic archiving only refers to electronic storing in the context of her study.

According to a 2009 sector report on financial management services, electronic archiving services are now also taking ground. These services include the preservation of invoices and receipts in electronic format and applications with search and retrieval functionalities. The term ‘voucher hotel’ is often associated with these services, which are offered by accounting firms and other institutions such as ICT firms and banks. Accounting firms often provide these services through the internet. (Metsä-Tokila, 2009: 41)

5.4.3. **Summary on previous research**

In their review of IT innovation predictors, Jeyaraj et al. (2006) identified external pressure, professionalism of IS unit, external information sources and top management support as the best predictors of organizational IT adoption across the identified eight dependent variables. With regards to IT adoption, top management support, external pressure and organization size emerged as the best predictors. It is important to note that the candidates for the best predictors were restricted in this review to variables examined at least five times and with a ‘success rate’ of at least 80%. The 135 predictor variables were therefore reduced to 14 overall and to six with IT adoption.
Table 2 summarizes the significant technological, organizational and environmental factors identified in the previously reviewed articles on innovation adoption. Some factors, such as relative advantage, emerge as prominent factors across studies. Organizational context seems to contain the highest amount of significant factors while environmental context factors are more often deemed insignificant. However, one of the studies did not include the environmental dimension (marked as N/A) and some only incorporated one construct under this context. It is also important to note that the insignificant factors not listed here may reveal as much as the significant factors.

<table>
<thead>
<tr>
<th>Cite</th>
<th>Innovation</th>
<th>Significant factors:</th>
<th>Organizational</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhu et al, 2003</td>
<td>e-business</td>
<td>technology competence</td>
<td>firm scope and size</td>
<td>competitive pressure, consumer and trading partner readiness</td>
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<td></td>
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<tr>
<td>Wang &amp; Cheung, 2004</td>
<td>e-business</td>
<td>perceived advantage</td>
<td>innovation orientation, IT resources and size</td>
<td>N/A</td>
</tr>
<tr>
<td>Teo et al, 2009</td>
<td>e-procurement</td>
<td>perceived indirect benefits</td>
<td>firm size, top management support</td>
<td>business partner readiness</td>
</tr>
<tr>
<td>Premkumar &amp; Roberts, 1999</td>
<td>EDI</td>
<td>relative advantage</td>
<td>size</td>
<td>vendor support</td>
</tr>
<tr>
<td>Chau &amp; Hui, 2001</td>
<td>EDI</td>
<td>perceived benefits</td>
<td>prior EDI experience, perceived costs</td>
<td>vendor support, business partner influence</td>
</tr>
<tr>
<td>Kuan &amp; Chau, 2001</td>
<td>EDI</td>
<td>perceived benefits</td>
<td>perceived costs, perceived technical competence</td>
<td>perceived industry pressure, perceived government pressure</td>
</tr>
<tr>
<td>Tan et al, 2009</td>
<td>internet-based ICT</td>
<td>security, relative advantage, complexity, observability, compatibility</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Thong, 1999</td>
<td>IS</td>
<td>relative advantage, compatibility, complexity</td>
<td>CEO innovativeness &amp; IS knowledge, size, employees’ IS knowledge</td>
<td></td>
</tr>
<tr>
<td>Ramdani et al, 2009</td>
<td>enterprise systems</td>
<td>trialability, relative advantage</td>
<td>top management support, size, organizational readiness</td>
<td></td>
</tr>
<tr>
<td>Ramamurthy et al, 2008</td>
<td>data warehouse</td>
<td>complexity, relative advantage</td>
<td>organizational commitment, size</td>
<td></td>
</tr>
</tbody>
</table>
6 RESEARCH METHODOLOGIES

6.1 Research model and development of hypotheses

This study examines the effect of various factors on the adoption of electronic archiving applications. This study synthesizes the TOE framework with the innovation characteristics proposed by the DOI theory to further emphasize the specific environmental and organizational circumstances of a potential adopter and its industry (Zhu et al., 2006:604). Following several of the studies reviewed previously (e.g. Premkumar & Roberts, 1999; Ramdani et al., 2009; Thong, 1999) innovation characteristics are considered as part of the technological context. Based on the previous technological innovation literature, a one stage normative research model (Figure 4) was developed relating the independent and dependent variables without any intervening variables.

Unfortunately it was not possible to include all possible factors affecting the adoption of electronic archiving applications, so ten factors were chosen based on a literature review. It is important to note that due to the initial restricted timeframe for questionnaire development, the more extensive literature review was conducted after survey completion. These ten factors were considered appropriate to the adoption context and especially to the specific innovation in question. They have all been examined previously in IS/IT adoption studies and in addition to well-utilized factors two more experimental ones were included in the research framework. Detailed justification for the inclusion of each independent variable in the model is described below with the related hypotheses.

6.1.1 Technological context

Rogers’ (2003) diffusion of innovations theory is employed as a theoretical basis for studying the impact of technological factors on SMEs’ adoption of electronic archiving applications. Following the DOI theory, potential adopters’ perceptions of innovation characteristics significantly influence their attitude formation toward innovations leading either to adoption or rejection. Based on Tornatzky and Klein’s (1982, cited by Premkumar & Roberts, 1999:469) meta-analysis, relative advantage, compatibility and
complexity are especially salient to this attitude formation and unlike trialability and observability they have also been widely addressed in previous IT innovation studies conducted at the organizational level (Beatty, Shim & Jones, 2001:338). A decision was therefore made to include only these three most prominent innovation characteristics as factors in the technological context.

Figure 4  The research model
Relative advantage

Relative advantage is ‘the degree to which an innovation is perceived as better than the idea it supersedes’ (Rogers, 2003:229). Relative advantage is the ratio of expected benefits and costs of innovation as perceived by the unit of adoption. Previous diffusion research has found relative advantage to be one of the strongest positive predictors of innovation’s rate of adoption. (Rogers, 2003:233) Firms’ decisions to adopt technological innovations therefore appear contingent on their perceived needs for the technology to overcome a recognized performance gap or to exploit a business opportunity (Premkumar & Roberts, 1999:480). For example electronic archiving benefits stem from the differences between paper and electronic documents and from the functionalities provided by electronic archiving systems including improved information search and faster information retrieval. The following linkage between relative advantage and electronic archiving applications’ adoption is therefore hypothesized:

**H1**: Higher degree of perceived relative advantage is positively associated with the likelihood of electronic archiving applications’ adoption.

Compatibility

Compatibility is defined by Rogers (2003:240), as ‘the degree to which an innovation is perceived as consistent with existing values, past experiences and needs of potential adopters’. In general, organizations have been found more inclined to deploy innovations that align closely with their firm’s culture, existing business processes, past experiences and potential needs (Eze, 2008:34; Rogers, 2003:240). Lack of compatibility, on the other hand, may affect adopters’ attitudes adversely and potentially lead to organizational resistance further retarding innovation deployment (Eze, 2008:34; Zhu et al., 2006:603). Prior research provides support for the salience of compatibility in the adoption (e.g. Premkumar & Roberts, 1999; Tan et al., 2009; Thong, 1999) of technological innovations. The following hypothesis is therefore posited:

**H2**: Higher degree of perceived compatibility is positively associated with the adoption of electronic archiving applications.
Complexity

Following Rogers (2003:257) complexity is defined as the degree of difficulty associated with understanding and learning to use an innovation. Complexity may pose a source of uncertainty for successful implementation and therefore increase risk in the adoption decision. Prior innovation research (e.g. Premkumar & Roberts, 1999; Tan et al., 2009; Thong, 1999) has therefore discovered a negative association between complexity and innovation adoption. Hence,

H3: Higher degree of perceived complexity is negatively related to the adoption of electronic archiving applications.

6.1.2. Organizational context

In their meta-analysis, Jeyaraj et al. (2006:1) found innovation and organizational characteristics good predictors of IT adoption at an aggregate level, whereas the analysis revealed more mixed results for the environmental characteristics. However, it has also been noted (Premkumar, 2003:104) that many studies in the small business context have primarily focused on the organizational variables. Nevertheless, many studies highlight the salience of organizational characteristics in the adoption (e.g. Chau & Hui, 2001) of technological innovations.

Organization size

According to Rogers (2003:411) organization size is often employed as a surrogate measure for various dimensions affecting innovations including total resources, employees’ technical expertise and organizational structure. For example in the e-business context larger firms 1) would possibly possess more slack resources for adoption, 2) would be more likely to achieve economies of scale and 3) would be more capable of bearing the risk associated with IT investments (Zhu et al., 2003:255). Larger firms may also possess a greater need to keep ahead in technological advances (Teo et al., 2009:982). Several studies have identified a significant relationship between size and IT adoption (e.g. Ramamurthy et al., 2008; Teo et al., 2009), but these findings have been inconsistent with respect to the direction of influence.
While larger organizations may possess more slack resources, they also tend to be less agile and flexible than smaller firms. For example, Zhu et al. (2006:611) discovered a negative association between size and e-business usage suggesting the existence of structural inertia retarding usage. Regardless of direction, the significance of size has also been recognized in studies conducted among SMEs (e.g. Premkumar & Roberts, 1999; Thong, 1999). Acknowledging the conflicting prior research the following hypothesis is proposed:

**H4:** Organization size is positively associated with the adoption of electronic archiving applications.

**Top management support**

According to Jeyaraj et al. (2006:9) top management support is one of the best predictors of organizational IT adoption. Especially in small businesses top management’s vision and commitment to the innovation is essential to secure adequate financial and organizational resources and to create a supportive climate for adoption. Top management support is further required to overcome the potential barriers and resistance to change. (Teo et al., 2009:975-976; Premkumar & Roberts, 1999:480) In SMEs the owner/manager is very likely the top management and their individual attitude and support is then crucial for organizational decision-making (Ramdani et al., 2009:13). Hence,

**H5:** Top management support is positively associated with the adoption of electronic archiving applications.

**Experience**

The Small Business EDI Adoption Model proposed by Iacovou, Benbasat and Dexter (1995:467-469) introduced the salience of organizational readiness covering both technological and financial resources of the firm. Technological readiness is then related to the ‘level of sophistication of IT usage and IT management in an organization’ (Iacovou et al., 1995:469). In their study on EDI adoption among SMEs, Chau and Hui (2001:236-244) conceptualized this technological constraint as prior EDI experience, which their study findings confirmed as the most significant contributor to EDI adoption. Chau and Hui therefore concluded that regardless of size organizations’
perceived extent of experience and/or knowledge of technology critically influences their decision to adopt. Past experience with related technologies has also been found significant in the context of internet (e.g. Dholakia & Kshetri, 2004) and general ICT adoption (e.g. Hollenstein, 2004). The following hypothesis is therefore made:

**H6:** Higher degree of prior experience with electronic services is positively associated with the adoption of electronic archiving applications.

**Information sharing culture**

Electronic archiving applications potentially offer improved means of sharing and distributing information between organizational units and other stakeholders including auditors and business partners (Fredman, 2009:28). Like with c-commerce, co-adoption of more than one organization is consequently sometimes required and a need may therefore arise to change the organizational mindset towards sharing information (Chong et al., 2009:14). Information sharing culture, conceptualized as a combination of trust and information distribution/interpretation, emerged as the most significant driver to the adoption of c-commerce in a study by Chong et al. (2009:19). Furthermore, Teo et al. (2009) considered this experimental factor important with its emphasis on knowledge management and their study supported its salience to the adoption of e-procurement. Hence,

**H7:** Information sharing culture is positively related to the adoption of electronic archiving applications.

**Technology policy**

Innovation oriented organizations closely follow changes in the external market for emerging technologies and business practices to better fulfill the latent needs of current and potential customers in the long-term. Furthermore, they are more likely to prioritize resources for new technology and product development. (Wang & Cheung, 2004:46) Teo and Pian (2002:81) distinguish between a proactive (aggressive) and a reactive (conservative) strategy for pursuing technological changes in such areas as process innovation, technological forecasting and recruitment of qualified human resources. Organizations with a more proactive strategy are then more inclined to innovate and to improve their current practices by adopting computer-based
information technologies. Prior research has provided support for the significance of technology policy in adoption (e.g. Wang & Cheung, 2004) of technological innovation. The following hypothesis is proposed:

**H8:** The proactiveness of a firm’s technology policy is positively associated with the adoption of electronic archiving applications.

### 6.1.3. Environmental context

Organizational IT adoption may also be due to influences exerted by the external environment including perceived pressure from business partners and competitors (Kuan & Chau, 2001:512). External pressure in general was identified as one of the best predictors of organizational IT adoption by Jeyaraj et al. (2006:9). In the proposed framework this external pressure is conceptualized as two closely related, but sufficiently distinct factors of competition and trading partner readiness.

**Competition**

Intense competition exerts peer pressure and is therefore generally believed to influence innovation adoption positively (Lee, 2004:59). New innovations are adopted under increasing pressure to uphold competitive advantage and to reduce the risk of falling behind competitors (Zhu et al., 2006:605,610). Wang and Cheung (2004:45) highlight the salience of tracking technological advances and strategic innovations in the highly competitive service industries. This leads to the following hypothesis:

**H9:** Competition is positively associated with the adoption of electronic archiving applications.

**Trading partner readiness**

According to Chau and Hui (2001:235), business partner influence is pronounced in the small business context where organizations possess fewer resources to improve their ‘internal knowledge base on current technological trends and developments’. As a result, SMEs rely more heavily on their business partners to assist in their decision
making. The importance of trading partner readiness is further emphasized in the context of interorganizational systems such as EDI, whose potential benefits are maximized by the number of adopters. For example Iacovou et al. (1995:470) identified business partner imposition as the strongest facilitator to small firm EDI adoption, whereas lack of trading partner readiness has been identified as a significant adoption inhibitor (Zhu et al., 2003:264). Hence, the following hypothesis is presented:

**H10:** Higher level of trading partner readiness is positively associated with the adoption of electronic archiving applications.

