ON THE NATURE AND SCOPE OF DIGITAL ACCOUNTING

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In recent years, a number of concepts related to the use of information technology within financial accounting, such as on-line real-time accounting, eaccounting, digital accounting, Internet reporting and continuous reporting, has emerged in accounting literature, academic journals and popular accounting press. The variety of concepts may cause confusion among academics and practicians, which creates a need to discuss the concepts in more detail. Further, the pace of digitization of accounting and business processes varies within organisations, but would need to be evaluated for instance by the auditor to be able to plan and conduct an audit. By drawing on academic literature and research journals, this article sets out to discuss the characteristics of digital accounting in companies. The article enhances our understanding of digital accounting, and the proposed instrument may be useful for practicians in assessing the current level of digital accounting advancement.

Keywords: accounting information system, digital accounting, electronic data, automated data transmission

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1. Introduction

Accounting has evolved with developments in business and information technology. The mechanization and computerization of accounting is now moving into a new stage, the digitization of accounting. Digital accounting does not as yet have a standard definition (Deshmukh 2005), but is usually referred to as changes in accounting due to computing and networking technologies. The development of Electronic Data Interchange (EDI) and Electronic Fund Transfer (EFT) can be said to be the beginning of the digital exchange of accounting information among trading partners (Deshmukh 2005).

One of the first areas explored by accounting researchers was electronic data processing (EDP) auditing (Sutton 1992). This research was followed by research on Electronic Data Interchange (EDI) and accounting, and/or auditing. In recent years, the implementation and use of ERP systems have given rise to articles discussing the impact of ERP systems on areas including accounting and organisations (for example Booth et al. 1998, Wieder et al. 2006). An increasing amount of research has focused on Internet reporting or digital reporting (for example Lymer 1997, Debreceny and Gray 1999, Bonsón & Escobar 2006). Further, discussions in academic journals concern technologies from computer sciences such as database expert systems, intelligent agents and XBRL/XML (for example FASB 2000, Hunton et al. 2004, Rezaee & Hoffman 2001; Rezaee et al. 2002). The focus of audit research has been on continuous audit and continuous assurance (for example Elliott 1997, Kogan et al. 1998, 1999, Rezaee et al. 2001, 2002; Woodroof and Searcy 2001, Vasarhelyi and Harper 1991). Recently, research articles on the development of the concept Continuous Online Audit (COA) including Continuous Assurance and Continuous Monitoring have emerged (Elliott 2001, Alles et al. 2004, 2005)

In brief, previous and ongoing research considers the transformation of financial accounting or auditing through the application of modern information technology. Focus has been on studying the implications of technology for accounting and auditing, on assessing the functionality and risks as well as studying the financial, behavioural and organisational implications. Less emphasis has been on developing theory and explaining constructs and concepts. Further, it seems as if new concepts have emerged along with emerging information technology and digitization of business processes. However, the variety of concepts may cause confusion and misconception for both academics and practitioners, and this creates a need to discuss the concepts in more detail. Further, the pace of digitization of accounting and business processes has been seen to vary within organisations and companies. Large companies and organisations have been more progressive with new technology whereas small ones seem to be hesitant. The level of a company's digitization of accounting and business processes is however of importance for a number of stakeholders such as suppliers,

customers, auditors and financial institutions involved with the company. For example, an auditor would have to be aware of the level of the company's digitization of the accounting function to plan and conduct his audit accordingly. Alternatively, a supplier might want to send an order confirmation and an invoice electronically.

The objective of this paper is to discuss the concepts and characteristics of digital accounting as well as develop and propose an instrument for assessing the current level of digital accounting implementation in a company. In this paper the concept "digital accounting" will be used as an overall concept including all definitions and concepts mentioned later in the discussion. Digital accounting refers to the representation of accounting information in the digital format, which then can be electronically manipulated and transmitted (Deshmukh 2005). In addition to this, a digital accounting information system is in this article seen as an inter-organisational system because of its capability to electronically integrate a set of companies or organisations.

This article is a theoretical study, drawing on academic literature and research articles, in order to discuss and analyze digital accounting. The analyses are based on the researcher's pre-knowledge of accounting and accounting research, insights and experience gathered through participating in implementation projects, by conducting accounting and auditing work in practice, and through discussions with professionals in the accounting and auditing field.

