

Historical Development of IT-Related Innovations: From Manual and Paper Bookkeeping to Automated and Digital Financial Accounting

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Abstract

This study addresses the historical development of information technology-related (IT) innovations in financial accounting in Finland. The research questions are twofold: 1) which were the main stages and phases in the historical development of the innovations over time and 2) how accounting legislative reforms established limits to and enabled the use of innovations? These questions were examined based on articles published in two professional accounting journals in Finland between 1970 and 2019, accounting laws and regulations. The results, firstly, identify two stages and seven phases in the historical development of IT innovations in financial accounting over half a century. Secondly, they identify several legislative reforms, which initially were more restrictive and later on more permissive about the use of IT innovations. Overall, the findings offer important insights into IT innovations in financial accounting particularly as Finland has been one of the chief proponents of the adoption of IT.

Keywords:

Financial accounting, Information technology, Digitalization, Historical research, Qualitative study

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1 Introduction

This study addresses the historical development of information technology-related innovations (hereafter IT innovations) in financial accounting in Finland. Research on this topic is of importance because a large number of IT applications have been introduced into financial accounting during the past decades significantly influencing accounting practice. In the 1970s, bookkeeping, financial reporting, and auditing were mainly manual activities and documents were produced, distributed, and stored on paper (Jaatinen, 2009; Kosonen, 2005). Today, 50 years later, automation (Gullkvist, 2011, 32; Dawson, 2015; Ojala, Penttinen, Collins and Virtanen, 2018; Roos 2015) and robotics (Applebaum & Nehmer, 2017, 40; Tucker, 2017) are increasingly utilized and digital documents are stored and distributed electronically. Most accounting studies that have examined this topic have, however, been cross-sectional and focused on current or future applications of accounting (for reviews, see Ferguson and Seow, 2011; Poston and Grabski, 2000). A more comprehensive picture of the historical development of IT innovations in financial accounting over time is needed to understand how we come to this point.

The *specific research questions* of this study are: 1) What were the main stages and phases in the historical development of IT innovations of financial accounting over decades and 2) how accounting legislative reforms established limits to and enabled the use of the innovations? Innovations are here understood to refer to “something new or different introduced” (Webster’s College Dictionary 1998, 673) that is an idea, practice or object that is at least perceived as new relative to the current knowledge of the analyzed individual or unit (Rogers 1962 and 1983). The term ‘IT-related innovation’ is used because the focus is not on the IT itself but rather on innovations in the financial accounting occasioned by the development of new IT. Financial accounting is understood to comprise bookkeeping, preparation of financial statements, auditing, and other financial accounting-related practices such as invoicing and communication with tax and other authorities. Because financial accounting is a phenomenon regulated by accounting legislation, this study traces the IT-related amendments in the Finnish accounting legislation over decades.

The historical development of IT innovations of financial accounting is analysed based on articles published on the IT innovations of financial accounting. So rather than focusing on the adoption of innovations in practice, the analysis provides a historical record of when ideas about IT innovations were introduced. Data were collected from the two main professional accounting journals published in Finland between 1970 and 2019. Other professional accounting journals with smaller circulation were excluded. Because 99.5 percent of Finnish firms are small and medium-sized enterprises (SMEs) with fewer than 100 employees (Statistics Finland, 2020), this context is likely to influence our data. It is likely that the professional journal articles have often been targeted at representatives of SMEs and/or accounting firms rather than just those of large pioneering companies. Nevertheless, our results provide empirical evidence from Finland and assist in furthering the understanding of the historical development of IT in financial accounting in comparable Nordic and European countries.

Subsequent sections of this paper are organized as follows. The research method and data are first described. Thereafter, the most important stages and phases in the historical development of IT innovations in financial accounting as well as legislative reforms are analysed over time. The final sections present a synthesis of the analysis and conclusions.

2 Research method and data

Regarding the research method, this study presents *qualitative historical research*. According to Edwards (2013), the uses of historical analysis are recreational, intellectual, and related to problem-solving. Our motivation to study the history of IT innovations in financial accounting is primarily *intellectual*, i.e. that the history helps us to understand our past, gives us an appreciation of how our current practices and problems came into being, and helps us to predict likely developments in the future. (Edwards, 2013, 3-6).

One view is that the historian's job is simply to state the facts and set the record straight. The historian is seen as a kind of record keeper, a chronicler, yet nevertheless expected to reconstruct the facts long after they have occurred (Edwards, 2013, 2). To some extent, our study represents "fact finding" because facts are needed to form a comprehensive picture of the development of the issue investigated. In addition to the 'fact finding' approach, we use 'sample approach' (Alasuutari, 1999) and present original text examples from the data (translated from Finnish into English) to illustrate the meaning of certain innovations.

This study uses textual (secondary) data – professional journal articles and legislative documents as historical data sources as relics from the past (Eriksson and Kovalainen, 2008, 89; Bryman and Bell, 2007, 568-572) – in analysing and interpreting the advent and development of IT innovations in financial accounting. The professional journal articles were selected from the two most important professional accounting journals in Finland. We reviewed journals from 1970 through 2019 to be able to offer an analysis of the past five decades.

The first of the professional accounting journals is *Tilisanomat* ('Account Journal'), published by the Association of Finnish Accounting Firms (Suomen Taloushallintoliitto ry., TAL), which is the national union of the authorized firms and societies providing financial accounting and management services in Finland. The members of TAL consist of about 800 authorized accounting firms and 3500 professional accountants, bookkeepers, and financial managers. All the members of the TAL association get the journal free as a membership benefit.

The second of the professional accounting journals is published by the Association of the Finnish Auditors (Suomen Tilintarkastajat ry). It was published by the title *Tilintarkastajalehti* ('Auditor journal') until the end of 1970, *Tilintarkastus* ('Auditing') during the period 1971-2012, *Balanssi* ('Balance') in 2013-2016 and *Profitti* ('Profit') ever since 2017. It is the only professional journal on auditing in Finland. It was published as a hard copy until the end of 2016 and, thereafter, in electronic form on the Association's web page. The advent and usage of IT innovations in financial accounting were frequently addressed in these two journals.