### 6.2. Design of the questionnaire

In spring of 2009 I attended a course in the Helsinki School of Economics (HSE) and the course lecturer Esko Penttinen kindly offered to assist in my thesis as part of the university's Real-Time Economy (RTE) program. Consequently I was offered the chance to participate in a survey organized in co-operation with the Association of Finnish Accounting Firms together with another HSE student studying the diffusion of electronic services in general. As a result, the final questionnaire was divided into three parts: 1) background information, 2) electronic services in accounting firms and 3) electronic archiving in accounting firms. Researchers collaborated on the background information questions, but were independently responsible for their own parts. Esko Penttinen provided valuable assistance in drafting a cohesive questionnaire and final approval for the questionnaire was obtained from Sirpa Airola, the office manager in the Association of Finnish Accounting Firms.

Part one of the questionnaire gathered background information on the respondent (position) and on the organization (e.g. location, size, specialization and percentage of electronic services). The questionnaire measured business size with two constructs: the number of personnel and turnover. Following Sirpa Airola’s recommendation, ordinal variables were used to measure these two constructs and their categorizations had been previously used in annual accounting firm surveys. Despite these categorizations, ten respondents were unwilling to disclose information on their revenue size and therefore number of personnel represents organizational size in further analyses.
Part three on electronic archiving was further divided into two sections: permanent and electronic archiving. In the beginning of the part permanent archiving was defined as archiving to electronic data media for a predetermined period of time, while electronic archiving was referred to as using electronic archiving applications in archiving. Electronic archiving applications were further explained by offering actual software examples and also highlighting the difference with electronic data media.

The subsection on electronic archiving included nine questions aimed to provide descriptive statistics on the current use of electronic archiving applications and various scales were employed to capture this information. All continuous predictor variables of the research model were operationalized using multi-item indicators aiming to capture the underlying theoretical domain of the construct. These indicators were included in the survey's final question and were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All constructs except complexity included one reverse-phrased item to reduce response bias (Field, 2009:675). Most of the items were obtained from previous innovation research, where their validity and reliability had been demonstrated. Question 25 provided five options on the organization's current status of adoption and the outcome variable (dichotomous scale) was formed by categorizing respondents into adopters or non-adopters. Parts one and three of the full questionnaire are provided in Appendix II and the independent variables with their related sources in Appendix III.

The questionnaire was pretested in a Helsinki based accounting firm with four accountants and the manager responsible for answering all surveys from the Association of Finnish Accounting Firms. The questionnaire was then refined based on their comments and suggestions mostly related to the survey instructions and the rephrasing of some measurement items. Prior to dissemination, suggestions and approval were also obtained from Esko Penttinen and Sirpa Airola.

6.3. Sample selection and survey

Participants to this study were selected by Sirpa Airola, the office manager in the Association of Finnish Accounting Firms. Due to the large number of surveys, about half of the member organizations were randomly selected to participate in the study. In
addition to these 350 organizations, 523 non-member organizations with valid e-mail addresses were also targeted. The survey was conducted using an online survey tool Webropol, which is one of the most prominent internet based survey software. Altogether 873 invitations with direct link to the survey were sent to the management level of the companies. To increase credibility, the recipients received the emails from Sirpa Airola’s email address and the accompanying cover letter (Appendix I) was signed by the researchers and Sirpa Airola. Respondents were assured in the cover letter that any information provided would be handled anonymously and in strict confidence. An executive summary published on the Association’s web pages was promised as an incentive to further encourage participation.

The survey was sent on September 9th 2009 and was scheduled so as not to conflict with the VAT due date rush. Response time was set for ten days until the 18th of September. Majority of the answers were received in the first 24 hours and due to the acceptable response rate no reminders were sent. Altogether 227 responses were received, of which one was dropped due to insufficient information for multivariate data analysis. The final useable response rate was therefore 25.89%. However, some of the questions yielded lower response rates, as only the questions relating to outcome and predictor variables were set as compulsory. Excluding cases from analysis to accommodate these background variables was considered unnecessary and possible detrimental to the chosen multivariate analysis method. As a result, the sample size is always explicitly mentioned in the following data analysis.

6.4. Validity and reliability assessment

Prior to descriptive statistics and hypothesis testing, predictor items measured in interval scale were assessed for validity and reliability to ensure that the research constructs were accurate and sound. Validity refers to an instrument measuring what it is designed to measure and this was assessed through content, convergent and discriminant validity. Content validity assesses whether measurement items cover the full range of the construct. (Field, 2009:11-12) This was established by carrying out an extensive literature review and measuring constructs with operationalizations used in past empirical studies. Survey also underwent pretesting prior to dissemination.
Convergent and discriminant validity were evaluated by performing factor analysis. The aim of factor analysis is to identify the latent variables explaining the shared variance among original variables (Afifi, Clark & May, 2004:392; Costello & Osborne, 2005:2). Factor analysis assumes a linear factor model where each variable is expressed as a linear function of common factors plus a unique factor (Afifi et al., 2004:412). Convergent validity is obtained if items load heavily on their associated factors and discriminant validity if items load higher on their associated factors than on any other factors (Chau & Hui, 2001:240).

Factor analysis assumes linearity and multivariate normality (Garson, 2010), but both the Kolmogorov-Smirnov and Shapiro-Wilk tests indicated significantly non-normal distributions in all of the 35 variables. On the other hand, both of these tests display significance easily in large samples (Garson, 2010) and further visual analysis with histograms and Q-Q plots revealed fairly normal distributions in many of the variables. The assumption of normality is also not so important in situations where factor analysis is only performed to verify the constructs used in a particular study (Field, 2009:650). Costello and Osborne (2005:2) recommend using principal axis factoring as a factoring method, when data is significantly non-normal. The goal of factor rotation is to simplify and clarify the factor structure by selecting new axes to represent them. While orthogonal rotations produce uncorrelated factors, oblique methods allow the factors to correlate. (Costello & Osborne, 2005:3) Factor analysis using principal axis factoring method was therefore performed on the complete set of 35 interval-scaled predictor variables with oblique rotation (direct oblimin method).

Oblique rotation methods like direct oblimin produce pattern and structure loading matrices, where pattern matrix is then used for determining the clusters of variables defined by the oblique factors. Structure loading matrix, on the other hand, displays the correlation of variables with the oblique factors. (Rummel, 1970:397-399) Appropriate factor solution was selected in this study by evaluating the individual pattern loadings and the sum of squared factor loadings i.e. communalities (Field, 2009:637). Items were retained on the following criteria: 1) pattern loadings of greater than 0.4; 2) items with no cross-loadings of greater than 0.4; 3) communality of greater than 0.4 and 4) well-explained factor structure. Factor loading of 0.4 was selected, as it has been recognized as an adequate cut-off value for both practical and statistical significance in sample sizes of over 200 respondents (Field, 2009:644-645).
Following the above criteria, five items (RELADV1, RELADV2, COMPA4, COMPE1, TPR4) were dropped from further analysis. After careful consideration for the overall factor structure one item (COMPA2) with a low pattern loading (-.310) and one item (COMPE2) with a low communality (.342) were retained. Two items (TPMGM2, TPMGM3) exhibited very high correlation (r = .935) and therefore the one with less effect on measure reliability (TPMGM2) was excluded to reduce possible multicollinearity. The Kaiser-Meyer-Olkin, KMO, measure exhibited excellent sampling adequacy (KMO=.902) for the final factor solution with 29 variables and all KMO values for individual items were well above the acceptable limit of .5 (Field, 2009:671). Bartlett’s test of sphericity $\chi^2 (406) = 4059.007$, $p < 0.000$ also indicated that correlations between items were sufficiently large for factor analysis.

The number of factors was determined by assessing eigenvalues, scree plot, nonredundant variables and the interpretability of the factor structure. The initial factor solution with 35 variables yielded eight factors corresponding with the Kaiser’s criterion of retaining all factors with eigenvalues greater than 1 (Field, 2009:640). The final factor solution, however, yielded seven factors with eigenvalues over one and a scree plot with no easily discernible point of inflexion. Based on subjective judgment an eight factor solution was selected to better map with the theorized constructs, even though the eighth factor exhibited an eigenvalue of less than one (.963). The suitability of this solution was also demonstrated by the small percentage of nonredundant residuals with absolute values greater than 0.05. Extracted eight factors in combination explain 73.54% of the variance in the variables and Table 3 presents the pattern loadings after rotation with loadings below 0.30 suppressed. Following Afifi et al. (2004:413) various combinations of extraction and rotation methods were experimented with before reaching the final solution with only minor differences to the presented solution.

Five of the eight factors mapped directly with their hypothesized theoretical constructs, but there were differences with items predicted to measure top management support, compatibility and technology policy. One item supposedly measuring compatibility COMPA1 (compatibility with current practices) and one item measuring technology policy TECHPOL3 (ready to invest in new technology) loaded on top management support instead. In a study by Beatty et al. (2001:346) items measuring organizational compatibility also loaded with top management support and the factor was accordingly renamed as organizational support. Investments in new technology would also
reasonably fall under this category, so top management support is relabeled as organizational support in subsequent analysis and hypothesis testing (H5). Top management support construct was therefore expanded after factor analysis to reflect a broader scope of support for adopting technology’ (Beatty et al., 2001:346).

Table 3  Factor analysis (pattern matrix) and reliability assessment

<table>
<thead>
<tr>
<th>Factor</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
<th>Factor 7</th>
<th>Factor 8</th>
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<td></td>
</tr>
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</tr>
<tr>
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<td>COMPE2</td>
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<td>-.453</td>
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<td>TPR1</td>
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<td></td>
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<td>.431</td>
<td></td>
</tr>
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<td>TPR2</td>
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<td></td>
<td></td>
<td></td>
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<td>.887</td>
<td></td>
</tr>
<tr>
<td>TPR3</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>.846</td>
<td></td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>10.771</td>
<td>2.379</td>
<td>1.830</td>
<td>1.689</td>
<td>1.464</td>
<td>1.191</td>
<td>1.041</td>
<td>.963</td>
</tr>
<tr>
<td>α</td>
<td>.882</td>
<td>.801</td>
<td>.801</td>
<td>.880</td>
<td>.639</td>
<td>.708</td>
<td>.889</td>
<td>.780</td>
</tr>
</tbody>
</table>

Two of the items predicted to measure compatibility, COMPA2 (organizational values and culture) and COMPA3 (importance of natural resources), loaded together with an item TPR5 (customer appreciation of environment preserving innovations) supposedly measuring trading partner readiness. Item TPR5 addresses customer appreciation of adopting environment friendly innovations and this item can be seen to
reflect organizational compatibility with the values of customers. Together these items measure the extent to which electronic archiving applications are seen to fit organizational culture and values in general and green or customers’ values in particular. Unlike projected these items do not address technical compatibility, as item COMPA4 related to technical compatibility did not meet the criteria for item retention. As a result, compatibility construct was relabeled as values for further analysis and hypothesis testing (H2) to reflect this reduction in scope.

Finally, closer examination of the items under complexity revealed a need to rename the construct. Instead of complexity the three items actually address the reverse i.e ease of use. Consequently the hypothesized effect on adoption is also reverse, as higher degree of ease of use is positively associated with the adoption of electronic archiving applications. After factor analysis the complexity construct was duly renamed as ease of use for subsequent analysis and hypothesis testing (H3).

Reliability assesses the instrument’s internal consistency and is usually measured with Cronbach’s $\alpha$ (Field, 2009:11, 674). All reverse-scaled items were reversed before reliability analysis was conducted separately for each of the eight multi-item constructs. As shown in Table 3 the Cronbach’s alpha values were above the standard cut-off value of 0.70 (Field, 2009:675) for all the theoretical constructs with the exception of trading partner readiness ($\alpha=0.639$). This should be noted as a limitation of this study.
7 **EMPIRICAL RESULTS**

7.1. **Demographic profile**

This section briefly presents information gathered on personal and organizational background information. Sample size is always explicitly presented in subsequent presentation, as many of these background variables have some missing values. Out of a sample size of 225, 174 (77.3%) respondents were owners and 30 (13.3%) respondents held management positions. The questionnaire was targeted to the management/owner level and this requirement was satisfied, as only 21 (9.3%) respondents were accountants and outside this level. While personal characteristics were only explored by position, organizational characteristics were gathered on location, membership of the Association of Finnish Accounting Firms, size per personnel and turnover, firm specialization and current level of electronic services.

From the total 226 respondent organizations, the majority was situated in Southern Finland with the metropolitan area (15.9%) and other parts (25.7%) accounting for 41.6% of the respondents. Southern Finland was followed by Western Finland (33.6%) and Eastern Finland (13.3%), after which the former provinces of Oulu (8.4%) and Lapland (3.1%) were only marginally represented in the sample. The survey was originally sent to both members and non-members of the Association of Finnish Accounting Firms with 40.09% and 59.91% shares respectively. Out of 222 respondents, over half (55.4%) were members of the Association of Finnish Accounting Firms yielding a response rate of 35.14%. Conversely 99 non-members participated in the study yielding a lower response rate of 18.93%.