The remainder of the article is structured as follows. Section Two provides a brief background to the evolution of digital accounting and discusses what digitization of accounting processes may imply in practice. Section Three examines various concepts and describes the nature of digital accounting based on literature. In Section Four methodological issues for the study are discussed. Section Five provides a brief discussion and conclusion.

2. The evolution of digital accounting

For almost 500 years, accounting was a manual process of handwritten entries in journals and ledgers. With the invention of the ENIAC mainframe computer in 1946, a new technology became available for processing accounting data. Mainframe accounting systems proliferated throughout the 1960s, 1970s and 1980s. In 1975, the first microcomputer was developed and by 1980, the first "packaged" software (spreadsheet, word processing and database) for these machines became available (Henry 1997). Since then, technology and software have evolved at an ever accelerating pace and are increasingly used for recording accounting information. The technological revolution has come in the form of personal computers, spreadsheets, faxes, cell phones, e-mail, Internet, online financial reporting, enterprise resource planning systems (ERPs), teleconferences, group systems, expert systems, knowledge management, document imaging and

e-commerce (Stone 2002). Alles et. al (2000:18) emphasize that the major trends in information technology consist of automating procedures, developing more

appropriate information technology-based processes, and replacing analog with digital information.

Deshmukh (2005) regards the development of Electronic Data Interchange (EDI) and Electronic Fund Transfer (EFT) as the beginning of the digital exchange of accounting information among trading partners. The advent of the Internet and e-commerce or

e-business has further challenged the established practices of both business and accounting. Deshmukh (2005) describes the effects of Internet on accounting as follows: utilization of the Internet as a communication medium for the exchange of accounting and financial information, provider of functionality to support selling and delivering products and services, and utilization of the Internet to redesign processes and workflows.

David et al. (1999:9) argue that the scope of corporate systems that are included under the accounting information system (AIS) umbrella is much broader nowadays than the general ledger system and the software that prepare journal entries to feed it. According to David et al. an AIS as a system that aids in processing transactions and in tracking the data that results from such transactions. These systems must also provide performance measurements and include transaction processing systems (such as billing systems), interorganisational systems (such as web-based order systems and electronic data interchange cash receipt processing), and support systems (such as order processing, customer market analysis, and inventory control systems). Further, Elliott (1998:7) suggests a change in the definition of accounting as follows:

"We should define accounting in a way that reflects a future in which enterprise accounting systems will typically be linked over the web, not isolated. Accounting could be defined as the information infrastructure necessary for an entity to achieve its objectives and, linked across all entities, the information infrastructure of the economy."

Scope of Digital Accounting

By considering digital accounting as an accounting information system, this section aims to briefly describe what the digitalization of financial accounting processes can imply in practice. The approach taken will be through utilizing the simple system model shown in Figure 1, even though a company's interaction with business partners and other stakeholders is not considered in the figure.



Figure 1: Accounting Information System (based on Gelinas et al. 2005:23)

Input stage

Input data is captured electronically as a direct data flow from, for example, the sales order as a business event of the enterprise system. Sales orders can arrive via the Internet through EDI, B2B and B2C storefronts or as automated sales force. Input data can also be captured by converting printed documents or characters to a machine-readable form using scanners, bar code readers or optical character recognition. The process of keying in input data is thus eliminated or transferred elsewhere (to the sales department or customer) or the data may be generated by or be the output of another (company's) software or enterprise application. The input data is automatically saved in storage.

Processing stage

The processing stage includes data/information processing and data maintenance. Much of the maintenance, such as adding, deleting, updating and replacing data, is handled by the computer and intelligent agents may be used to check for errors in the input data. However, to some extent manual input and monitoring of the system as well as manual correction or updating of entries still appear to exist. The billing function can be carried out electronically as an electronic invoice and payments made by using credit cards or direct debit arrangements.