In selecting articles, all journal issues published during the period 1970–2019 were read to identify articles that mentioned computers and electronic or digital applications in relation to financial accounting. In total, 341 articles were identified. Approximately two-thirds (229 articles; 67.2%) were published in *Tilisanomat* and nearly one-third (112 articles; 32.8%) in *Tilintarkastajalehti/Tilintarkastus/Balanssi/Profitti*. Table 1 shows the number of articles published in both journals by decade. 58 percent of the articles were written by accounting and auditing professionals and the rest by the representatives of e.g. banks, government, and software houses.

Table 1. Numbers of articles (the source data) by decade and journal.

DECADE	NUMBER OF ARTICLES BY JOURNALS	
	('Account Journal') Tilisanomat	('Auditing Journal') Tilintarkastaja-lehti/ Tilintarkastus/Balanssi/Profiiitti
1970s		14
1980s	35	33
1990s	40	27
2000s	56	11
2010s	98	27
Total	229	112
In total		341

Next, the 341 articles were analyzed utilizing elements of the following types of methods: data-driven analysis, content analysis, and textual analysis. *Data-driven analysis* was used to interpret and understand the issues studied and to outline themes, stages, and phases relevant to the phenomenon under study. The processing of the material aimed at comprehensiveness i.e. to understand the phenomenon under study in relation to its context (Eriksson & Kovalainen, 2008, 5; Kiviniemi, 2001, 68). In practice, this meant that relevant texts from the 341 articles were analysed and discussed by the authors of this study in order to reach a common understanding about the most important IT innovations and about their meaning as part of the historical change process of financial accounting in Finland. *Content analysis* (Tuomi & Sarajärvi, 2002, 106; Eriksson & Kovalainen, 2008, 90-91) was used to assess the frequencies of articles on different IT -innovations at certain time points, and the *textual analysis* (linguistic and interpretative approaches, Eriksson & Kovalainen, 2008, 91) was used to ascertain what was written about each innovation and by whom. These methods of analysis enabled us to identify the main stages and phases of IT-related innovations and, hence, to form a comprehensive picture of the historical development and the gradual change of financial accounting from manual and paper bookkeeping activities towards digital and automated financial accounting in Finland.

Journal articles published on certain dates provide a historical record of when certain IT innovations were introduced to Finnish accounting professionals. It allowed a comprehensive chronological representation to be obtained regarding the advent of different innovations in the field of financial accounting during different decades. *Procedural reliability* (Ryan, Scapens & Theobald, 2002, 155-156) was enhanced by adopting as appropriate and reliable research methods and procedures as possible, and by documenting how the data was collected, produced, and interpreted. *Contextual credibility* of evidence and conclusions drawn (Ryan et al., 2002, 155-156) was enhanced by really trying to capture the phenomenon that we intended to. Regarding the *transferability of findings* (Ryan et al., 2002, 149-150, 155), it may be feasible to apply at least some of our findings in other contexts (e.g., in Nordic and European countries).

3 Analysis of IT innovations in the field of financial accounting

In the first phase of analysis relevant articles had been selected to form our data.¹ Based on the second and third rounds of chronological analysis we identified the following primary IT innovations and phases of development over time, and will discuss them and their meaning in more detail underneath:

- The advent of large and minicomputers in the field of bookkeeping and auditing in the 1970s
- Microcomputers and data transfer innovations in the 1980s
- Internet and electronic data transfer innovations in the 1990s and early 2000s
- Introduction of the Single Euro Payments Area (SEPA) and online tax accounting in the late 2000s
- Net invoicing: a slowly progressing innovation in the 2000s and 2010s
- Projects seeking to develop electronic financial statements and automated financial reporting in the 2010s
- Digi leap: an ideological term in the 2010s

Because financial accounting is a phenomenon regulated by accounting legislation we shall also discuss the IT-related amendments in the Finnish accounting legislation in the following.

3.1 Advent of large and minicomputers in the field of bookkeeping and auditing during the 1970s

Computerization of financial accounting began in the late 1960s and early 1970s, but the historical development was different in big companies and in SMEs. According to our data, big companies already began to purchase large computer devices (Ahtiainen, 1988) during the last years of the 1960s. These big companies used electronic data interchange (EDI) in billing and developed tailored accounting software in their own automatic data processing (ADP) departments in the early 1970s. The first integrated accounting information systems (AIS) were also introduced and some of the bigger firms developed or purchased them (Forsblom, 1973; Vaarimo, 1981). By contrast, manual or Taylorix bookkeeping and bookkeeping machines were still in common use in Finnish accounting firms and in SMEs in the 1970s. (Jaatinen, 2009, 71–75).

In the 1970s, a large number of computer service centres were established by accounting and ADP-companies and banks (Jaatinen, 2009, 72–73). The data input system used perforated cards prior to the introduction of perforated tape and the data were processed in a computer centre. Very few accounting firms had their own computers in the 1970s and at the beginning of the 1980s. They, therefore, used the ADP accounting services provided by computer service centres. (Ahtiainen, 1985; Forsblom, 1973).

Minicomputers also arrived during the 1970s. Their success was largely attributable to low cost, user-friendliness, and the option to access a terminal in the user's own office. With the advent of minicomputers, the cost of creating software applications decreased and numerous software houses entered the market to produce plug-in software (Ahtiainen, 1988). At that time, an issue commonly discussed in the professional journal articles centred on the factors – benefits and costs – influencing companies' decisions to purchase computers and software.

¹ In this section, references primarily refer to the data sources, which are separately listed in chronological order after the list of references in the end of the paper.