Firm size was measured by the number of personnel and turnover and Table 4 summarizes these results. Based on the number of personnel, organizations were predominantly small employing nine persons or less with a mean of 2.349 (between 3 and 9), median of 2 (between 3 and 4) and mode of 1 (between 1 and 2). Size measured by revenue indicates the predominance of organizations with an annual revenue below 500 000 EUR, as this represents both the median and mode and is very close to the mean of 2.6359.
Table 4  Organizational size by number of personnel and revenue

<table>
<thead>
<tr>
<th>Measure</th>
<th>Values</th>
<th>Frequency</th>
<th>Valid percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of personnel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>71 (mo)</td>
<td>31.4</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>56 (md)</td>
<td>24.8</td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>57</td>
<td>25.2</td>
<td></td>
</tr>
<tr>
<td>10-25</td>
<td>33</td>
<td>14.6</td>
<td></td>
</tr>
<tr>
<td>over 25</td>
<td>9</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td>Revenue last financial period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1000 EUR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>below 100</td>
<td>52</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>100-200</td>
<td>50</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>200-500</td>
<td>68 (mo, md)</td>
<td>31.3</td>
<td></td>
</tr>
<tr>
<td>500-1000</td>
<td>26</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>1000-2000</td>
<td>14</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>over 2000</td>
<td>7</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>217</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Over two thirds of the organizations (77.9%) had not specialized in serving any particular line of business. At least ten organizations had specialized in providing services for the construction (13), accommodation and tourism (10) and for other non-specified service industries (16) as well as to an unspecified line of business (13). Over 60% of 224 respondents utilized electronic services in less than ten percent of their operations and 82.6% concentrated on ‘traditional’ accounting firm services. Table 5 summarizes the findings on the share of electronic and traditional accounting firm services.

Table 5  Percentage of electronic and traditional accounting firm services

<table>
<thead>
<tr>
<th>Measure</th>
<th>Values</th>
<th>Frequency</th>
<th>Valid percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of electronic services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>77 (mo)</td>
<td>34.4</td>
<td></td>
</tr>
<tr>
<td>5-10</td>
<td>58 (md)</td>
<td>25.9</td>
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<tr>
<td>10-30</td>
<td>49</td>
<td>21.9</td>
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</tr>
<tr>
<td>30-50</td>
<td>13</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>over 50</td>
<td>27</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>224</td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td>Percentage of traditional accounting firm services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(excluding tax consulting)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>2</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>5-10</td>
<td>4</td>
<td>1.8</td>
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</tr>
<tr>
<td>10-30</td>
<td>13</td>
<td>5.8</td>
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</tr>
<tr>
<td>30-50</td>
<td>20</td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>over 50</td>
<td>185 (mo, md)</td>
<td>82.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>224</td>
<td>100.00</td>
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</tr>
</tbody>
</table>

7.2. Current use of electronic archiving applications
Optical archiving using CDs or DVDs had been adopted by 114 organizations (50.4%) at the time of the survey, while 112 (49.6%) were non-adopters.

Following Figure 5, accounting reports are most often archived optically and nearly half of the adopter organizations archive all types of accounting material optically. At the time of the survey 87 (38.5%) organizations had adopted an electronic archiving application, whereas 32 (14.2%) were considering and 63 (27.9%) organizations had not yet made a decision to adopt. Altogether 34 (15%) organizations had decided to refrain from adoption, while 10 (4.4%) organizations were not aware of electronic archiving. Subsequently 87 (38.5%) organizations are therefore classified as adopters and 139 (61.5%) organizations as non-adopters in further analyses.

In the questionnaire, seven questions were directed specifically to adopters and the full sample size was accordingly reduced to 87 organizations. However, one respondent only answered one of these questions and the total sample size for this set of seven questions was therefore further reduced to 86. Financial information systems like Tikon and Econet emerged as the most prominent types of electronic archiving applications with a share of 48.8% (42 respondents). Browser-based financial information systems or document management systems were used by 21 organizations (24.4%) and 15 organizations (17.4%), respectively. Three organizations (3.5%) had adopted an EDMS and four organizations (4.7%) utilized some other solution developed for EDM such as MOSS. Finally one organization (1.2%) employed ERP systems for their electronic archiving.

Figure 6 displays the findings on the year of adoption and as expected the majority of organizations (61.6%) had adopted their electronic archiving applications within the...
last three years. In fact 76 out of 86 organizations (88.3%) had adopted their applications within the last five years further highlighting the innovation’s novelty. Altogether 44 organizations (51.2%) had acquired their applications as off-the-shelf software, while 28 organizations (32.6%) had obtained them through Application Service Providers (ASPs). Fourteen organizations had adopted more customized solutions to suit their organizational needs, as ten organizations (11.6%) had had their software customized by the vendor and four organizations (4.7%) had developed their own solution.

![Figure 6](chart.png)

**Figure 6  Electronic archiving applications' year of adoption**

Section 4.4 reviewed different functionalities of electronic archiving applications and concentrated especially on metadata, search capabilities and security. One question was aimed to review the most prominent features of electronic archiving applications. Eight features were originally chosen based on a review of software vendors’ document management solutions, but after literature review one of them (controlled versioning) was excluded from further analysis. Sample sizes slightly differed on each question, which might be due to the questions’ more technical nature. This is probably also reflected in the relatively high proportions of ‘don’t know’ answers found with e-mail notifications (30.8%), metadata (39%) and flexible file structure (42.1%).

Based on Table 6, the most prevalent features at the time of the study were transfers to and from other systems (67.1%), drilling down with links (70%) and access control with user names and passwords (76.2%). Over 20 per cent of electronic archiving applications did not support free text search by content (21.5%) or have flexible file
structure (26.3%). However, for example flexible file structure may be inherently a feature of document management systems and as such not widely available in other kinds of electronic archiving applications. ‘Yes’ emerged as the most frequent value (mode) in all other features except the flexible file structure thus supporting their prevalence in these applications.

Table 6  Features of electronic archiving applications

<table>
<thead>
<tr>
<th>Feature</th>
<th>N</th>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free text search by content</td>
<td>79</td>
<td>49 (62%)</td>
<td>17 (21.5%)</td>
<td>13 (16.5%)</td>
</tr>
<tr>
<td>Metadata creation and search</td>
<td>77</td>
<td>35 (45.5%)</td>
<td>12 (15.6%)</td>
<td>30 (39%)</td>
</tr>
<tr>
<td>Drilling down with links</td>
<td>80</td>
<td>56 (70%)</td>
<td>11 (13.8%)</td>
<td>13 (16.3%)</td>
</tr>
<tr>
<td>Flexible file structure</td>
<td>76</td>
<td>24 (31.6%)</td>
<td>11 (13.9%)</td>
<td>32 (42.1%)</td>
</tr>
<tr>
<td>Transfers from and to other systems</td>
<td>79</td>
<td>53 (67.1%)</td>
<td>11 (13.9%)</td>
<td>15 (19%)</td>
</tr>
<tr>
<td>E-mail notifications</td>
<td>78</td>
<td>40 (51.3%)</td>
<td>14 (17.9%)</td>
<td>24 (30.8%)</td>
</tr>
<tr>
<td>Access control</td>
<td>84</td>
<td>64 (76.2%)</td>
<td>4 (4.8%)</td>
<td>16 (19%)</td>
</tr>
</tbody>
</table>

Table 7 and Figure 7 summarize information on the current use of electronic archiving applications following a categorization presented by AB (2000:12-15). This categorization was adjusted based on a suggestion from the accounting firm manager in the questionnaire pretesting phase. As a result, material management was excluded as irrelevant to the context and accounting reporting was added as the sixth category.

Table 7  Electronic archiving per voucher type

<table>
<thead>
<tr>
<th>Type</th>
<th>N</th>
<th>Yes</th>
<th>Planning</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales invoices</td>
<td>80</td>
<td>52 (65%)</td>
<td>15 (18.8%)</td>
<td>13 (16.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Purchase invoices</td>
<td>79</td>
<td>56 (70.9%)</td>
<td>13 (16.5%)</td>
<td>10 (12.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Salary invoices</td>
<td>79</td>
<td>50 (63.3%)</td>
<td>12 (15.2%)</td>
<td>16 (20.3%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Payment invoices</td>
<td>80</td>
<td>48 (60%)</td>
<td>16 (20%)</td>
<td>15 (18.8%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Main accounting</td>
<td>79</td>
<td>54 (68.4%)</td>
<td>11 (13.9%)</td>
<td>13 (16.5%)</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Accounting</td>
<td>83</td>
<td>71 (85.5%)</td>
<td>8 (9.6%)</td>
<td>3 (3.6%)</td>
<td>1 (1.2%)</td>
</tr>
</tbody>
</table>

Compared with optical archiving, organizations had utilized electronic archiving applications more extensively with a marked difference on the archiving of purchase invoices. Purchase invoices were archived optically in 49.1% of organizations, while 70.9% of firms stored them in electronic archiving applications. This is probably strongly influenced by the inclusion of electronic archiving functionalities in many browser-based electronic invoice circulation systems. It would also seem that many organizations were planning to extend their electronic archiving to other voucher types
within the next two years. However, some organizations would still seem reluctant to exploit electronic archiving applications to their full potential, as over 15% of respondents were not planning to archive sales, salary, payment and main accounting invoices electronically.

Figure 7 provides a more detailed picture on the current state of digitalization in archiving.

Sales invoices emerged as the most paper-intensive voucher type with 52.5% of organizations archiving less than 5% of them electronically. At the other end, 51.2% organizations archived over 80% of their accounting reports electronically. Despite the increasing use of purchase invoice circulation systems, majority of organizations (65.1%) archived less than 20% of their purchase invoices electronically. This would provide support for the importance of electronic invoicing in connection with electronic archiving. Quite interestingly, the two most frequently occurring scores were at the opposite ends of the scale in three of the voucher types (salary, payment and main accounting).

One question was specifically targeted to adopters to discover how the benefits associated with electronic archiving applications had been realized in their organizations. Eight items in this question were measured with a five-point Likert scale ranging from 1 (very poorly) to 5 (very well). Table 8 presents the results with a sample
size of 83 adopters in a descending order of mean. Over half of the adopters perceived that electronic archiving applications had succeeded very well in improving access to information, enabling faster information retrieval and reducing the need for warehousing space. According to the adopters, electronic archiving applications had also reached well their goals of reducing paper usage, improving information security and enabling information transfer to clients and auditors. However, responses to attaining competitive advantage and reducing the consumption of natural resources were more dispersed and on average below 4 (well). Fewer organizations had therefore perceived improvements in their competitive advantage and natural resources consumption following the adoption of electronic archiving applications.

Table 8  Goals of adopting electronic archiving applications

<table>
<thead>
<tr>
<th>Goals</th>
<th>Mean</th>
<th>Well (%)</th>
<th>Neutral (%)</th>
<th>Poorly (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information access</td>
<td>4.3012</td>
<td>83.1</td>
<td>14.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Faster information retrieval</td>
<td>4.2771</td>
<td>80.7</td>
<td>13.3</td>
<td>6.0</td>
</tr>
<tr>
<td>Cost reduction (warehousing)</td>
<td>4.2530</td>
<td>77.1</td>
<td>20.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Information transfer to clients and auditors</td>
<td>4.1446</td>
<td>80.7</td>
<td>15.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Reduction in paper usage</td>
<td>4.0964</td>
<td>72.3</td>
<td>21.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Information security</td>
<td>4.0120</td>
<td>69.9</td>
<td>22.9</td>
<td>7.2</td>
</tr>
<tr>
<td>Consumption of natural resources</td>
<td>3.8313</td>
<td>61.5</td>
<td>30.1</td>
<td>8.4</td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>3.6506</td>
<td>57.8</td>
<td>25.3</td>
<td>16.9</td>
</tr>
</tbody>
</table>

Finally one question investigated the reasons for non-adoptions with nine items measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Out of 139 non-adopters, 116 organizations responded to all nine questions and their descriptive statistics are presented in Table 9 in descending order of mean. Those items with higher percentage of Agree than Disagree could be considered as prominent reasons for non-adoptions. Lack of client demand clearly emerged as the most prominent reason with 74 respondents (63.8%) strongly agreeing with the statement. Four other important reasons for non-adoptions were costs, uncertain benefits, time-consuming adoption and concerns about security. Peer pressure from competitors, on the other hand, was the least cited reason for non-adoptions. Quite interestingly, non-adoptions was also not related to the technology itself, as only 34.5% of non-adopters found the technology untrustworthy.
Table 9  Reasons for non-adoption

<table>
<thead>
<tr>
<th>Reasons for non-adoption</th>
<th>Mean</th>
<th>Agree (%)</th>
<th>Neutral (%)</th>
<th>Disagree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clients not requested</td>
<td>4.3103</td>
<td>81.1</td>
<td>10.3</td>
<td>8.6</td>
</tr>
<tr>
<td>Too expensive</td>
<td>3.2759</td>
<td>43.1</td>
<td>31.0</td>
<td>25.9</td>
</tr>
<tr>
<td>Not convinced of benefits</td>
<td>3.2241</td>
<td>46.6</td>
<td>24.1</td>
<td>29.3</td>
</tr>
<tr>
<td>Adoption time-consuming</td>
<td>3.1121</td>
<td>37.9</td>
<td>32.8</td>
<td>29.3</td>
</tr>
<tr>
<td>Concerns about security</td>
<td>3.0086</td>
<td>40.6</td>
<td>21.6</td>
<td>37.9</td>
</tr>
<tr>
<td>Not enough information</td>
<td>2.9741</td>
<td>30.1</td>
<td>39.7</td>
<td>30.2</td>
</tr>
<tr>
<td>Good existing archiving routines</td>
<td>2.9655</td>
<td>28.4</td>
<td>39.7</td>
<td>31.7</td>
</tr>
<tr>
<td>Technology not trustworthy</td>
<td>2.8793</td>
<td>34.5</td>
<td>20.7</td>
<td>44.8</td>
</tr>
<tr>
<td>Not used by biggest competitors</td>
<td>2.5086</td>
<td>14.6</td>
<td>41.4</td>
<td>44.0</td>
</tr>
</tbody>
</table>

7.3.  Factors associated with electronic archiving applications adoption

All statistical procedures were carried out using PASW Statistics version 17 software (formerly SPSS). Summated scales were formed from the extracted eight factors by calculating the mean of associated separate variables. Two measures (size and experience) were created as ordinal scaled with five categories each, but it was considered necessary to reduce the number of categories to two (size) and three (experience) for subsequent multivariate data analysis. The resulting ten predictors were subjected to both univariate and multivariate data analysis.