Storage

Databases provide the mechanism for orderly storage and retrieval of captured data. In recent years, database management systems, such as data warehousing and data mining, have been implemented in organisations. Data warehousing focus on the collection, organisation, integration and long-term storage of entity-wide data (Gelinas et al. 2005:180). The users can through data warehousing easily access large quantities of varied data. Data mining is used as a multidimensional analytic tools and exploratory technique to explore, aggregate and analyze large data quantities. Further, intelligent agents can be used to refine the search and thus decrease the search time.

Output

The Internet is vastly used as a communication medium for the exchange of accounting and financial information. Further, reports are run automatically by software and saved in files accessible by end-users and management. Ad hoc reporting and reports on demand are increasing.

Users

The transition to digital accounting information systems is not only about having access to the technology but also about using it. Keen (1991:220) stated: ..."it is not the software but the human side of the implementation cycle that will block the process in seeing that the systems are used effectively." Even though new technology may hold all capabilities for the digitization of business and accounting process, the outcome may transpire differently. The interaction of human beings with IT and their involvement in the change process are of significant importance.

The end-users of the technology may be stuck in old habits, work procedures and processes, claiming a need for paper. Based on previous research, factors such as support from management, IT-support, provided training as well as factors related to end-user's age, education level or company's geographical location and size may play a significant role as antecedents when studying technology acceptance and use. Thus, factors related to individuals and organisation would have to be considered and discussed as well with regards to digital accounting and its evolution within a specific company.

(IT-)Environment

Further, the larger technology environment of the company, within which a digital AIS application is developed and used, will affect the overall functionality of digitization of the accounting process. In addition, not only the IT-environment but the existence of IT and the possible interconnectivity with business partners' applications are very important factors affecting the possibility to manage data and information electronically. Further, accounting laws and regulations may constitute important facilitators or constraints to the adoption of new technology. In short, factors affecting the implementation of new technology may be dependent on the technology level of organization or its business partners or on society, regulations and norms.

3. Literature analysis

3.1. Emerging concepts in accounting research and literature

Academic literature and research articles use a number of concepts to associate to the transformation of financial accounting through the application of modern information technology. It appears as if the concepts have been amended and that new ones have emerged along with developments in information technology. In this section, the concepts will be presented and grouped in technology-related and time-related concepts.

Technology-related concepts

Data processing was an integral aspect of accounting prior to the computer, but the type of technology employed was paper. The concept "**on-line**" became popular very early. For example, Bodnar and Hopwood (2001:411, 426-427) used concepts such as *on-line input systems, on-line real-time processing* and *on-line reporting* to refer to "paperless input systems where transactions are input directly into the computer network, and the need for keying in source documents is eliminated."

Debates about a paperless office run high already in the early stages of the computerized era. The use of IT to reduce the amount of paper-based information has been an important theme in the development and use of information systems, but as a concept "paperless accounting" never seemed to have caught on although the advantages and disadvantages of electronically stored data over paper-based data were discussed. Instead the concept of electronic data

management (EDM) was used to describe the handling of electronic documents (Komito 1998, Sprague 1995). Within auditing, Helms and Mancino brought forward the concept "paperless auditing" including EDI, imaging systems and similar technologies where source documents are in electronic form (Helms and Mancino 1998:48).

It would seem as if the term "*electronic*" has been very popular in describing the transition from data on paper to data in electronic form. The term "*electronic*" is in the Encarta Dictionary defined in the computer context as: "relating to computer, using computer, or accessed through a computer network, e.g. the Internet." Along with the development and utilization of computer technology, a number of constructs using the term electronic has emerged in the last twenty years, for example EDP (Electronic Data Processing), EDI (Electronic Data Interchange), EDM (Electronic Data Management),

e-business and e-commerce, e-mail (electronic mail), electronic publishing and electronic communication. In accounting the term would consequently be electronic accounting or e-accounting. However, until now this concept has not been used very often in academic journals for conceptualizing the change in accounting, but can be found in popular accounting press. For instance, Bland (2002) uses the wordings "e-accounting" in an article when discussing emerging technology in accounting.