There were doubts about the reliability of automatic data processing (ADP) and of those working with it. Hence a great deal of attention was paid in the 1970s to articles in professional journals regarding the risks inherent in ADP accounting. Several articles considered the implications for auditing in cases where accounting was maintained using ADP. (Suoniemi, 1970 and Tilintarkastajalehti 'the Auditor Journal', issue 11-12/1970). A certified auditor wrote in his article on the topic "An auditor and ADP" as follows:

"The auditor has so far managed to audit relatively well without actual ADP expertise... The development in the field, however, is very rapid. During the past few years, the field of applications has widened, and along with integrated information systems, even the auditor has to possess at least good general knowledge of ADP". (Koskelainen, 1971).

Thus, the 1970s also marked the start of a need for ADP knowledge among auditing professionals. The first article in our data examining auditing software was published in 1973. The purpose of the software was to provide auditors with information about sales, receivables, debt collection, current assets, accounts payable, etc. (Nieminen, 1973).

The advent of computers caused a need to amend the Finnish accounting legislation. Until 1974, all accounting documents had to be kept in paper form. After 1974, the Accounting Act (KPL 655/1973) legalized the *preservation of bookkeeping source documents and correspondence* on microfilm but only with permission from the Finnish Accounting Board. Microphotography was new, an innovation for which permission could only be obtained on a temporary basis, and for no more than three years at a time. It was a general condition for being granted permission that the original documents be preserved for at least one year after the end of the calendar year in which the auditing period had ended. (Document issued by the Finnish Accounting Board, 27.6.1974) According to a writer representing the institution for auditing and bookkeeping:

"From the perspective of being amenable to scrutiny the conditions for granting permission have evolved on the basis of the principle that the original documents are not destroyed before the required audit has been accomplished and the closing of the books confirmed. In the case of taxation audits it has also been deemed indispensable to submit the information on direct and indirect taxation and the taxes duly levied. (Tikkanen, 1974).

The phrase used to refer to computerized accounting in the Finnish Accounting Statute (KPA 783/1973, 11 § 1) was "bookkeeping made using machinery methods" or "*machinery bookkeeping*" ("koneellinen kirjanpito"). The legislation of 1973 permits the use of ADP, but in practice, such use was limited by the requirement in law for plain language and original material. This was criticised by members of the Accounting Board in 1978 as follows:

"As bookkeeping entries have been deemed to be entries in written form which can be read without auxiliary equipment the aforementioned rules have constituted an obstacle to automatic data processing and the efficient deployment of IT in accounting." (Nuorvala, Tikkanen, Ikäheimo, 1978)

ADP and IT continued to develop but the legislation limited their dissemination for use in the field of bookkeeping. Therefore, the accounting legislation was reformed again in 1978. The new section of the Accounting Act (KPL 644/1978) defined the machinery methods as punch

cards, magnetic tapes, or the like and made it acceptable to use *computer output microfilm (COM)* either for source documents or for journal and general ledger entries, but the parallel use of computerized preservation was prohibited. The Accounting Act reform in 1978 marked the beginning of *paperless bookkeeping* (“paperiton kirjanpito”) in Finland.

In conclusion, the 1970s meant the first steps from manual bookkeeping towards computerized accounting. This was a decade for the big firms to show the way as the forerunners in developing software and diffusing knowledge of the new ways to organize financial accounting tasks. Legislative reforms in two different phases during the 1970s are an indication of the legislator’s important but initially restrictive role in the use of the IT innovations in bookkeeping and related financial accounting tasks.

3.2 Microcomputers and data transfer innovations in the 1980s

In the 1980s, the use of microcomputers in accounting and auditing was a popular topic in our data throughout the entire decade. In the early 1980s, many accounting firms still did not have their own computers, and accounting was performed in computer centres. Direct terminal connections to the service centres were rare due to associated high process costs. The proliferation of microcomputers began when International Business Machines (IBM) launched the first truly usable personal computer on December 8, 1981. Accounting firms began to acquire their own computers in the mid-1980s. “Why does it make sense for an accounting firm to acquire its own computer?” was a particular issue raised in some articles (e.g. Mäkinen, 1983). One of the articles from the mid-1980s illustrated a concrete example of the dramatic fall in the price of computers by over 90% in 10 years, while the memory capacity increased fourfold.

“Konttorivalvonta [the company represented by the writer] acquired a 16 K RAM-memory computer at a cost of about 120,000 Finnish Marks [ca. 20,000 Euros] in 1975. Today, a 64 K RAM-memory computer costs under 10,000 Finnish Marks (ca. 1,666 Euros).” (Kock, 1984)

As the price of computers began to fall, having one’s own computer became a necessity, often for image reasons. One of the authors representing the computer software business (Data General) wrote in *Tilisanomat* in 1985:

“A traditional business manager talks about his thirty years’ experience and complains about the current circumstances. He has fallen behind the development. Factually, he has only one year’s experience that he has repeated twenty-nine years. In contrast, a dynamic manager relies on the possibilities provided by the information technology. He can and does start new kinds of projects, which offer exceptional possibilities to obtain results. His firm grows by ten per cent per year, while the competitors moan with zero growth and atrophy of profits.” (Ahtiainen, 1985)

Control and auditability of ADP systems were addressed in our data (e.g. Andersen, 1981). A distinction between “ADP auditors” and “traditional auditors” was commonly used in texts during the 1980s (Ahti, 1987). While the development of audit software continued for large computers (Jolkkonen & Köppä, 1985), at first, there was no suitable Finnish audit software for microcomputers, and foreign computer programs could not be utilized (Ahti, 1987). Hence, microcomputers were initially mainly used in writing audit reports and in spreadsheet analysis of financial statements (Ahti, 1987; Luoma, 1984). Spreadsheets, such as Lotus 1-2-3 and Ex-

cel, were utilized. This was referred to as *computer-aided auditing* (Luoma, 1984; Tupakka, 1987; Vahtera, 1988).

Only the largest accounting firms and banks initially developed and used computer-aided auditing; smaller firms could not yet utilize them due to the high cost and lack of know-how (Tupakka, 1987). Computer-aided auditing of small enterprises was first discussed in the 2000s (Gävert, 2006).