7.3.1.  Univariate data analysis

Univariate data analysis was performed with Mann-Whitney test, which is the non-parametric equivalent of the independent t-test without distributional assumptions (Field, 2009:540). Non-parametric test was considered appropriate, as all interval-scaled predictors exhibited significantly non-normal distributions with Kolmogorov-Smirnov and Shapiro-Wilk statistics. According to the Levene’s test, three predictors (ease of use, information sharing culture and trading partner readiness) further violated another assumption of the independent t-test by not demonstrating homogeneity of variance.

Table 10 provides the descriptive statistics (median and standard deviations) as well as Mann-Whitney's U statistics across the adopter/non-adopter groups for the ten
constructs examined in this study. Median is reported instead of mean, as according to Field (2009:550) this is more appropriate for non-parametric tests.

Table 10  Descriptive and Mann-Whitney test statistics

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Median (S.D) Adopters</th>
<th>Median (S.D) Non-adopters</th>
<th>Mann-Whitney U</th>
<th>Z</th>
<th>Effect size r</th>
<th>Exact sig. (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>4.2 (.74303)</td>
<td>3.2 (.87064)</td>
<td>2552.5</td>
<td>-7.238</td>
<td>-.4825</td>
<td>.000</td>
</tr>
<tr>
<td>Values</td>
<td>4.0 (.77720)</td>
<td>3.333 (.84814)</td>
<td>3372.5</td>
<td>-5.536</td>
<td>-.3690</td>
<td>.000</td>
</tr>
<tr>
<td>Ease of use</td>
<td>4.0 (.91097)</td>
<td>3.0 (.86428)</td>
<td>2700.00</td>
<td>-6.996</td>
<td>-.4664</td>
<td>.000</td>
</tr>
<tr>
<td>Size (personnel)</td>
<td>2.0 (.84641)</td>
<td>1.0 (.65827)</td>
<td>3857.5</td>
<td>-4.989</td>
<td>-.3326</td>
<td>.000</td>
</tr>
<tr>
<td>Organizational support</td>
<td>4.6 (.74442)</td>
<td>3.0 (.89376)</td>
<td>1503.0</td>
<td>-9.463</td>
<td>-.6308</td>
<td>.000</td>
</tr>
<tr>
<td>Experience</td>
<td>2.0 (.62593)</td>
<td>2.0 (.62438)</td>
<td>2863.0</td>
<td>-7.129</td>
<td>-.4752</td>
<td>.000</td>
</tr>
<tr>
<td>Information sharing culture</td>
<td>4.25 (.66601)</td>
<td>3.75 (.84959)</td>
<td>3765.0</td>
<td>-4.694</td>
<td>-.3129</td>
<td>.000</td>
</tr>
<tr>
<td>Technology policy</td>
<td>4.0 (.85142)</td>
<td>3.0 (.91317)</td>
<td>2715.0</td>
<td>-6.911</td>
<td>-.4607</td>
<td>.000</td>
</tr>
<tr>
<td>Competition</td>
<td>3.6667 (.82073)</td>
<td>3.0 (.82782)</td>
<td>3903.5</td>
<td>-4.413</td>
<td>-.2942</td>
<td>.000</td>
</tr>
<tr>
<td>Trading partner readiness</td>
<td>2.6667 (.98930)</td>
<td>1.6667 (.72384)</td>
<td>3090.5</td>
<td>-6.144</td>
<td>-.4096</td>
<td>.000</td>
</tr>
</tbody>
</table>

Overall adopters exhibited higher median than non-adopters and this difference between groups is statistically significant (p<0.001) across all ten constructs. These results therefore provide initial support for all the hypotheses made on the association of these factors to the adoption of electronic archiving applications. Effect size was also calculated manually from Z score to convey the magnitude of an observed relationship (Field, 2009:785). Whereas most of the constructs display moderate effects ranging from -.2942 to -.4825, organizational support possesses a large effect (r=-.6308) indicating practical significance. Afifi et al. (2004:296) recommended univariate data analysis as a preprocessing step for binary logistic regression to reduce the number of predictor variables. In this case all predictors exhibited significance and were therefore considered in subsequent multivariate data analysis.
7.3.2. Multivariate data analysis

Discriminant analysis and logistic regression are used to predict group membership for a known dichotomous outcome variable based on a set of discrete and continuous predictor variables. In addition, both techniques can be utilized for identifying those predictor variables that contribute most to the classification. (Afifi et al., 2004:250, 282) Discriminant analysis assumes multivariate normal distribution of data with equal covariance matrices in each group (Afifi et al., 2004:260). According to Sharma (1996:374-389), univariate nonnormality can be taken as an indication of multivariate nonnormality and as mentioned earlier all interval-scaled predictors exhibit significantly non-normal distributions in this study. The homogeneity of covariance matrices was also tested with Box’s M test, which was significant (Box’s M=68.36, p<0.002) indicating a difference in the groups’ covariance matrices. Binary logistic regression was therefore chosen over discriminant analysis, as it has less stringent assumptions.

Assumptions of binary logistic regression

Logistic regression still assumes lack of gross outliers, large sample size, absence of high multicollinearity and a linear relationship between continuous predictors and the logit of the outcome variable (ln(odds)) (Afifi et al., 2004:301; Field, 2009:273). Before analyzing the data, standardized residuals were examined to identify outliers and this analysis revealed nine cases with an absolute value greater than two and five cases with greater than three. As a rule of thumb, cases with a standardized residual of above three are potential outliers that differ substantially from the main trend of the data and bias the model (Field, 2009:215-217). Leverage and Cook’s distance measures were then explored to assess whether any of these five cases exerted substantial influence over the parameters of the model. Based on the results, one case with an excessive standardized residual (13.133) also showed signs of undue influence and logistic regression was therefore performed with and without this one case. Excluding this case improved model fit substantially and subsequent analyses were therefore conducted with a reduced sample size of 225.

Logistic regression uses the maximum likelihood method to derive estimates of parameters, whose reliability decline with too small sample sizes. As a rule of thumb, the category of outcome variable occurring less often should have at least ten cases per
predictor variable. (Garson, 2010) This rule of thumb is violated in this study, as there are 11 predictor variables in the model and only 86 cases in the smaller group (adopters). Sample size is therefore clearly inadequate and a serious limitation of this study. However, the final multivariate model did not exhibit large standard errors or confidence intervals to suggest inadequate sample size (Katz, 2006:81). The issue of minimum sample size for logistic regression is also still being studied and may depend on other factors than the ratio of cases to variables (Afifi et al., 2004:297). For example in OLS regression adequate sample size is determined by the size of the expected effect and the required statistical power to detect these effects. Detecting smaller effect sizes therefore requires far greater sample sizes. (Field, 2009:222-223) Due to the limited sample size, separate logistic regression models were also run to determine the influence of each of the predictor variables on adoption.

Multicollinearity refers to the existence of strong correlation between two or more predictor variables. High multicollinearity inflates the standard errors of the logit coefficients reducing their reliability and making it more difficult to assess the individual importance of predictors. (Field, 2009:223-224) None of the squared correlations was close to 0.80 to indicate problems with multicollinearity (Thong, 1999:202). Table 11 presents Spearman’s correlation coefficients, rs, for the predictor variables, where the highest squared correlation was 0.42 between organizational support and technology policy.

Table 11  Correlation matrix (non-parametric Spearman’s correlation)

<table>
<thead>
<tr>
<th></th>
<th>EASE</th>
<th>RELADV</th>
<th>VALUES</th>
<th>SIZE</th>
<th>ORGSPT</th>
<th>EXP</th>
<th>INFOSHA</th>
<th>TECHPOL</th>
<th>COMPE</th>
<th>TPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASE</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RELADV</td>
<td>.618*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VALUES</td>
<td>.480**</td>
<td>.530**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>.205**</td>
<td>.228**</td>
<td>.186**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORGSPT</td>
<td>.581**</td>
<td>.618**</td>
<td>.562**</td>
<td>.321**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXP</td>
<td>.331**</td>
<td>.384**</td>
<td>.324**</td>
<td>.277**</td>
<td>.489**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFOSHA</td>
<td>.429**</td>
<td>.376**</td>
<td>.504**</td>
<td>.118</td>
<td>.523**</td>
<td>.264**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TECHPOL</td>
<td>.502**</td>
<td>.462**</td>
<td>.514**</td>
<td>.282**</td>
<td>.645**</td>
<td>.434**</td>
<td>.483**</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPE</td>
<td>.260**</td>
<td>.342**</td>
<td>.280**</td>
<td>.188**</td>
<td>.233**</td>
<td>.163**</td>
<td>.200**</td>
<td>.201**</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>TPR</td>
<td>.354**</td>
<td>.389**</td>
<td>.322**</td>
<td>.191**</td>
<td>.370**</td>
<td>.395**</td>
<td>.127</td>
<td>.376**</td>
<td>.189**</td>
<td>1.000</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01 (two-tailed).
However, most of the correlations were significant and multicollinearity was therefore investigated further by running OLS regression. Tolerance and corresponding VIF values did not indicate serious problems with multicollinearity, as all predictor variables had tolerance above 0.2 and VIF below 4. The existence of multicollinearity was also assessed by looking at the condition indexes, where an index of over 30 indicates a serious problem and an index of over 15 a possible problem (Garson, 2010). Four condition indexes exceeded the cut-off value for possible problems (15) with the highest value being 27.514. Variance proportions were therefore reviewed to look for two or more predictors with a high proportion on a factor with high condition index (Garson, 2010). This review did not reveal any serious signs of multicollinearity, as no two predictors exhibited sizeable proportions of over 0.50 on the same condition index. Variance proportions did show moderate signs of multicollinearity between relative advantage and organisational support as well as between technology policy and information sharing.

Finally logistic regression assumes that there is a linear relationship between ln(odds) and the predictor variables (Afifi et al., 2004:298). This assumption was tested by performing the Box-Tidwell transformation, where interaction terms are created as the crossproduct of each continuous predictor times its natural logarithm \([X*\ln(X)]\). If any of these interactions is significant, then the corresponding predictor exhibits nonlinearity in the logit. (Field, 2009:296; Garson, 2010) All eight interactions in this study were non-significant and the assumption of linearity was therefore met. Out of the four assumptions, the assumption of large sample size has been violated, but this has occurred even in some of the previously cited peer-reviewed academic articles (e.g. Ramdani et al., 2009; Teo et al., 2009). The coefficients for predictors depend on the other variables included in the logit model (Afifi et al., 2004:326) and therefore demonstrate the effect of one variable adjusted for the others. The next subsection presents the results from univariate logistic regressions, while the following subsections concentrate on the full model with 11 predictors.

### Univariate binary logistic models

To compensate for the insufficient sample size, univariate logistic regression was also performed separately for each predictor variable (Table 12). Box-Tidwell transformations were carried out on each model and all met the assumption of linearity
in the logit. Logistic regression models were then evaluated by assessing model
goodness-of-fit, discriminating power and the significance of coefficients.

PASW estimates logistic coefficients by iteratively minimizing negative log-likelihood (-2LL). Log-likelihood is a measure of error or unexplained variation in the model and large values of the log-likelihood statistic indicate poorly fitting models. (Field, 2009:285, 789) The omnibus test of model coefficients measures the decrease in -2LL achieved by the model and indicates the joint explanation power of predictor variables (Field, 2009:267-268). All models exhibited significant likelihood ratio tests implying a strong relationship between the predictor and outcome variables. The Hosmer-Lemeshow (H-L) test measures the overall fit of the regression model to the data by comparing fitted expected values to the actual values. An insignificant H-L statistic indicates no significant differences between the observed and predicted classifications and significance values close to one represent better fitting models. (Afifi et al., 2004:299-300) All models for continuous predictors showed non-significance (p>0.05).

Cox and Snell $R^2$ and Nagelkerke $R^2$ measure the proportion of data variation accounted for by the predictor variables (Garson, 2010) and both can be used to assess the explanatory power of the model (Ramamurthy et al., 2008:830). Classification rate is an alternative measure of effect size and it is often compared with the chance rate. Model hit rate should be higher than by chance alone and some researchers would also prefer a 25% increase on the chance model. (Garson, 2010) The classification accuracy by random guess would be here $(86/225)^2 + (139/225)^2 = 52.77\%$ and with a 25% increase 65.96%. All models achieved classification accuracy better than by random choice and most of the models were above the threshold of 65.96% indicating sufficient discriminating power.

Wald statistic with chi-square distribution is used to test the significance of a single coefficient in a model (Field, 2009:269-270). All coefficients were found significant (p<0.001), when logistic regression was performed separately for each predictor variable. For continuous predictor variables, the odds ratio ($\exp(B)$) represents the predicted change in odds for a unit increase in the corresponding predictor variable (Field, 2009:270). All continuous variables exhibit odds ratios of more than one indicating an increase in odds with higher values of predictor variables. In other words,
the likelihood of being grouped as Adopter is increased with higher values of these variables.