Another term used within this context is "digital". According to the Encarta Dictionary digital is defined as "representing data as numbers: processing, storing, transmitting, representing, or displaying data in the form of numerical digits, as in the digital computer." Computers are digital machines processing encoded digital data in a series of zeroes and ones. The opposite of digital is analog, which is the way humans experience the world. In the accounting context digital is for instance used in the name of the academic journal: International Journal of Digital Accounting Research, which has published articles electronically since 2001. It may seem as if the trend moves towards the use of the term digital. For example, in recent articles by Vasarhelyi (2006) the concept "digitization of business processes" has been used in the same way as previous research articles gave as "electronization of business processes" (Vasarhelyi and Greenstein 2003). Quite often the terms "electronic" and "digital" have however been used synonymously in published research articles referring to the changes taking place in, for example, accounting practice, in processes and in the type of data media used.

The emergence and utilization of the Internet in business and accounting created new concepts. One of the concepts is *Internet reporting*, which is described as corporate financial reporting using the Internet (Xiao et al. 2002), and primarily means presenting at least some financial information for the public on the Internet.

Time-related concepts

Alles et al. (2000:14) noted in 2000 that the globalization of financial markets and increasingly specialized demand for business information will challenge

traditional accounting and reporting models, but will also likely increase the demand and value of the right information presented to the right consumer at the right time. In a similar way, Rezaee et al. (2000) pointed out that traditional, paper-based accounting systems that showed financial position and results of operations for time periods in the past increasingly seem to be out of synchronization with current practices in the information age. Further, Alles et al. (2000) emphasizes that there will be a need for real-time interpretation of the flood of information. The term "*real-time*" existed however already in 1981 when Hicks & Leininger (1981: 172) writes about the real-time computer system as follows: "It can immediately capture data about ongoing events or processes and provide the information necessary to manage them. Consequently, at that point in time, the data in real-time master files should accurately reflect the status of the variables they represent."

Rezaee et al. (2000) use the concept **online**, **real-time accounting** (*RTA*) and state that as "many economic events are now being captured, measured, recognized and reported electronically, without any paper documentation; an online, real-time accounting (RTA) is emerging as the system of choice." In another article by Rezaee et al. (2001), the authors describe the concept real-time accounting (*RTA*) systems as follows:

"Under real-time accounting (RTA) systems, much of the financial information and audit evidence are available only in electronic form. Traditional source documents such as purchase orders, invoices, and cheques are replaced with electronic messages, and underlying accounting data (e g. journals, ledgers, and schedules) are in electronic forms or files."

Another time-related concept that has been used in academic journals for indicating the need for faster reporting, in pace with the emergence of business events, is the concept "*continuous reporting*" (for example Hunton et al. 2004). According to Elliott (2002:140) continuous reporting means "making digitized information available through electronic channels simultaneously with its creation".

The term "continuous" has also been widely used within auditing. According to CICA/AICPA (1999) a continuous audit is "a methodology that enables independent auditors to provide written assurance on a subject matter... using a series of auditors' reports issued virtually simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter." Alles et al. (2004) further note that continuous auditing includes continuous control monitoring and continuous data assurance.

Andersson (2002) argues that the new business reporting model is online, realtime disclosure. It is also performance measurement based. He argues further that users today want "*data on demand*", in formats that allow quick access and analysis to help make better decisions to fulfill their demands for more relevant, up-to-the-minute information. Elliott (2002) emphasizes that the next generation of business reporting is investors having direct access to corporate databases over the Internet and thus being able to specify the information they require and the format in which it is to be presented.

3.2. Nature of Digital Accounting

It would be seen that the various concepts in use describe and relate to the nature of digital accounting. By drawing on academic literature and research journals, this section attempts to interpret and understand the underlying principles of digital accounting system compared to a paper-based accounting system. A summary on the comparison is provided in Table 1.

One of the main characteristics of digital accounting is that the technology in use is IT-related, not paper-based. Along with development, various kinds of technology have been implemented in accounting to capture, measure, recognize, and report economic and business events. As innovation of new technology is an on-going process, the implementation of new technology into the accounting domain would be excepted to continue in the future. This also implies that the level of standardization of technology and work-related procedures are still in the development phase. Further, the implementation and utilization within companies and in different processes seem to vary considerably, thus implying different stages of digitization of accounting processes.