In the 1980s, integrated accounting information systems were prevalent in big firms, but other firms were beginning to use standalone software. While the use of various types of plug-in software started in the 1970s, it became more commonplace as firms adopted or renewed their computer systems (Lindroos, 1993).

Data transfer between banks and companies became more common in the 1980s. Data transfer was accomplished in mechanical language form. In 1979, banks began to use *payments with reference numbers*. According to Viitanen's (1987) article, almost 20,000 companies utilized this method. The Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) was developed under the United Nations, providing an international standard for data transfer between companies. The development of the public information net began in Finland in 1989 on the initiative of the Ministry of Transport (Järvinen, 1994; Mäkinen, 1989). The transfer of taxation to ADP systems also commenced in the 1980s. Tax authorities established a task force to plan and implement an information system for corporate tax (Hakola, 1985). (Jaatinen, 2008, 94).

During the 1970s and 1980s, new standards issued by the Finnish Accounting Board aimed to address particular concerns with regard to the misuse of computers and accounting records kept using machinery-based methods. A new section was added to the Finnish Accounting Act (1361/1989, § 8a), *prohibiting the parallel use of computers both in source documents and accounting books*. Either the source document or the accounting entry had to be in readable literal form. This rule came into force in 1990. The same year the Finnish Accounting Board outlined general guidance concerning accounting using machinery methods (The Accounting Board, 15.10.1990).

The Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) was developed by the United Nations in 1985, providing an international standard for data transfer between companies. Yet, for the SMEs in our data, the EDI was introduced first in the middle of the 1990s (Salmi, 1995; Salmi and Vahtera, 1996).

In conclusion, the emergence of microcomputers and the declining cost of computers and software made it economically feasible for accounting firms and SMEs also to use computers for financial accounting tasks during the 1980s. Data transfers and interchange opened up new opportunities for the development of innovations based on public information nets. At the same time, however, there was a major concern about the *misuse* of computers and the *auditability* of ADP-systems in financial accounting. Legislators imposed limits on the parallel use of computers in different bookkeeping tasks.

3.3 Internet and electronic data transfer innovations in the 1990s and early 2000s

The history of the Internet in Finland began in 1982 (Internet Society, Finland Chapter, isoc.fi, 2017). The Finnish State Computer Center's Scientific Calculation Unit, the Ministry of Education, and some Finnish universities were active in developing Internet-based networks in the first half of the 1980s. In 1993, EUNET Finland began commercial sales of Internet connections in Finland (Internet Society, Finland Chapter, isoc.fi, 2017). In 1994, the Finnish Internet Association (Suomen Internet-yhdistys – SIY ry) was founded. Pennanen (1996) was one of the first

authors in our data to describe the Internet and how it can be utilized for payments via banks.

From the late 1980s until the mid-1990s, ten articles in our data discussed the so-called TITO project, i.e. the issue of using bank statements as accepted source documents of the bank payments. The Finnish Accounting Board made several decisions to permit it (Decisions 1114 and 1115/1990). The term “receipt free bookkeeping” was often used in referring to the TITO reform even though the more correct term “bank statement bookkeeping” also was used. On the one hand, the analysed articles revealed concern regarding the possible misuse of computer-assisted accounting as well as the utilization of bank statements as receipts (source documents) (Tuokko, 1989a; Tuokko, 1989b). Such concerns largely centred on the use of microcomputers in bookkeeping. On the other hand, the utilization of bank statements as receipts (source documents) and the Finnish legislation were deemed progressive and innovative solutions (Vahtera, 1989), even on an international scale.

“TITO [use of bank statements as receipts in bookkeeping projects] is still the most progressive in the world... We can be proud that the Finnish legislation regarding the utilization of IT is the most progressive in the world...” (Salmi and Vahtera, 1995)

With the development of technology in the banking sector, payments using bar-coded bank gyros were introduced. It meant that the bank statements replaced the papyry bank transfer forms in 1993.

In addition to the above-mentioned innovations, integrated AIS became more common in smaller firms in the 1990s. Discussions on the use of computers in auditing continued and shifted to computer-aided audit methods (Halonen, 1992) and stages (Turpiainen, 1994) during the 1990s and 2000s. A wide range of audit software became available for both large and microcomputers in the 1990s (Turpiainen, 1994). Some of the articles published were concerned with the risks (Niemi, 1991; Salmi, 1995), security, and confidentiality (Lindroos, 1993) of ADP in accounting and auditing.

Different application services providers (ASP-services) were first discussed during the 1990s (Akselin, 2001). Thus, a firm could outsource the maintenance of its financial administration systems to an external service provider via the Internet. Soon the term ASP disappeared from our data, instead of the terms ‘cloud service’, ‘cloud computing’² and ‘cloud accounting’ came to be in common use. In 2010, several articles (Alhola, 2010; Lähdesmäki, 2010; Remes, 2010) discussed the outsourcing of financial administration and accounting and electronic archiving in order to expedite information reporting and enhance reliability.

The new Accounting Act (KPL 1336/1997) harmonized the Finnish accounting legislation with the 4th and 7th EU Council Directives. Chapter 2 of the Accounting Act, which addresses the procedural regulations for bookkeeping, was not, however, based on the EU Directives. The Finnish legislation allows paperless preservation of all accounting documents except for balance books pertaining to the closing of the books. The law was permissive in its points of departure. It was stated in the justifications for the Accounting Act that due to advances in the development of computers it was no longer necessary to restrict the utilization of computers and other mechanical IT devices (Government proposal, HE 173/1997). Subsequently, companies no longer required permission from the Accounting Board to use electronic methods in

² Cloud computing means storing and accessing data and programs over the Internet instead of a computer’s hard drive (<http://uk.pcmag.com/networking-communications-software-products/16824/feature/what-is-cloud-computing>).

financial accounting.