Table 12  Univariate logistic regression analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>H-L (p-value)</th>
<th>C &amp; S R²</th>
<th>% correct classified</th>
<th>Coefficient (S.E.)</th>
<th>Wald (p-value)</th>
<th>exp (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>7.460 (.488)</td>
<td>.232</td>
<td>.315</td>
<td>1.405 (.218)</td>
<td>41.521 (.004)</td>
<td>4.074</td>
</tr>
<tr>
<td>Values</td>
<td>2.370 (.883)</td>
<td>.136</td>
<td>.185</td>
<td>1.031 (.202)</td>
<td>26.174 (.000)</td>
<td>2.805</td>
</tr>
<tr>
<td>Ease of use</td>
<td>13.488 (.061)</td>
<td>.223</td>
<td>.304</td>
<td>1.237 (.192)</td>
<td>41.350 (.000)</td>
<td>3.444</td>
</tr>
<tr>
<td>Size</td>
<td>-</td>
<td>.085</td>
<td>.116</td>
<td>-1.26 (.287)</td>
<td>19.21 (.000)</td>
<td>.284</td>
</tr>
<tr>
<td>Organizational support</td>
<td>5.749 (.569)</td>
<td>.377</td>
<td>.512</td>
<td>1.861 (.239)</td>
<td>60.58 (.000)</td>
<td>6.432</td>
</tr>
<tr>
<td>Experience (1)</td>
<td>-</td>
<td>.220</td>
<td>.299</td>
<td>-3.303 (.521)</td>
<td>40.269 (.000)</td>
<td>.037</td>
</tr>
<tr>
<td>Experience (2)</td>
<td>-</td>
<td>.220</td>
<td>.299</td>
<td>-1.445 (.412)</td>
<td>12.334 (.000)</td>
<td>.236</td>
</tr>
<tr>
<td>Information sharing culture</td>
<td>5.08 (.650)</td>
<td>.101</td>
<td>.138</td>
<td>.899 (.198)</td>
<td>20.638 (.000)</td>
<td>2.456</td>
</tr>
<tr>
<td>Technology policy</td>
<td>3.439 (.984)</td>
<td>.211</td>
<td>.287</td>
<td>1.18 (.188)</td>
<td>39.521 (.000)</td>
<td>3.253</td>
</tr>
<tr>
<td>Competition</td>
<td>1.1 (.982)</td>
<td>.089</td>
<td>.121</td>
<td>.793 (.186)</td>
<td>18.101 (.000)</td>
<td>2.210</td>
</tr>
<tr>
<td>Trading partner readiness</td>
<td>4.257 (.642)</td>
<td>.178</td>
<td>.242</td>
<td>1.103 (.187)</td>
<td>34.678 (.000)</td>
<td>3.015</td>
</tr>
</tbody>
</table>

Interpretation for categorical variables is dependent on their coding (Afifi et al., 2004:285-287) and in this study larger size and higher degrees of experience act as reference categories. For example the odds ratio of Size indicates that the odds of adoption are decreased by a factor of .284 by being small and inversely larger organizations exhibit 3.5 times higher probability of being adopters. All in all, the univariate logistic regression results provide further support to the significance of all ten predictors, when considered independently from each other. The next subsections present the result from multivariate logistic regression, where all predictors are considered simultaneously.
Multivariate binary logistic regression model

The overall fit of the full model was assessed by the change in the log-likelihood statistic and the H-L statistic. The omnibus test of model coefficients was significant (chi-square=141.76, df = 11, p<0.01) with at least one of the coefficients differing from 0 and contributing significantly to the performance of the model. In other words, it can be concluded that adding predictor variables to the model significantly improves the model fit and enables prediction of group membership based on independent variables (Sharma, 1996:323-324). The Hosmer-Lemeshow statistic (C=4.323, df=8, p=0.827) also suggests that the model does not differ significantly from a model classifying all respondents correctly into their respective groups.

Explanatory power of the model was evaluated by examining Hosmer and Lemeshow $R^2$ (.5263), Cox and Snell $R^2$ (.467) and Nagelkerke $R^2$ (.635). In terms of interpretation all of these measures are similar to the $R^2$ in linear regression providing a ‘gauge of the substantive significance of the model’ (Field, 2009:269). These measures range from .467 to .635 suggesting that about half of the data variation is explained by the model. Garson (2010) presents two ‘chance hit rates’ calculated either from the group proportions (CP) or from classifying all cases to the most numerous category (PRE). In the previous section CP was calculated as 52.77%, while PRE for the baseline model is 61.8%. The overall classification accuracy of the full model is satisfactory, as the overall prediction accuracy of 86.7% is over 25% higher than the calculated CP and PRE.

Wald statistics (Table 13) were used to test the significance of single coefficients and three out of the eleven predictors had coefficients significantly different from zero (p<0.05). These three variables were organizational support, competition and trading partner readiness. In addition, the dummy variable Experience (1), which compares the lowest level of electronic services’ use (0-5%) with a usage of over 30%, was also marginally significant at the 0.1 level. The relative importance of predictor variables was evaluated by looking at the odds ratios and their 95% confidence intervals. Confidence interval encompasses the true value of the odds ratio in the population (rather than the sample) with a certain probability (e.g. 95%). Confidence intervals crossing 1 do not lend sufficient support for the observed direction of the relationship to be true in the population. (Field, 2009:289) As a result, these kinds of variables are not considered as useful predictors in the logit model (Garson, 2010).
The coefficients for five continuous predictors were not significant and three of them (values, information sharing culture and technology policy) were to the opposite direction as hypothesized. The odds ratios for other continuous predictors were above one, which means that ‘a unit increase in the independent variable is associated with an increase in the odds that the dependent equals 1’ (Garson, 2010). In short, the likelihood of being grouped as Adopters increases with higher values of these variables. Organizational support has a substantively higher odds ratio relative to others and clearly exhibits the strongest association with adoption. Trading partner readiness and competition exhibit fairly similar levels of influence on adoption with trading partner readiness having a slightly higher coefficient.

Table 13  Multivariate logistic regression analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient (S.E.)</th>
<th>Wald</th>
<th>Sig.</th>
<th>exp (B)</th>
<th>95% CI for Exp (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>.193 (.333)</td>
<td>.335</td>
<td>.563</td>
<td>1.213</td>
<td>.631 - 2.332</td>
</tr>
<tr>
<td>Values</td>
<td>-.436 (.315)</td>
<td>1.924</td>
<td>.165</td>
<td>.646</td>
<td>.349 - 1.198</td>
</tr>
<tr>
<td>Ease of use</td>
<td>-.255 (.300)</td>
<td>.725</td>
<td>.394</td>
<td>1.291</td>
<td>.718 - 2.321</td>
</tr>
<tr>
<td>Size</td>
<td>-.343 (.415)</td>
<td>.685</td>
<td>.408</td>
<td>.710</td>
<td>.315 - 1.599</td>
</tr>
<tr>
<td>Organizational support</td>
<td>1.778 (.405)</td>
<td>19.263</td>
<td>.000</td>
<td>5.919</td>
<td>2.675 - 13.095</td>
</tr>
<tr>
<td>Experience (1)</td>
<td>-1.136 (.691)</td>
<td>2.704</td>
<td>.100</td>
<td>.321</td>
<td>.083 - 1.244</td>
</tr>
<tr>
<td>Experience (2)</td>
<td>-.424 (.592)</td>
<td>.514</td>
<td>.473</td>
<td>.654</td>
<td>.205 - 2.088</td>
</tr>
<tr>
<td>Information sharing culture</td>
<td>-.357 (.381)</td>
<td>.875</td>
<td>.350</td>
<td>.700</td>
<td>.331 - 1.478</td>
</tr>
<tr>
<td>Technology policy</td>
<td>-.038 (.395)</td>
<td>.016</td>
<td>.900</td>
<td>.962</td>
<td>.529 - 1.749</td>
</tr>
<tr>
<td>Competition</td>
<td>.718 (.292)</td>
<td>6.056</td>
<td>.014</td>
<td>2.051</td>
<td>1.157 - 3.633</td>
</tr>
<tr>
<td>Trading partner readiness</td>
<td>.789 (.298)</td>
<td>7.013</td>
<td>.008</td>
<td>2.200</td>
<td>1.227 - 3.944</td>
</tr>
</tbody>
</table>

As mentioned in the previous subsection, interpretation for categorical variables is dependent on their coding (Afifi et al., 2004:285-287) and in this study larger size and higher degrees of experience act as reference categories. Odds ratio of .710 for size implies that organizations with less than four employees are less likely to adopt
electronic archiving applications than their larger counterparts. On the other hand, the odds of larger organizations being adopters are 1.41 times that of smaller organizations. The categorical variable, experience, was constructed from the measure of electronic service level and further categorized into three groups. This categorical variable was further configured into two dummy variables, experience(1) and experience(2). The first one compares low usage of electronic services (0-5%) to high usage (over 30%), while the second compares medium usage (5-30%) to high usage (over 30%). As with size, odds ratio of below one indicates that organizations with lower prior use of electronic services are less likely adopters.

7.4. Hypothesis testing and assessment of the results

Ten factors were proposed in this study to affect the adoption of electronic archiving applications in Finnish accounting firms. Consequently ten hypotheses were formulated and tested both individually and in connection with each other. Factor analysis was used as a method for construct validation and led to the adjustment of three constructs (compatibility, complexity and top management support) and their corresponding hypotheses (H2, H3 and H5). Compatibility factor (H2) was reduced in scope to address organizational culture and values in general and green or customers’ values in particular and was accordingly relabeled as values. After factor analysis complexity items were considered to measure ease of use instead and the factor was accordingly renamed. As a consequence, the hypothesized effect on adoption was also reversed with higher degree of ease of use positively associated with the adoption of electronic archiving applications (H3). Finally top management support (H5) was relabeled as organizational support to better reflect a broader scope of support for adoption.

Table 14 summarizes the essential statistics from both univariate and multivariate data analysis. Based on Mann-Whitney test adopters and non-adopters differed significantly in their responses, as adopters scored consistently higher on all ten factors. Furthermore logistic regression performed separately for each factor revealed their significance in predicting the group membership of respondents. All in all, both univariate data analyses found significant relationships between the ten factors and the adoption of electronic archiving applications. However, only three factors (organizational support, trading partner readiness and competition) emerged as
significant, when all factors were considered simultaneously and the effect of each variable was adjusted for the others in the model (Afifi et al., 2004:326).

Table 14  Summary of results and hypothesis testing

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Mann-Whitney</th>
<th>Coefficient (univariate)</th>
<th>Coefficient (multivariate)</th>
<th>Hypothesis testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Relative advantage</td>
<td>2552.5**</td>
<td>1.405**</td>
<td>.193</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H2: Values (adjusted from Compatibility)</td>
<td>3372.5**</td>
<td>1.031**</td>
<td>-.436</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H3: Ease of use (adjusted from Complexity)</td>
<td>2700.0**</td>
<td>1.237**</td>
<td>.255</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H4: Organization size</td>
<td>3857.5**</td>
<td>-1.26**</td>
<td>-.343</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H5: Organizational support (adjusted from Top management support)</td>
<td>1503.0**</td>
<td>1.861**</td>
<td>1.778**</td>
<td>Supported</td>
</tr>
<tr>
<td>H6: Experience (1) Experience (2)</td>
<td>2863.0**</td>
<td>-3.303**</td>
<td>-1.136</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H7: Information sharing culture</td>
<td>3765.0**</td>
<td>.899**</td>
<td>-.357</td>
<td>Supported</td>
</tr>
<tr>
<td>H8: Technology policy</td>
<td>2715.0**</td>
<td>1.18**</td>
<td>-.038</td>
<td>Partially supported</td>
</tr>
<tr>
<td>H9: Competition</td>
<td>3903.5**</td>
<td>.793**</td>
<td>.718*</td>
<td>Supported</td>
</tr>
<tr>
<td>H10: Trading partner readiness</td>
<td>3090.5**</td>
<td>1.103**</td>
<td>.789**</td>
<td>Supported</td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01.

The results of this study show that consistent with prior studies (e.g. Beatty et al., 2001; Teo et al., 2009) organizational support is by far the most prominent factor affecting the adoption of electronic archiving applications. Hence, hypothesis 5 is fully supported by the findings. Due to its overwhelming influence, the construct was reviewed closer by looking specifically to the five items comprising it (Table 15). This review shows that organizations with higher levels of top management commitment, support and interest are more predisposed to undertake electronic archiving. Garnering this managerial support and commitment is especially important in small businesses to secure adequate financial and organizational resources and to create a supportive climate for adoption (Premkumare & Roberts, 1999:480). In addition, adopters perceived electronic archiving as more compatible with their existing practices, which could indicate a more widespread diffusion of electronic services as a whole in these
organizations. Finally adopters exhibited greater willingness to invest in new technology, although it is interesting to note that this item was ranked lowest within the organizational support construct.