Another feature of IT-based accounting processes is the automatic transmission of information and data on operating activities directly into the accounting system through the use of integrated software solutions (IFAC 2002:8). Previously, the accounting information system (AIS) was a separate software or system, whereas the AIS today can be seen as a sub-system to the overall (management) information system (Gelinas et al. 2005) or an enterprise system linked over the Internet, across entities and not isolated (Elliott 1998). As a result, the accessibility to data and information from almost anywhere in the world and at any time has been seen as an advantage in the global business environment.

The data processing tasks were early superseded by the computer and this feature is not new to digital accounting, but speed and the processable data amount have increased over time. Data is stored, instead of on paper, on electronic data media in huge databases and accessed by computer tools electronically. Controls have to some extent existed in computer software previously, but the system and user controls have been further developed and still need to be developed within digital AISs. The focus of academic research has been very high on controls and concepts such as data assurance services and monitoring.

The work tasks carried out by professionals within accounting have and will change from routine based to more consultative. Hunton (2002:67) argues that as many traditional accounting tasks dealing with recording and processing of accounting transactions can be reliably automated, "an accountant's worth is now reflected in higher-order critical-thinking skills, such as designing business

processes, developing e-business models, providing independent assurance, and integrating strategic knowledge." Furthermore, Hunton stresses the importance and emergence of e-work, where professionals may work from anywhere.

Table 1: Comparison between Paper-based and Digital Accounting		
	Paper-based Accounting	Digital Accounting
Technology in use	paper	digital, electronic data media
Level of Maturity in Technology	stable, mature	on-going development
Level of Standardization	high	under development
Interconnectivity	separate, stand alone system	software integration, inter-organisational systems
Data/System Accessibility	limited to time and place	online, web-based access, not limited to time and place
Data/Information transmission	manually	automated data/info flow within system or between modules and systems in integrated systems
Data processing	manually	by computer software
Data/Information Up-date and Reports	periodic, details limited to reports	real-time, continuous, on-demand (Internet), details according to input data
Controls	manually	system-based, manual monitoring, assurance
Data Storage	paper-based	digital, large quantities
User	routine tasks, transaction processing	consultation tasks, operational control, e-work

4. Instrument (Index) Development

One aim of this study is to develop and propose an instrument for assessing the level of digital accounting in companies. At present, an instrument for measuring the level of digital accounting is not available. The proposed, continuously developed instrument may be found in Appendix 1. This section sums up some considerations related to the instrument construction and development phases.

The proposed instrument will be developed in three phases. The first step will be to identify the variables that will comprise the surrogate for the construct "level of digital accounting". In this first, on-going phase, the initial items have been developed from an extensive review of the literature. Further, open-ended interviews with accounting professionals were conducted in 2005 and 2006 for a previous study. A content analysis was conducted on the transcribed texts to find important issues for the instrument. Further, feedback on the instrument has been received from colleagues and accounting professionals. Based on feedback and comments, changes and modifications have been done and the work will still be continued for some time. In the second phase (scheduled for autumn 2007), the aim is to test the instrument with empirical data in order to evaluate the construct validity of the measurement. During the third phase, the instrument will be further tested and evaluated with empirical data.

According to Bollen & Lennox (1991), the creation of an index should be based on the use of formative (cause, causal) indicators, e.g. observed variables that are assumed to cause a latent variable, is this context the level of digital accounting. Guidelines for constructing indexes based on formative indicators appear to be hard to find. However, inspection of the dispersed literature on formative indicators reveals that four issues are critical to successful index construction: 1) content specification, 2) indicator specification, 3) indicator collinearity, and 4) external validity.