Another significant step towards electronic financial management was the start-up of the TYVI project in 1996 with support from the Ministry of Finance. Since the late 1990s, services comprising information flows from companies to public authorities (i.e., so-called TYVI services) have made it possible to send notifications electronically to the taxation authorities, to retirement insurance companies, Statistics Finland, customs authorities, etc. Data transfers were taken place by TYVI operators operating between enterprises and officialdom.

Internet afforded opportunities to organize financial accounting and administration in a new and innovative way. Options for the electronic transfer of payments and information between firms, between firms and banks, and between firms and public authorities meant radical steps in moving towards electronic accounting. Also, the accounting legislation allowed the use of electronic methods without permission.

3.4 Introduction of the Single Euro Payments Area (SEPA) and online tax accounts in the late 2000s

Two specific reforms related to the use of the Internet were discussed in our data during the first decade of the 2000s. The first reform concerned the transfer of payments and the second one concerned the online tax account. The Single Euro Payment Area (SEPA) was a joint initiative by European banks, the European Central Bank, and the European Commission to create an integrated euro payment market. The aim of SEPA was to harmonize and speed up European-wide payment transmissions. Several articles discussed SEPA before and immediately following its introduction on May 1, 2010 (Nilsén, 2010; Snellman, 2010). All banking customers, not solely companies, were obligated to adopt SEPA. The legal framework for the SEPA was provided by the EU Commission's Payment Services Directive (2007/6/EU) and was implemented in Finland by new legislation (Finnish Payment Services Act 290/2010 and Finnish Payment Institution Act 297/2010), which came into force in 2011.

At the same time as the SEPA reform, a lively debate ensued concerning the online tax account reform going on in Finland. A tax account is an individual online account that is used to register all taxes and fees paid by a taxpayer. The introduction of online tax accounts was anticipated in articles published during 2009 (Lönnroth, 2009; Heiliö and Järvinen, 2009; Rekola-Nieminen, 2009; Koponen, 2009; Grekin, 2009). In 2010, some articles reported on the initial stage as well as various problems that were, however, rapidly resolved following the implementation of the tax account online system in 2010. A tax account online was again discussed in 2016 because it was replaced by a new system called 'MyTax' in 2017. Clients of the Finnish tax authorities are to transition fully from paper documents to electronic tax returns. As a new innovation, the Finnish employers have to register all the payments to their employees (salaries, wages, per diem, and other allowances) the employee's individual income register system within five days after payment. (Lehtinen, 2017; Järvinen and Korhonen, 2018). Both the online tax account and the income register systems are based on legislation and obligatory for users.

3.5 Net invoicing: a slowly progressing innovation in the 2000s and 2010s

During the 2000s, the Internet facilitated (Inter)net invoicing, thereby introducing a more advanced form of electronic invoicing. Net invoicing was viewed as the core of digital accounting. Some professional journal articles described the preconditions and obstacles that affected net invoicing when streamlining accounting routines at the beginning of the 2000s.

The articles in professional journals included much debate on various standards devel-

oped for net invoicing and archiving (Fredman, 2011; Iivari, 2011; Sipponen, 2000). In addition to the Nordic net invoicing standard, i.e., *eInvoice*, two national net invoicing standards were introduced in Finland: the so-called *TEAPPSXML*, which was developed by a private software company, and the *Finvoice*, which was developed and widely used by Finnish banks (Rytsy, 2015b; Vallenius, 2005).

A further precondition of net invoicing entailed the acquisition of a register of customers who could receive net invoices. Consequently, in the early 2000s, a Finnish association, known as Information Society Development Center (Tietoyhteiskunnan kehittämiskeskus ry, TIEKE), developed a register of companies and their addresses to facilitate the sending and receiving of net invoices. This *eInvoice Address Service* was an important step in the promotion of net invoicing in Finland (Vallenius, 2005).

Sending and receiving net invoices also required specific software, the consent of the receiving company and an operator (Lätti, 2000; Vallenius, 2005). Operators (banks and other IT-service firms) forwarded net-invoices between companies but also information flows from companies to public authorities (i.e., so-called TYVI-messages). Thus the governmental administration outsourced the transfer of electronic TYVI-messages to the operators. (Salmi, 2000)

The rapid spread of net invoicing, especially within business-to-business, was predicted by Vahtera (2002), Vahtera also predicted that by 2010, 90% of business-to-business invoicing would entail net invoicing. This failed to materialize due to various obstacles. Only 4.4% of firms were able to receive net invoices in 2007, and it was estimated that in 2015, only 20% of business-to-business invoices issued in Finland were net invoices (Ojala, 2015; Tallberg, 2015). According to some articles, the lack of a commonly agreed standard was one of the main reasons why the utilization of net invoicing did not develop and spread rapidly.

“Net invoicing would develop very rapidly in Finland, if it were possible to agree on a common invoicing standard recommendation.” (Sipponen, 2000)

Insufficient information content was deemed another obstacle to the use of net invoices. An assessment carried out in 2015 revealed that there were still obstacles within all net invoicing solutions concerning taxation and other obligatory information contents. According to Tallberg (2015):

“The most fundamental reasons for the slow adoption of net invoicing seem to be the following: the quality and utility problems that affect the invoice data files and operator systems and the basic structure of the system.”

Some attempts were made to improve the preconditions for net invoicing. The minimum requirements for the information contents were published at the beginning of 2015. However, one of the studies described the diffusion of the minimum requirements for information content as follows:

“It is not highly beneficial to define the minimum information requirements, if the software companies do not update their invoicing programs, and the senders of receipts do not use the latest version of the message description.” (Rytsy, 2015b)

A total of 18 articles were related to net invoicing in our data during 2000-2019. Titles such as

'Electronic invoicing brings new intelligence to the accounting firm' (Launonen, 2007), 'Paper invoice has no future' (Gedik 2008), 'Net invoicing moves rapidly ahead' (From, 2009) or 'Entrepreneurs encouraged to go for net invoices' (Hurme, 2011) were found in journals published during the 2000s. The latest article on e-invoicing "Adding energy to e-invoicing" (Fredman, 2019) in our data deals with the Electronic Invoicing Act (241/2019) - the e-invoicing law under the EU e-Invoicing Directive, which entered into force in its entirety on 1.4.2020 and guides public administration and companies to electronic invoicing.