Table 15  Univariate statistics on items relating to organizational support

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Median (S.D) Adopters</th>
<th>Median (S.D) Non-adopters</th>
<th>Mann-Whitney U</th>
<th>Z</th>
<th>Effect size r</th>
<th>Exact sig. (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committed</td>
<td>5.0 (.956)</td>
<td>3.0 (1.050)</td>
<td>1472.0</td>
<td>-9.883</td>
<td>-.6588</td>
<td>.000</td>
</tr>
<tr>
<td>Support</td>
<td>5.0 (.982)</td>
<td>3.0 (1.126)</td>
<td>1982.0</td>
<td>-8.814</td>
<td>-.5876</td>
<td>.000</td>
</tr>
<tr>
<td>Compatible with existing</td>
<td>5.0 (1.117)</td>
<td>3.0 (1.221)</td>
<td>2703.5</td>
<td>-7.290</td>
<td>-.4860</td>
<td>.000</td>
</tr>
<tr>
<td>practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interested</td>
<td>5.0 (1.014)</td>
<td>4.0 (1.204)</td>
<td>2812.0</td>
<td>-7.157</td>
<td>-.4771</td>
<td>.000</td>
</tr>
<tr>
<td>Investment in technology</td>
<td>5.0 (1.018)</td>
<td>3.0 (1.201)</td>
<td>2903.0</td>
<td>-6.867</td>
<td>-.4578</td>
<td>.000</td>
</tr>
</tbody>
</table>

The results from multivariate logistic regression also provide support for hypotheses relating to the environmental context regarding competition (H9) and trading partner readiness (H10). Competition emerged as a significant environmental stimulator with higher levels of perceived competition related to the adoption of electronic archiving applications. This finding is consistent with previous studies on e-business (e.g. Zhu et al., 2003) and e-commerce (e.g. Al-Qirim, 2007), where peer pressure from competitors was found to affect organizational decision-making. Adopters were not only influenced by their competitors’ actions, but also perceived more intense competitive pressure than non-adopters. Nearly 80% of adopter firms also found it necessary to follow technological changes to sustain their competitive position.

The findings also revealed a strong positive relation between adoption and trading partner readiness, which is in line with previous studies on e-business (e.g. Zhu et al., 2003), e-procurement (e.g. Teo et al., 2009) and EDI (e.g. Kim & Lee, 2008). Considerable empirical support exists for the importance of trading partner readiness in the context of interorganizational systems, whose potential benefits are maximized by the number of adopters. In this study respondents found their customers generally unaware of technological developments and lacking substantial IT expertise. It is therefore not surprising that external pressure from business partners was still
considered fairly low even within the adopter category. Nevertheless, increasing number of business partners may request, or even require, adoption, because the item (‘requested’) emerged as the most important discriminator within this construct. At the same time, small organizations would still seem to defer adoption in the absence of explicitly expressed pressure from business partners probably owing to their lack of financial resources and internal IT expertise.

The results from multivariate logistic regression were insignificant for seven predictors: relative advantage, values, ease of use, size, experience, information sharing culture and technology policy. However, univariate data analysis revealed that there is a significant difference between adopters and non-adopters across all these seven constructs. Additionally, all of them showed significant impact on the adoption when considered in isolation providing partial support to the corresponding hypotheses (H1, H2, H3, H4, H6, H7 and H8). It is also important to note that both analyses showed almost identical order of importance for all the ten factors.

Finding of insignificance for relative advantage contradicts with prior research (e.g. Premkumar & Roberts, 1999), but is still not without precedence. For example Seyal and Rahman (2003:18) attributed the insignificance of relative advantage in e-commerce adoption to managerial unawareness of its potential benefits. In univariate data analyses relative advantage emerged as the second strongest factor discriminating between adopters and non-adopters exhibiting a positive association with the likelihood of adoption. Compared with non-adopter firms, adopter firms perceived electronic archiving applications higher in their capability to attain certain benefits including cost reduction, efficient information retrieval, improved information transfer and nature preservation. Reasons for non-adoption were reviewed earlier (Table 9) and the high cost of applications and unclear benefits emerged among the prominent ones. Correspondingly, the perceptions of adopters and non-adopters differed the most in their view of cost reduction as a benefit. Clearly the higher perception of benefits among adopters reiterates that organizations do expect and need confirmation on the feasibility of substantive benefits prior to adoption.

Compatibility construct was relabeled as values after factor analysis, as it was found to reflect the values and culture of organizations and their customers. The insignificance of this construct in the full model corroborates the findings by Premkumar and Roberts (1999), where compatibility with values and beliefs was considered insignificant for
three out of the four studied communications technologies. Nevertheless, Mann-Whitney test statistics indicated that adopter and non-adopter organizations differed in their perceptions of electronic archiving as compatible with their values and culture, with green values in specific and with the values of their customers. Findings from univariate logistic regression also suggested that innovations aligned with organizational values and needs would be more likely deployed.

The full logistic model also did not indicate any significant relationship between ease of use and adoption, which conforms to the findings by Lee (2004). In this study adopter firms perceived electronic archiving applications easy to implement, use and learn and those organizations with a more favourable view on applications’ simplicity were found more likely to adopt. Non-adopter firms, on the other hand, exhibited either a negative (35.3% of respondents) or a neutral (37.4%) stance to applications’ ease of use possibly owing to their limited experience with these applications. This would imply that the availability of these applications on a trial basis might assist non-adopters in their decision to adopt these systems. So despite its insignificance in the full model, the study findings still suggest that ease of use has a positive influence on the adoption of these applications.

Size was found to be an insignificant determinant in the full logistic model, which contradicts with the prior research on innovation adoption reviewed in section 5.4.1. However, this finding is still in line with prior studies on e-commerce adoption (e.g. Dholakia & Kshetri, 2004; Seyal & Rahman, 2003). Nevertheless, the difference in size between adopter and non-adopter firms was statistically significant, as 67.6% (94 firms) of non-adopters had less and 62.8% (54 firms) of adopters had more than five employees. Size was therefore a distinguishing variable even within the context of SMEs with larger firm size associated with adoption. Larger organizations possess the resources to invest in technologies and the organizational slack to experiment with them. Adoption of innovative technologies may also be facilitated by in-house IT personnel creating awareness and acting as change agents in larger organizations. Smaller organizations, on the other hand, may feel less need to keep ahead in technological advances.

Prior technology use was considered insignificant to the adoption of the internet among SMEs in a study by Dholakia and Kshetri (2004) consistent with the insignificance of experience in this study. Percentage of electronic services from operations was used as
a proxy for experience in this study and was further categorized into low (0-5%), medium (5-30%) and high (over 30%). Nearly half of the non-adopter firms (48.9%) exhibited low usage of electronic services in their operations, while 53.5% of adopters showed medium and 36% high usage of electronic services. Furthermore, both univariate and multivariate logistic regressions found a greater likelihood of adoption for organizations with high as opposed to low usage of electronic services. However, the impact of experience was far less pronounced between organizations with high and medium usage of electronic services, as the corresponding variable, experience(2), exhibited the lowest odds ratio in all of the ten univariate logistic regression models. Multivariate logistic regression also highlighted this difference, as high-to-low comparison was found marginally significant (p=0.1) and high-to-medium comparison was considered insignificant to the overall model.

Information sharing culture was the second experimental construct included in the research model and was originally adapted from Teo et al. (2009). Although only marginally significant in that study, the construct was considered appropriate to this study considering the type of innovation with its emphasis on information management. Both adopter and non-adopter firms generally agreed with the existence of a culture, where information is being shared actively with the support and appreciation of the organization. Information sharing was especially encouraged in adopter firms, as majority of these organizations (53.5%) strongly agreed with the corresponding item. Correspondingly, existence of an information sharing culture was found positively associated with adoption in univariate logistic regression, even though the model’s classification accuracy (64%) failed to meet the preferred ‘hit rate’ of 65.96%. This finding would tentatively suggest that technology adoption requires changing organizational mindsets in terms of sharing of information.

Finally, technology policy was included in the research model as an experimental factor and at least according to the meta-analysis by Jeyaraj et al. (2006) this finding of insignificance was not unprecedented. In this study the majority of adopter firms perceived themselves as aware of the latest technological developments and willing to invest in IT expertise. While the majority of non-adopters also followed technological advances, they were not ready to commit resources for skilled IT personnel. Quite interestingly, this awareness had also not led to a clear picture on the potential benefits of these applications among non-adopters. Furthermore, 68.6% of adopter firms considered themselves as frontrunners in adopting innovative technologies compared
with 19.4% of the non-adopters. The findings from univariate logistic regression are also consistent with the proposition that firms with aggressive and forward-looking technology strategies are more likely to adopt innovative technologies (e.g. Teo & Pian, 2002:81).

So far we have established the significance of all ten predictors when considered in isolation and the insignificance of seven predictors when considered in conjunction with each other. It is therefore important to review the potential reasons for this occurrence. Multivariate regression methods concentrate on the unique contribution each predictor variable makes to the prediction when combined with all the other predictors. Individual predictors must therefore account for separate rather than the same portion of the outcome variable’s variance to contribute significantly to the model. (Meyers, Gamst & Guarino, 2006:182) So even though the predictors are highly associated with the outcome variable in isolation, their unique contribution to the full model can remain low if their effect has already been accounted for by other predictors in the model.

Some researchers (e.g. Premkumar & Roberts, 1999:480; Ramdani et al., 2009:21) have suggested that the finding of insignificance may be caused by the overwhelming influence of other variables. As a result, it is possible that organizational support has paled the influence of other variables. On the other hand, examination of distributions revealed distinctly non-normal distribution for organizational support in the adopter group. Nearly 40% of adopter firms agreed strongly with all five items related to this construct, while the corresponding figure for non-adopter firms was 2.2%. The overwhelming influence of organizational support could therefore also be indicative of the actual discriminating power of the variable.

Univariate data analyses suggested a positive relation between technology policy, values and information sharing to adoption, but in the full logistic model their logistic coefficients indicated an effect to the opposite direction. This kind of reversal may be indicative of suppressor variables. These kinds of variables correlate more with other predictors than the outcome variable and as a result suppress irrelevant variance of other predictors (Garson, 2010). Suppressor variables can occur with multicollinearity or simply because of the inherent nature of certain variables (Meyers et al., 2006:182).
Although collinearity statistics did not reveal any serious signs of multicollinearity, there were significant correlations with large effects (Spearman’s $r_s > 0.5$) between organizational support and other continuous factors within the technological and organizational context. In contrast, trading partner readiness and competition only exhibited moderate correlations ($0.3 < r_s < 0.5$) with the same factors and consequently emerged as significant predictors of adoption. Previous review of collinearity statistics also showed moderate signs of multicollinearity between relative advantage and organizational support as well as between technology policy and information sharing.

The ratio of cases to predictor variables is below the suggested minimum of 10:1 in this study and for example in linear regression insufficient sample size limits the size of effect to be detected (Field, 2009:222-223). Larger sample sizes are therefore required to detect smaller effects. Multicollinearity, suppressor variables, inadequate sample size and non-normality of variables are therefore potential causes for the insignificance of predictor variables in the full logistic model.
8 CONCLUSION

8.1. Conclusions and implications

The objective of this study was to examine the key factors associated with the adoption of electronic archiving applications in Finnish accounting firms. In addition, this study aimed to review the current diffusion of electronic archiving practices and applications. Drawing upon extant body of research in various IS domains, a one stage normative research model was proposed based on the TOE framework. In addition, three of the innovation characteristics proposed by the DOI theory were included as factors in the technological context. Data for this study was gathered through an e-mail survey conducted in September 2009 with the beneficial assistance of the Association of Finnish Accounting Firms in co-operation with the Real-Time Economy (RTE) programme in the Helsinki School of Economics (HSE). The model with ten predictor variables was then empirically evaluated using data collected from 226 SMEs, out of which one was later excluded from the full logistic model as an outlier.

Out of the total 226 respondent organizations, 87 (38.5%) had adopted an electronic archiving application, while the remaining 139 (61.5%) were non-adopters. At the time of the survey, optical archiving using CDs or DVDs had also been adopted by 114 organizations (50.4%), whereas 112 (49.6%) were non-adopters. These findings represent a notable increase from earlier studies by Toivonen (2003:56-59, cited by Mäkelä, 2005:19) and Gullkvist and Ylinen with their reported adoption rates of 10% and 15%, respectively. This increase reiterates the notion that electronic archiving applications are being increasingly used by accounting firms. Both electronic storing and electronic archiving applications had also reached the estimated critical mass point (10-20%) for innovation’s further rate of adoption to become self-sustaining (Rogers, 2003:283,343) as anticipated in 2005 by Gullkvist and Ylinen (115).

Even though the majority of adopter organizations archive various voucher types in these applications, the extent of digitalization could still be considered relatively low. At the time of the survey, the majority of adopters archived less than 20% of their vouchers and about 40% of organizations archived less than 5%. Electronic archiving is
of course closely connected with the diffusion of other e-accounting systems including electronic invoicing and their full advantage cannot be obtained while paper and electronic archiving coexist. Nevertheless, the majority of adopters reported obtaining their projected benefits well and especially those related to information access and retrieval.

Organizational support, trading partner readiness and competition emerged as the significant factors in the adoption of electronic archiving applications. The study findings therefore highlight the salience of organizational and environmental contexts in the adoption decision. Over 80% of respondents represented microenterprises with no more than nine employees, so the demands on organizational support are usually directed towards a single person (i.e. owner or manager). It is therefore essential for these individuals to remain well informed about new technologies and their possible benefits. Senior management, especially in microenterprises, need to allocate sufficient time and effort to explore new innovations and then consciously develop appropriate strategies for their exploitation to remain competitive in the long run.

In small organizations, technology policy largely stems from senior management and adopting a proactive strategy requires taking an interest in technological developments. In this study, the majority of respondents perceived themselves as being aware of technological changes, but especially the non-adopter firms did not recognize the benefits of electronic archiving applications. As a result, these organizations cannot necessarily see beyond the initial acquisition costs. For example the Association of Finnish Accounting Firms and software vendors could play a role in convincing these organizations of the potential benefits of these applications.