The first issue in index construction is to specify the scope of the latent variable "level of digital accounting", e.g. the domain of content the index is intended to capture. This was done through extensive literature studies, and the outcome is to some extent included in previous sections of this article. Because under formative measurement the latent variable is determined by its indicators (rather than vice versa), "breadth of definition is extremely important to causal indicators" (Nunnally & Bernstein 1994, p. 484), and failure to consider all facets of the construct will lead to an exclusion of relevant indicators. Thus, relevant indicator specification is of utmost importance. Further, an issue particular to formative indicators is that of multicollinearity. Excessive collinearity among indicators makes it difficult to separate the distinct influence of an individual variable on the latent variable. Finally, the very nature of formative measurement renders an internal consistency perspective inappropriate for assessing the suitability of indicators. From a theoretical perspective, elimination of indicators carries the risk of changing the construct itself., and from a practical perspective, an excessive number of indicators is undesirable because of both the data collection demands it imposes and the increase in the number of parameters. At a basic level, to obtain an initial idea of the quality of individual indicators, each indicator could be correlated to another variable (external to the index), and only those indicators that are significantly correlated with the variable of interest would be retained (see Spector 1992).

Further, it would have to be decided whether each of the variables may take a value of 1 or 0 (Yes /No) or whether there will be a weighting of the variables. In order to use a weighted index and to obtain the correct weighting coefficients, it would be necessary to first identify the relative importance of each construct

category. At the moment the choice made indicates an index by simple aggregation, in such a way that the value of the index utilized is the result of summing the scores assigned to each category of information.

In previous research the evolution or maturity level of information systems (IS) has been investigated using a stage model. The initial fours stages: initiation, contagion, control and maturity, have later been modified to six stages (see Nolan 1973, 1983). This stage model has been used and modified in various contexts, for measuring IT maturity (for example Karmi et al. 1996) and EDI maturity (Saxena & Wagenaar 1995). In the article concerning EDI maturity the three main stages suggested are: discovery stage, operational use stage and strategic use stage. As digital accounting in this study has been seen to emerge along with development in technology and business and major international variations appear to exist, the development could be seen as an evolutionary process and the stage model has thus been regarded a useful approach.

5. Discussion and Conclusion

This article provides a review of the foundations for and nature of digital accounting. It is suggested that emerging concepts in accounting literature and academic journals have evolved along with information technology. The concepts were examined as and grouped into technology- and time-related concepts. Further, it appears as if the concepts have been amended with the development in information technology and utilization of technology within the accounting and business processes.

Digital accounting refers to the representation, transmission and manipulation of accounting data and information in digital format. The nature of digital accounting may be characterized by easy accessible and retrievable data through utilization of computer-based technology, networks and integrated systems, system-based and automatic controls, real-time continuous reporting and on-going, continuous development.

As companies and organisations appear to employ a variety of systems and technologies, an instrument for assessing the current level of digital accounting implementation in a company will be useful for various stakeholders such as auditors, suppliers and customers. The initial instrument was developed from an extensive review of the literature, and a content analysis of open-ended questions posed to accounting professionals during interviews in 2005 and 2006. The instrument (index) is based on four broad categories or dimensions: technology, processes, people and environment. The proposed instrument is still under development, which is a limitation of this paper. Further, it has not yet been tested empirically which means construct validity cannot be established.

A final interest of this study lies in its foundation for future research; having identified the critical categories and factors in the instrument, the next stage is to apply it to practice and to measure the index value and efficiency. Further

research in this area is currently under way. Finally, since technology change, it would be necessary to re-evaluate the index in the future.

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APPENDIX 1

INSTRUMENT FOR ASSESSING THE LEVEL OF DIGITAL ACCOUNTING

ENVIRONMENT AND BUSINESS Country Industry Business size Laws and regulations

PEOPLE (& USE)

Amount and frequency of end-user system use Number of hours connected to system _____ Number of functions /records / reports accessed _____

Nature of use Mandatory – voluntary

Status of utilization of digital accounting technology Under development Pilot Partly in use, processes _____ Certain processes: _____ Full adoption and use

TECHNOLOGY

Nature of accounting system Manual Manual and Computer Computerized Enterprise System (integrated system) Enterprise Application Integration (EAI)

Existing, utilized hardware and software in accounting processes Database Data warehousing, Data mining Intelligent agents EDI Bar-coding OCR Scanners EDM E-Invoicing Credit card payment, E-payment, Direct Debit Agreement E-Commerce, e-business CRM, SCM, KMS

PROCESSES

Nature of data in-/outflow Manual Manual and automatic Fully automatic (direct flow) Standardized (EDI, XML, XBRL)

Nature of data processing Batch Online batch Online real-time