3.6 Projects seeking to develop electronic financial statements and automated financial reporting in the 2010s

Electronically produced financial statements were expected to emerge as a standard practice already in the 1990s. However, this failed to occur due to a lack of suitable standard reporting code (Mäkinen, 1999). New and more concrete ideas about automated and real-time accounting were presented in the end of the 2000s. In 2009, *Tilisanomat* (3/2009) published several articles with regard to the development of a standard reporting code for producing all accounting books and reports, including tax returns and other official reports from the same system. This development was part of the *Fully Integrated Accounting project*, the aim of which was centred on the automation of financial accounting processes in real-time. Led by universities, the Association of Finnish Accounting Firms, and a number of firms, the Fully Integrated Accounting project was financed by the Finnish Funding Agency for Technology and Innovation. Fully integrated financial administration was expected to yield cost savings for firms to the amount of one billion euros (Ahvenniemi, 2009; Helin, 2009).

The original version of the standard reporting code used the eXtensible Business Reporting Language (XBRL).³ It was published in 2009 (Koskentalo, 2016), and the first information content of electronic financial statements was published in 2013 (Koskentalo, 2013). The XBRL reporting standard was expected to spread worldwide (Iivari, 2011). The benefits of XBRL pertain to clearly defined concepts and elements that facilitate the comparability of accounting reports for individual business firms (Penttinen and Suosalo, 2012).

In 2014, a project, called TALTIO was established to promote the digitalization of small companies, associations, and companies operating in the housing sector. The development work was based on open-source code and was an extension of the international XBRL Global Ledger standard (Ojala, 2016; Remes, 2016; Rytsy, 2015a; Rytsy, 2015b). The aim of TALTIO was to create a standard model for structured data by defining the format in which invoices, receipts, and financial statement information can be entered into financial management systems without manual data entry. In 2015, Tallberg discussed both the need and attempt to develop a standard chart of accounts in Finland to assist companies in automating their accounting processes. A reporting code was considered as the common standard chart of accounts (Tallberg 2015). In 2016, the development of the reporting code was described as follows:

"This development is based on the idea that a firm should only produce a list of its accounting transactions using the reporting code accounts, and all reports can be produced automatically. However, the list of reporting requirements was not a sufficient solution to the problem. A transfer format that can forward information in electronic form was also needed. The solution was

³ In many countries, e.g., the Netherlands, Denmark and the UK, XBRL reporting was said to be the only acceptable reporting method (Koskentalo, 2013).

the global use of the eXtensible Business Reporting Language (XBRL), which brings business transactions from the analogical world into an electronic, structural form.” (Koskentalo, 2016)

The TALTIO project was led by the Association of Finnish Accounting Firms.⁴The Chair of the Association described the importance of the TALTIO project as follows:

“It is an even larger reform than electronic bank statements or net invoices were at their time.” (Mäkinen, interviewed by Remes, 2016)

Article titles, such as ‘Revolution in the financial management’ (Balanssi 3/2016), ‘Towards more fluent, electronic bookkeeping’ (Tilisanomat 1/2016), ‘Savings of billion euros with the integrated financial management’ (Tilisanomat 3/2009), and ‘Hundreds of millions of savings’ with a standardized electronic financial reporting (Tilisanomat 4/2013) promoted the necessity and advent of the fully integrated accounting. The TALTIO project ended in 2017, and the next project RTECO, Real-time economy ecosystem, led by the Finnish Technology Industries, was established to carry on the development of structured, automated, and real-time accounting including the e-receipt as an addition to e-invoicing. Also, this project has ended, and the heading of the most recent article (Fredman, 2019b) concerning automation of financial management asks: “What next in the XBRL, GL frontier?”

The so-called Financial Accounts 2.0 service for financial reporting in a machine-readable format was introduced in 2016. The Finnish tax authorities and the Finnish Patent and Registration Office had undertaken the task to jointly develop a structural financial statement service using the XBRL format. The aim of this service was to allow firms to automate their official reporting to authorities. The clients of the software houses involved in developing the standard code were expected to be able to provide their income tax returns and financial reports in the XBRL format in the Fall of 2016, when the service was tested (Koskentalo, 2016). However, this did not occur in 2016, but two years later.⁵

Finally, an article by Pelkonen (2018) introduced the European Single Electronic Format (ESEF), which assumes that from 2020 listed European companies report their financial accounts and annual reports in a common electronic form, and the European Securities and Market Authority (ESMA) taxonomy as the chart of accounts as the basis of financial reporting. This was the only article discussing these issues primarily relevant for listed companies only.

3.7 The Digi leap: an ideological term in the 2010s

The most recent phase of digitalization in Finland is based on the Programme of the Government in 2015 (see the Programme of the Finnish Government, *Ratkaisujen Suomi*, 2015, and the Ministry of Finance, *Digitalization*, 2017), the principal e-projects of which consist of the digitalization of public services and the establishment of a digital business environment for growth, re-regulation and experimental innovations.

The concept of digitization or “digi” is a vague concept and has often been applied in varying contexts, in spite of it not always being clearly defined (Linblom, 2015; Tallberg, 2016;).

⁴ <http://taltio.net/hanke>

⁵ Tax authorities and the Patent and Registration Office postponed the introduction of their Financial Accounts 2.0 service because they first wanted to ensure that the technical solution functioned sufficiently well in that service (https://www.prh.fi/fi/uutislistaus/2017/P_10775.html 27.1.2017).

Robotization is concerned with the use of equipment (Linblom, 2015), whereas digitalization reflects changes that may occur when Internet tools are used. Digitalization can be considered a more superior concept talking about electronic or digital financial accounting or the digitalization of financial administration. Terms such as “digital leap”, “digi bee”, “digi-time” and “digi-transition” are considered fashionable terms that are utilized in both everyday language and in financial administration. According to Ryttsy (2015b):

“With a digi leap, we take a long leap forward toward genuinely electronic financial administration and its opportunities. The success of this digi bee requires that all parties are committed to developing the process.”