The results also emphasize the importance of finding means to build customer awareness of technological changes. In this study respondents found their customers generally unaware of technological developments and lacking substantial IT expertise. It is therefore not surprising that external pressure from business partners was still considered fairly low even within the adopter category. However, non-adopter organizations did not attribute their decision to defer adoption to the technology itself but more to the lack of client demand and unclear benefits. Increasing number of business partners may request, or even require, adoption in the future leading to a competitive advantage for those organizations with existing applications. In this respect larger accounting firms have the advantage of operating with more substantial clients
possessing more advanced IT resources and knowledge. It is therefore not surprising that larger accounting firms are more likely to benefit from e-accounting systems and the sector is projected to polarize causing problems to micro firms (Metsä-Tokila, 2009: 10, 41-42).

Seven out of the ten factors showed insignificant association with the adoption of electronic archiving applications in the full model. These seven predictors were: ease of use, relative advantage, values, technology policy, information sharing, size and experience. However, univariate data analysis revealed that there is a significant difference between adopters and non-adopters, as generally adopters scored higher across all seven constructs. Additionally, all of them showed significant impact on the adoption when considered in isolation providing partial support to the corresponding hypotheses. Therefore in section 7.4, the hypotheses related to these constructs were not rejected, but considered partially supported by the findings in this study. Naturally additional research needs to be conducted before full support for their association with adoption can be concluded.

The findings of this study have some implications for both research and practice. This study built on previous innovation research and corroborated some of its findings in the specific context of Finnish accounting firms. The study also represented the first attempt to distinguish the particular factors pertaining to the adoption of electronic archiving applications. The results from this study indicate that adoption decisions are not primarily based on the characteristics of the technology itself but dependent on factors related to the internal and external environment of the organization. This study therefore confirms the usefulness of the Technology-Organization-Environment framework for studying adoption of technological innovations. However, as such this study does not provide any further evidence on the usefulness of the DOI theory in conjunction with the TOE framework.

Finally it is hoped that the study findings would be of value to non-adopters and software vendors alike. Organizational support, trading partner readiness and competition emerged as the key determinants of adoption and acknowledging their significance in the adoption could assist non-adopters to make timely decisions. Furthermore non-adopters are hopefully better equipped to take these determinants into consideration and develop appropriate strategies to further foster their realization in the future. Hopefully this insight into these key determinants will also assist software
vendors in devising more efficient and effective marketing strategies to target potential adopters for example through the clear communication of the potential benefits of electronic archiving applications.

8.2. Limitations of the study

A study is valid if its research instrument measures what it is designed to measure and if there are no logical errors in drawing conclusions from the data (Garson, 2010). The validity and reliability of the research instrument was assessed previously in section 6.4. Constructs used in this study were chosen after an extensive literature review and measured with operationalizations used in prior empirical research. Factor analysis was also performed to establish the convergent and discriminant validity of the constructs. Statistical methods used in this study were chosen after careful consideration of their assumptions and their possible violations were further explained. All statistical procedures were carried out with the latest version of PASW available at Hanken and the following print-outs were interpreted with guidance from many exemplary annotated outputs (e.g. Field, 2009; Garson, 2010). It is therefore believed that the study’s conclusions are based on proper use of statistics and as such statistical validity is attained (Garson, 2010).

Replicability is fundamental to the scientific method and it is not possible without reliable research instruments (Garson, 2010). Reliability of the research instrument was assessed previously in section 6.4 by examining the internal consistency of the constructs. The questionnaire was constructed as clear as possible and underwent pretesting to minimize the likelihood of respondents misunderstanding the questions or marking their answers incorrectly.

Despite these considerations for validity and reliability, this study has a number of limitations. First, a critical limitation of this study is its cross-sectional design (i.e. survey). The results can therefore only indicate associations between constructs and not their causal relationships. Second, the conclusions drawn from the data are based upon perceptions of a single informant from each small business possibly leading to a certain degree of response bias. This was not considered as a serious problem in the context of SMEs, where decision making is mostly done by a single person and not by a group of senior management (Chau & Hui, 2001:244-245). The contact details of key informants
were also regarded as sufficiently accurate and up-to-date in this study, as they were obtained through the Finnish Association of Accounting Firms.

Third, it is impossible to assess how many of the non-responding firms were adopters or non-adopters. It is, however, quite possible that non-adopters were less likely to respond to the questionnaire than adopters. This kind of ‘pro-technology bias’ should be taken into account when interpreting the results. For example, the current level of adoption could actually be lower than these findings suggest, if the current sample is more representative of the adopter than non-adopter organizations. Fourth, the research instrument relied primarily on perceptual constructs instead of utilizing a mix of both subjective and objective data.

Fifth, the factors related to adoption may be dependent on different industry environments or influenced by specific cultural aspects. This study, however, focused on a single industry (accounting firms) within a limited geographical area (Finland) and the study findings are not necessarily generalizable beyond this restricted context. On the other hand, Finland was positioned in the high EB-intensity cluster with Denmark and UK in a study by Zhu et al. (2003) suggesting that similar results could be attained from the Nordic countries and Western Europe.

Sixth, the lowest standard for logistic regression is at least ten samples per predictor variable in the category of outcome variable occurring less often. This rule of thumb was violated in this study, as there were 11 predictor variables and 86 cases in the smaller group (adopters). Sample size was therefore insufficient for logistic regression and a serious limitation of this study. On the other hand, this guideline has also been violated in some of the previously reviewed academic articles (e.g. Ramdani et al., 2009; Teo et al., 2009) and the final multivariate model did not exhibit any obvious signs of inadequate sample size. Nevertheless, larger sample size would have strengthened the validity of this research.

Finally, the insignificance of factors in the full logistic model represented a challenge in this research, as they contradicted with the hypotheses and the findings from univariate statistics. At the same time, these findings were not without precedence in prior research. Multicollinearity, suppressor variables, inadequate sample size and non-normality of variables were suggested (see Section 7.4) as potential causes for the insignificance of predictor variables in the full logistic model. It is also possible that the
overwhelming influence of organizational support has paled the significance of other variables in this study.

8.3. Suggestions for further research

First of all, future research should strive to address the limitations noted above. For example a cross-sectional survey study can only infer associations between constructs, so a longitudinal study is suggested to examine the causality and interrelationships between constructs. Second, this study synthesized the DOI with the TOE framework to investigate the key variables associated with the adoption of electronic archiving applications. Future research could use different theoretical lenses (e.g. resource dependency theory) or different statistical methods (e.g. structural equation modelling, SEM) to better understand the interaction among the variables. For example Ramamurthy et al. (2008) proposed a LISREL structural model in addition to a direct effects model to depict ‘a richer and more complex set of relationships’ (2008:835).

Future research could also explore other factors salient to the adoption of electronic archiving applications. For example perceived costs have been significantly linked with the adoption of EDI in SMEs (e.g. Chau & Hui, 2001; Kuan & Chau, 2001) and costs also emerged as one of the primary reasons for non-adoption in this study. Given the marginal significance of experience in this study, it could also be beneficial to include constructs measuring organizational IS knowledge (e.g. Thong, 1999) or perceived technical competence (e.g. Kuan & Chau, 2001) in future studies. Finally vendor support could be included as a third construct in the environmental context, as the availability and quality of external expertise has been found to affect the adoption decision significantly in prior research (e.g. Chau & Hui, 2001; Premkumar & Roberts, 1999).

Finally, this study focused only on the initial adoption of electronic archiving applications. Future studies could further examine what organizational benefits accrue from their subsequent use within the organization (Ramamurthy et al., 2008:837). Similarly the evaluation and assessment of subsequent implementation processes is important to gain a more holistic understanding of electronic archiving and their applications. It would also be interesting to study the extent of adoption with the same model to explore whether these same factors affect the diffusion of electronic archiving
applications. Longitudinal study could also be conducted to see how the importance of these contextual factors varies over time in this diffusion.
REFERENCES


APPENDIX 1  COVERING LETTER (E-MAIL TO RESPONDENTS)

Hyvä tilitoimistoammattilainen,

Pk-yritysten sähköisten palvelujen kehittyminen on taloushallinnon näkökulmasta kiinnostava tutkimusaihe ja tutkimuksesta saatava tieto tärkeää Taloushallintoliiton edunvalvonnalle ja tiedottamiselle. Pyydämme sinua vastaamaan oheiseen kyselyyn, jonka tuloksia käytetään yliopistollisiin opintoihin ja Taloushallintoliiton tarpeisiin.

Kysymykset ovat pääosin monivalintakykyisiä, joihin vastaaminen vie yhteensä n. 10 minuuttia. Osallistujien kesken arvotaan osallistuminen Taloushallintoliitoni 5.5.2010 järjestämään Sähköisen taloushallinnon koulutustilaisuuteen sekä 5 kpl Iittalan Kivi tuikkuja. Mikäli haluat osallistua arvontaan, ilmoita yhteystietosi kyselyn lopussa.


Tästä linkistä pääset täyttämään kyselyä!

#codelink

Kiitos osallistumisestanne!

Yhteistyöterveisin,

Sirpa Airola  Henna Mäkinen  Eeva Ollikainen
Toimistopäällikkö  opiskelija  opiskelija
Taloushallintoliitto  Helsingin Kauppakorkeakoulu  Hanken

Lisätietoja tutkimuksesta antavat:

Sähköinen taloushallinto: Henna Mäkinen +358 400 017 505
henna.makinen@student.hse.fi

Sähköinen arkistointi: Eeva Ollikainen +358 40 509 75 41
eevaollikainen@hotmail.com
APPENDIX 2 QUESTIONNAIRE (PARTS I AND III)

Sähköiset palvelut ja tilitoimisto

Tämä kysely liittyy Henna Mäkisen (HKKK) ja Eeva Ollikaisen (Hanken) pro gradu töihin. Henna Mäkinen tutkii sähköisten palveluiden leviämistä tilitoimistoissa. Eeva Ollikainen keskittyy työssään sähköiseen arkistointiin ja sen käyttöönottoon vaikuttaviin tekijöihin.


I TAUSTATIEDOT

1) Asemanne yrityksessä
   o  omistaja
   o  johtoasemassa
   o  kirjanpitäjä

2) Missä yrityksenne sijaitsee
   □  Pääkaupunkiseutu (Espoo, Helsinki, Vantaa, Kauniainen)
   □  Muu Etelä-Suomen lääni
   □  Itä-Suomen lääni
   □  Länsi-Suomen lääni
   □  Oulun lääni
   □  Lapin lääni

3) Onko edustamanne yritys Taloushallintoliiton jäsen?
   o  On
   o  Ei

4) Henkilöstön lukumäärä
   o  1-2
   o  3-4
   o  5-9
   o  10–25
   o  yli 25

5) Yrityksenne liikevaihto viimeksi päättyneellä tilikaudella (tuhansia euroja)
   o  alle 100
   o  100–200
   o  200–500
   o  500–1000
   o  1000–2000
   o  yli 2000
6) Onko tilitoimistonne erikoistunut palvelemaan jotain seuraavista toimialoista?

☐ Teollisuus
☐ Rakentaminen
☐ Tukku- ja vähittäiskauppa
☐ Kuljetus ja varastointi
☐ Majoitus- ja ravitsemistoiminta
☐ Informaatio ja viestintä
☐ Asunto-osakeyhhtiöt
☐ Terveys- ja sosiaalipalvelut
☐ Muut palvelut
☐ Muu toimiala
☐ Ei ole erikoistunut

7) Sähköisten palveluiden tuottamisen % -osuus tehdystä työstä

○ 0–5
○ 5–10
○ 10–30
○ 30–50
○ yli 50

8) Verokonsultoinnin % -osuus tehdystä työstä

○ 0–5
○ 5–10
○ 10–30
○ 30–50
○ yli 50

9) Perinteisten tilitoimistopalvelujen (muu kuin veroneuvonta) %-osuus tehdystä työstä

○ 0–5
○ 5–10
○ 10–30
○ 30–50
○ yli 50

III SÄHKÖINEN ARKISTOINTI TILITOIMISTOISSA

Keskeisten käsitteiden määritelmät

_Pysyväisarkistoinnilla_ tarkoitetaan tässä kyselyssä kirjanpitoaineiston arkistoointia datan tallennusvälineille (kuten CD tai DVD) tai kiintolevyjärjestelmälle säännösten vaatimaksi ajaksi.

_Sähköinen arkistoointi_ määritellään tässä kyselyssä siten, että sillä tarkoitetaan sähköisen arkistoointijärjestelmän hyödyntämistä arkistoinnissa. Arkistoitava aineisto on rajattu tässä kyselyssä vain kirjanpitoaineistoon eli sähköisellä arkistoinnilla _ei_ viitata muun yrityksen hallinnollisen aineiston (kuten pöytäkirjojen ja sopimusten) arkistoointiin.
Sähköisellä arkistointijärjestelmällä tarkoitetaan tässä kyselyssä arkistointia varten kehitettyä valmisohjelmistoa (kuten M-Files), taloushallintojärjestelmää, jossa arkistointimahdollisuus (kuten Netvisor tai Personec Tikon) tai muuta organisaation tiedonhallintaan soveltuvaa ohjelmistokokonaisuutta.

Sähköisellä arkistointijärjestelmällä ei tarkoiteta tässä kyselyssä kirjanpitoaineiston tallentamista datan tallennusvälineille (kuten CD tai DVD), kiintolevylle sijaitsevaan hakemistorakenteeseen tai sähköpostijärjestelmään.

**PYSYVÄSARKISTOINTI**

23) Arkistoitteko yrityksessänne kirjanpitoaineistoa datan tallennusvälineille (kuten CD ja DVD)?* Mikäli vastasitte kieltävästi, siirrykää kysymykseen 25.

- kyllä
- ei

24) Mitä kirjanpitoaineistoa arkistoitte datan tallennusvälineille (kuten CD ja DVD)? Valitkaa sopivat vaihtoehdot.