In the financial administration sector, TALTIO, RTECO, and others were projects striving to fulfill the ideological digi leap, but in practice, the transformation of all the old accounting programs into the XBRL, GL, or other standard form seems to be too difficult or expensive and therefore change to the integrated accounting systems has been much slower than expected (Fredman, 2019a). Even the integration of e-invoicing is a challenge for small and medium-sized firms (Fredman, 2019c).

The latest themes in our data are automation, robotics, and artificial intelligence (Fredman, 2017; Fischer, 2017; Remes, 2018a and 2018b), all of which are tools decreasing the routine work done by human beings. Nevertheless, some of the articles analysed focused on the challenges (Airisniemi, 2016; Alander, 2014) or opportunities of digitalization for auditing. For example:

“The work of auditors and the financial management of clients are digitizing at an accelerating pace. Digitalisation creates opportunities for auditors to develop their audit work and thus bring new added value to clients. Our association is involved in key digital projects and working groups where we highlight the audit perspective and special needs.” (Profitti, 2018).

In the same 2018 issue the Vice Chair of the Board of the Finnish Auditors wrote:

“Nordic auditors are pioneers in digitalization. Nordic auditors are well equipped for the changes brought about by digitalization. The role of pioneer is not always easy, but we like it.” (Grönroos, 2018)

As part of this digi leap, the most recent reform of Finnish accounting legislation in 2015 removed all restrictions concerning the technical form and geographical preservation of accounting documents. Hard copies are no longer required (not even for Financial Statements). The sole requirement stipulates that public authorities and auditors be able to open the documents in Finland without delay (Accounting Act, 30.12.2015/1620, Chapter 2. § 7–9).

4 Synthesis of the results

This study has improved understanding of the historical development of IT innovations in financial accounting and of the accounting legislative reforms that have established limits to and enabled the use of the IT innovations during the past five decades as follows:

4.1 Development of IT innovations in financial accounting

The main findings of this study identify two stages and seven phases in the gradual historical development of IT-related innovations in financial accounting from manual work and paper documents towards digital and automate financial accounting. The period studied of half a century can be divided into the following two stages in development: the time before and after the advent of the Internet. The first stage *computerization of accounting and auditing* from 1970–1988 (see also Jaatinen, 2009) refers to the time before the advent of the Internet and the second stage *electronic/digital financial administration* is based on the use of the Internet from 1989 to the present (see the top of Figure 1). The computerization of accounting describes the first stage. It comprises the following phases: *Advent of large and minicomputers in the field of bookkeeping and auditing in the 1970s* and *Microcomputers and data transfer innovations in the 1980s*. ADP in general and *computerized accounting and auditing, ADP auditing, and computer-aided auditing* were primarily discussed during this stage.

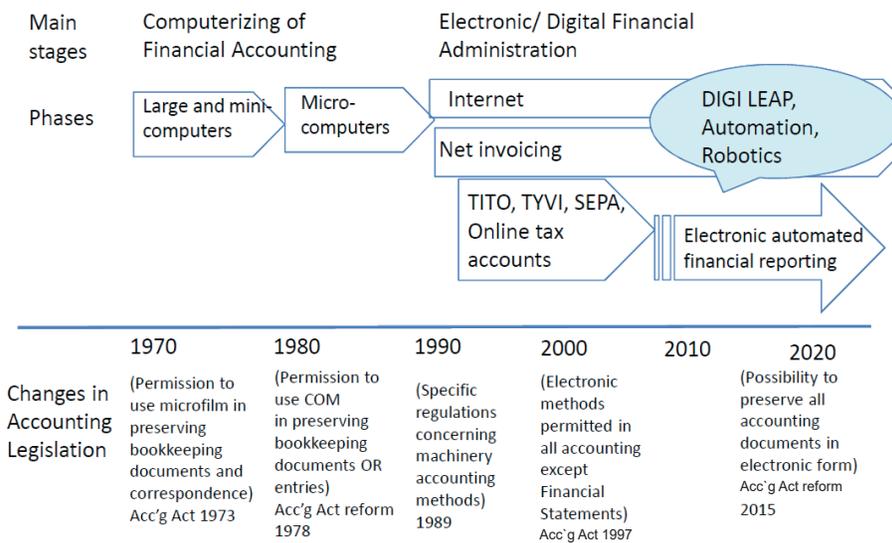


Figure 1. Development of IT innovations in financial accounting in Finland 1970-2020.

The later stage, *electronic/digital financial administration*, entailed the spread of online connections and computerized data transmissions, paperless accounting, electronic invoicing, e-banking, and online tax returns. It was during this stage, and during the past decade in particular, that the frequency and range of IT innovations in financial accounting escalated. As many as five phases describe this period: *Internet and electronic data transfer innovations in the 1990s and early 2000s, net invoicing: a slowly progressing innovation of the 2000s, introduction of the Single Euro Payments Area (SEPA) and online tax accounting at the turn of the 2010s, projects seeking to develop electronic financial statements and automated financial reporting in the 2010s and the Digi leap as an ideological term in the 2010s*

Several new concepts were introduced during this latter stage. The misleading concept of *receipt-free accounting* was introduced and used in the 1990s (referring to the use of bank state-

ments as source documents in bookkeeping). After the mid-1990s, *paperless accounting* was adopted as a key concept (though it was no longer used after the 2010s). At the beginning of the 21st century, the *e-Accounting* concept emerged (partially replacing the concept of paperless accounting) as well as *electronic (net) invoicing*, which has been considered as the core of modern financial administration. *e-Accounting* and *digital accounting/financial administration* and also *cloud accounting* refer to various electronic solutions used in different financial accounting tasks undertaken by firms and other organizations.⁶ The latest concepts are *structured bookkeeping*, *fully integrated* and *automated, real-time accounting*, which will be based on the standardized reporting code (based on an open-source code as an extension to the international XBRL Global Ledger (GL) standard). Consequently, there has been a strong shift towards electronic and digital applications. The current attempts towards automated, real-time accounting would be a digital revolution for accounting practices. The creation of compatible standards and reaching an agreement on these has for decades been a delaying obstacle to the progress of various IT innovations in practice and indeed also to the digital revolution.