- myyntitoiminnan tositteet
- ostotoiminnan tositteet
- palkanlaskennan tositteet
- maksu- ja rahaliikenteen tositteet
- pääkirjanpidon tositteet
- kirjanpidon raportointi

**SÄHKÖINEN ARKISTOINTI**


- kyllä
- ei, mutta suunnittelemme siirtymistä sähköiseen arkistointiin
- emme ole vielä tehneet päätöstä sähköiseen arkistointiin siirtymisestä
- emme aio siirtyä sähköiseen arkistointiin
- emme ole tietoisia sähköisestä arkistoinnista


- dokumenttienhallintajärjestelmä (esim M-Files tai Personec archive)
- selainpohjainen dokumenttienhallintajärjestelmä (esim Heeros Admina tai Docusend)
- selainpohjainen taloushallinnon ohjelmisto (esim Netvisor, Fivaldi tai ProCountor)
- taloushallinnon ohjelmisto (esim Personec Tikon, Econet)
o talouden- ja toiminnanohjauksen järjestelmä, ERP (esim SAP tai Microsoft Dynamics NAV)
o muu dokumenttienhallintaan kehitetty ratkaisu kuten Microsoft Office SharePoint Server (MOSS)

27) Minä vuonna kyseinen järjestelmä otettiin käyttöön sähköisessä arkistoiminnassa?

Vuonna _____________________


o valmisohjelmisto
o sähköinen sovelluspalvelu (ASP-malli)
o itse kehitetty
o ohjelmistotoimittajan räätälöimä ohjelmisto

29) Mitkä seuraavista toiminnoista sähköisessä arkistointi-järjestelmässänne on mukana?

<table>
<thead>
<tr>
<th>toiminto</th>
<th>ei tietoa</th>
<th>ei</th>
<th>kyllä</th>
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<tbody>
<tr>
<td>vapaa tekstihaku sisällön mukaan</td>
<td>o</td>
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<td>metatietojen luonti ja haku</td>
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<td>käyttäjäoikeuksien hallinta (tunnukset/salasanat)</td>
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<td>siirrot muihin ja muista tietojärjestelmistä</td>
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<td>hallittu versiointi (versioiden luonti)</td>
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<td>porautuminen linkkien avulla</td>
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<td>sähköposti-ilmoitukset</td>
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<tr>
<td>muokattava dokumenttien esitysrakenne</td>
<td>o</td>
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</tr>
</tbody>
</table>

30) Minkä aineiston sähköiseen arkistoointiin kyseistä järjestelmästä käytetään? Mitä aineistoja yrityksessänne on tarkoitus arkistooida sähköisesti kahden vuoden sisällä?

<table>
<thead>
<tr>
<th>aineisto</th>
<th>ei tietoa</th>
<th>ei</th>
<th>suunnitelmissa</th>
<th>kyllä</th>
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<tbody>
<tr>
<td>ostotoiminnan tositteet</td>
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<tr>
<td>myyntitoiminnan tositteet</td>
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<tr>
<td>palkanlaskennan tositteet</td>
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<tr>
<td>maksu- ja rahaliikenteen tositteet</td>
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<tr>
<td>pääkirjanpidon tositteet</td>
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<tr>
<td>kirjanpidon raportointi</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

31) Miten arvioisitte kirjanpidon arkistoinnin nykyisen sähköistämisen asteen?
### 32) Alla on lueteltu muutamia syitä sähköisen arkistoinnin käyttöönnottoon. Miten hyvin arvioisitte näiden tavoitteiden toteutuneen yrityksessänne? (arviointiasteikko: 1=erittäin huonosti... 5=erittäin hyvin)

<table>
<thead>
<tr>
<th>Tapahtuma</th>
<th>Pape- Alle</th>
<th>5-20%</th>
<th>21-40%</th>
<th>41-60%</th>
<th>61-80%</th>
<th>Yli 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>myyntitoiminnan tositteet</td>
<td>o o o o o o</td>
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<tr>
<td>ostotoiminnan tositteet</td>
<td>o o o o o o</td>
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<tr>
<td>palkanlaskennan tositteet</td>
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<td>maksu- ja rahaliikenteen tositteet</td>
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<td>pääkirjanpidon tositteet</td>
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<tr>
<td>kirjanpidon raportointi</td>
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</table>

32) Alla on lueteltu muutamia syitä sähköisen arkistoinnin käyttöönnottoon. Miten hyvin arvioisitte näiden tavoitteiden toteutuneen yrityksessänne? (arviointiasteikko: 1=erittäin huonosti... 5=erittäin hyvin)

<table>
<thead>
<tr>
<th>Tapahtuma</th>
<th>1=erittäin</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5=erittäin</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiedonhaun nopeuttaminen</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>varastotilan säästö ja siihen liittyvä</td>
<td></td>
<td>0</td>
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<tr>
<td>kustannussäästö</td>
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<tr>
<td>tiedon saatavuuden parantaminen</td>
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<td>paperin käytön vähentäminen</td>
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<tr>
<td>tietoturvallisuuden parantaminen</td>
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<tr>
<td>tiedonkulun parantaminen asiakkaalle ja</td>
<td></td>
<td>0</td>
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<tr>
<td>tilintarkastajalle</td>
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<tr>
<td>kilpailuedun saavuttaminen</td>
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<td>0</td>
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</tbody>
</table>

### 33) Mikäli ette ole siirtyneet sähköiseen arkistointiin, miten hyvin seuraavat väittämät pitävät paikkansa? (arviointiasteikko: 1=täysin eri mieltä... 5=täysin samaa mieltä)

Yrityksemme ei ole vielä siirtynyt sähköiseen arkistointiin, koska...

<table>
<thead>
<tr>
<th>Tapahtuma</th>
<th>1=täysin</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5= täysin samaa</th>
</tr>
</thead>
<tbody>
<tr>
<td>... sähköiseen arkistointiin siirtyminen on liian kallista</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>... sähköisestä arkistoinnistaa ei ole saatavilla tarpeeksi tietoa</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>... olemme huolissamme tietoturvasta</td>
<td>o</td>
<td>o</td>
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<td>o</td>
<td>o</td>
</tr>
<tr>
<td>... sen käyttöönnotto vie liikaa aikaa</td>
<td>o</td>
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<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>... asiakkaamme eivät ole pyytäneet sitä meiltä</td>
<td>o</td>
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<td>o</td>
</tr>
<tr>
<td>... yrityksessämme on hyvät arkistoinnin rutiiinit, emmekä halua muuttaa niitä</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>
... se ei ole käytössä suurimmilla kilpailijoillammekaan
... emme ole vakuuttuneita sähköisen arkistoinnin tuomista hyödyistä
... emme luota sähköiseen arkistoointiin liittyvään teknologiaan

34) Seuraavassa osiossa tarkastellaan sähköisen arkistoinnin ja sähköisen arkistointijärjestelmän käyttöönottoon vaikuttavia tekijöitä. Arvioikaa väittämiä tämän hetkisen tietojenne pohjalta, mikäli kyseinen järjestelmä ei ole vielä yrityksessänne käytössä.* Valitkaa sopivin vaihtoehto väittämistä.

(arviointiasteikko: 1=täysin eri mieltä... 5=täysin samaa mieltä)

<table>
<thead>
<tr>
<th>1=täysin eri mieltä</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5=täysin samaa mieltä</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sähköisen arkistoinnin käyttöönotto on vaihatonta</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköisen arkiston käyttö on vaikeaa</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköistä arkistoa on helppo oppia käyttämään</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköinen arkistoointi ei nopeuta tiedonhakua</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Yrityksemme saa huomattavan kilpailuedun sähköisestä arkistoinnasta</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköinen arkistoointi ei vähennyä arkistoinnin kustannuksia</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköinen arkistoointi vaikuttaa negatiivisesti tiedonhaun tehokkuuteen</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Tiedonkulku asiakkaalle ja tilintarkastajalle paranee</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköinen arkistoointi vähentää luonnonvarojen kulutusta</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Kaiken kaikkiaan sähköisen arkiston käyttöönotosta on hyötyä</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Nykyiset toimintatapamme eivät sovi yhteen sähköisen arkistoinnin kanssa</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Yrityksen arvot ja kulttuuri tukevat sähköistä arkistoointia</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Luonnonvarojen säästämistä pidetään yrityksessämme tärkeänä</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Sähköinen arkistointijärjestelmä on yhteensopiva nykyisten laitteistojen ja ohjelmistojen kanssa</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>
| Yrityksemme on perinteisesti ollut edelläkävijä uusien
teknologioiden käytössä
Ammattitaitoisin IT-osaaajiin panostetaan
yrityksessämme
Yrityksen ylin johto ei ole valmis sijoittamaan uuteen
teknologiaan
Yrityksessämme ollaan tietoisia alan
teknologisista muutoksista
Ylin johto ei ole kiinnostunut sähköisestä
arkistoiminnasta
Sähköisen arkistoinnin käyttöä pidetään tärkeänä
ylimmässä johdossa
Ylin johto on ilmatisesti selvästi tukena sähköiselle
arkistoimille
Sähköiseen arkistointiin ei olla sitoutuneita ylimmän
johdon taholta
Yrityksessämme kannustetaan tiedon
jakamiseen
Työntekijämme vaihtavat keskenään aktiivisesti tiedoita
ja ideoita
Yrityksessämme ei arvosteta tiedon
jakamista
Yrityksessämme on tiedon jakamisen
kulttuuri
Emme joudu kilpailemaan osaavasta
työvoimasta
Kilpailijoiden toimet voivat vaikuttaa uuden teknologian
käyttöönnotoon yrityksessämme
Kilpailu toimialallamme on kiristynyt
Pysyäksemme kilpailussa mukana meidän on seurattava jatkuvasti
alan teknologisia muutoksia
Asiakkaamme ovat pyytäneet sähköistä
arkistointia
Asiakkaamme eivät ole yleensä hyvin tietoisia
teknologisista asiioista
Asiakkaillamme ovat huomattavaa teknistä
asiantuntijuutta
Asiakkaamme eivät ole suositelleet meille sähköisen
arkistoinnin käyttöä
Asiakkaamme arvostavat ympäristöä säästävien
innovaatioiden käyttöönnottoa
## APPENDIX 3  QUESTIONNAIRE ITEMS RELATED TO PREDICTOR VARIABLES

<table>
<thead>
<tr>
<th>Factors</th>
<th>Items</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>RELADV3. Electronic archiving reduces the cost of archiving.</td>
<td>R3,R5 adapted from Teo et al. (2009), R7 adapted from Plouffe, Holland &amp; Vandenbosch (2001)</td>
</tr>
<tr>
<td></td>
<td>RELADV4. Electronic archiving affects the efficiency of information retrieval positively.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RELADV5. Information transfer to customers and auditors improves.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RELADV6. Electronic archiving reduces the consumption of natural resources.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RELADV7. As a whole, there is relative advantage in implementing electronic archiving.</td>
<td></td>
</tr>
<tr>
<td>Values</td>
<td>COMPA2. Organization’s values and culture support electronic archiving.</td>
<td>C2, C3 from Lin &amp; Lin (2008)</td>
</tr>
<tr>
<td></td>
<td>COMPA3. Preserving natural resources is considered important in our organization.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TPR5. Our customers appreciate the adoption of innovations preserving nature.</td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>COMPL1. Implementation of electronic archiving is effortless.</td>
<td>All adapted from Plouffe et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>COMPL2. Electronic archives are easy to use.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMPL3. Learning to use electronic archives is easy.</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>Value 1. 1-4 employees.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Value 2. Over 4 employees.</td>
<td></td>
</tr>
<tr>
<td>Organizational support</td>
<td>TPMGM1. Management is not interested in electronic archiving.</td>
<td>T1, T3, T4 from Teo &amp; Pian (2003), C1 from Lin &amp; Lin (2008), TE3 from Eze (2008)</td>
</tr>
<tr>
<td></td>
<td>TPMGM3. Management has clearly expressed their support to electronic archiving.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TPMGM4. Management is committed to electronic archiving.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMPA1. Our current practices are not compatible with electronic archiving.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TECHPOL3. Management is not ready to invest in new technology.</td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>Value 1. 0-5% of electronic services from operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Value 2. 5-30% of electronic services from operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Value 3. Over 30% of electronic services from operations</td>
<td></td>
</tr>
<tr>
<td>Information sharing culture</td>
<td>INFOSHA1. Information sharing is encouraged within our organization.</td>
<td>All from Teo et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>INFOSHA2. Employees share information and ideas actively.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INFOSHA3. Information sharing is not valued in our organization.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>INFOSHA4. Our organization has a culture of sharing information.</td>
<td></td>
</tr>
<tr>
<td>Technology policy</td>
<td>TECHPOL1. Our organization has traditionally been a frontrunner in adopting new technologies.</td>
<td>All from Teo &amp; Pian (2003)</td>
</tr>
<tr>
<td></td>
<td>TECHPOL2. Our organization invests in skilled technical personnel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TECHPOL4. We are aware of the latest technological developments within our field in our organization.</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>COMPE2. Competitors’ actions can affect the adoption of new technology in our organization.</td>
<td>COM3 from Eze(2008), COM4 from Pulli (2008)</td>
</tr>
<tr>
<td></td>
<td>COMPE3. Competition within our field has intensified.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COMPE4. To keep abreast with competition, we have to</td>
<td></td>
</tr>
</tbody>
</table>
| Trading partner readiness | TPR1. Our customers have requested electronic archiving.  
TPR2. Our customers are usually very aware of technological matters.  
TPR3. Our customers possess substantial technical expertise. | All from Lin & Lin (2008) |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>constantly monitor technological changes within our field.</td>
</tr>
</tbody>
</table>