4.2 Legislative reforms

The lower part of Figure 1 indicates the main accounting legislative reforms that established limits to or enabled the use of IT innovations in financial accounting. In the beginning of the computerizing of financial accounting stage, the use of computers for bookkeeping and other financial accounting purposes was constrained by legislation. The Accounting Act of 1973 made it obligatory to outline a description of the bookkeeping method ('kirjanpidon menetelmäkuvaus') and restricted the use of microfilm. Only bookkeeping source documentation and correspondence could be preserved using microfilm. For the use of microfilm a permission from accounting authorities (the Finnish Accounting Board) was needed.

The 1978 Accounting Act reform widened the possibilities for the usage of computers in accounting; the use of computer output microfilm (COM) was permitted to preserve *either* source documents *or* bookkeeping entries, but its *parallel use was prohibited* and permission from the Finnish Accounting Board was still also required. In 1990, more specific regulations were developed with regard to bookkeeping using machinery methods. The parallel use of computers for preserving both source documents and accounting books was still prohibited. As such, it was stipulated that either the source document or the accounting entry be in readable literal form. To sum up, from the beginning of computerization in the 1970s up until the latter half of the 1990s, the Finnish accounting legislation imposed limitations on the use of computers for accounting purposes i.e. it was *restrictive* in nature.

Since the 1997 reform of the Accounting Act, the legislation has proved more *permissive* in nature. Possibilities to use electronic methods were extended to all bookkeeping. Both the prohibition of parallel use of electronic source documents and accounting books and the obligation to obtain permission from the authorities were abandoned. Bookkeeping could be paperless to the extent that only the financial statements with notes ('tilinpäätösaineistoon kuuluva tasekirja') had to be preserved in readable literal form.

As part of the Digi leap, the 2015 Accounting Act reform removed all restrictions concerning the technical methods and geographical preservation of accounting documents. All ac-

⁶ Although these terms are often used as synonyms, they differ in this context. For example, with regard to the electronic method, it is sufficient that the data are in electronic form (e.g., in e-mail receipts or pdf files). Thus, it is possible to obtain an electronic invoice by scanning. In contrast, in digital financial administration, data must be converted into a digital format (Mäkinen and Vuorio, 2002).

counting documents could be preserved in electronic form. Therefore, regulations concerning the use of computers and electronic systems in financial accounting in Finland were initially restrictive but are currently very permissive, but so far mostly voluntary. Today, information from limited companies, cooperatives, and other societies to the tax authorities can be sent - as a general rule - in electronic form only (Decision 1020/2019 of the Tax Authorities), and since 2019 the Finnish state administration has only accepted electronic invoices. This is how the Finnish government has promoted the realization of the governmental programme of the Digi leap through its own actions. EU regulation, (the EU e-Invoicing Directive, 2014/55/EU) and the Finnish Electronic Invoicing Act (241/2019), were needed to harmonize e-Invoicing standards and implement large-scale e-Invoicing in practice.

5 Conclusions

The contributions of this study to financial accounting research are both theoretical and empirical. Recent studies have predicted that technology-driven changes will become more prevalent in society (Bhimani and Willcocks, 2014; Roos, 2015 in Guthrie and Parker, 2016) and result in a technological revolution (Arnaboldi et al., 2017). Our results (Figure 1) show that considerable changes have occurred within the past 50 years as well. The first contribution of this study is to identify two stages and seven main phases in how a wide range of IT innovations were introduced in financial accounting in Finnish firms over five decades. They improve understanding of the gradual development of financial accounting from manual work and papyery accounting books towards real-time and fully automated accounting processes and possibly to the use of robots (cf. Lahti & Salminen; 2008; Karika, 2017).

The second contribution of the study concerns the legislative reforms that both established limits to and enabled the use of IT innovations. Initially, from the beginning of the period of computerization in the 1970s up until the latter half of the 1990s, Finnish accounting legislation was restrictive in nature. Since the 1997 reform of the Accounting Act, the legislation has proved more permissive in nature. Overall, regulations concerning the adoption of electronic systems in Finland have been permissive but it seems that they are gradually becoming coercive.

The IT innovations of financial accounting identified in this study have affected accounting practice. One of the implications concerns the role of accounting professionals in business and in society. Bookkeepers, accountants, and auditors have been highly appreciated accounting professionals. Today, either computer replaces their work or it has become very different than earlier. As computers and IT have gradually become an important part of accounting knowledge, it is essential to remain cognizant of the roles of IT, as well as the possibilities IT provides.

The data of this study is limited to accounting laws and regulations and professional journal articles, the latter ones of which are often utilized as a channel for the dissemination of new ideas to the managerial audience (Abrahamson 1991, 1996). While it was possible to identify several primary innovations within financial accounting, other accounting-related innovations – such as Enterprise Resource Planning systems (Granlund and Malmi, 2002; Hyvönen, 2003; Chapman and Kihn, 2009; Lepistö 2015) Internet reporting (Jones and Xiao, 2003 and 2004), ESEF and ESMA taxonomy – were rarely or never discussed in our data. Also, this suggests that the articles reviewed emphasised IT applications for SMEs rather than those for large companies. Despite the aforementioned constraints, the findings of the present study nonetheless provide important insights into the historical development and state of the art of IT innovations, particularly as Finland has been a leading country in terms of the adoption of IT.

Future research may extend the analysis of IT innovations in accounting in several ways. First, comparable research regarding IT innovations in accounting may be conducted across countries. Second, the key actors diffusing innovations could be analysed. Finally, the historical analysis of IT innovations could be extended to management accounting and to large companies.

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