Aalto University
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XBRL and the Qualitative Characteristics of Useful Financial Statement Information

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ABSTRACT
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Purpose of the Thesis

The purpose of the thesis is to explore, identify, describe and evaluate technological and accounting issues and problems and their potential solutions that are related to the eXtensible Business Reporting Language (XBRL), together with providing some further research ideas.

Research Methods and Data

The thesis is conducted as a literature review of scientific journal articles and working papers. XBRL has emerged as a solution to many so-called "wicked" problems related to financial reporting in the Internet, a field where little theoretical understanding can a priori be taken for granted, and where pragmatic problem-solving procedures are needed to develop a solution that can be adopted for general use. The review follows the phases of a constructive Design Research process. Technological and accounting issues are discussed and evaluated at each phase, with the qualitative characteristics of useful financial statement information, relevance and faithful representation as the two fundamental qualitative characteristics and comparability and understandability as the most pertinent of the enhancing qualitative characteristics, used as the main accounting evaluation criteria.

Results

The results indicate that there still remain many types of significant technical deficiencies in the first officially filed XBRL financial statements. Moreover, XBRL seems to bring in new types of deficiencies, which jeopardize the faithful representation objective of financial statements. Consequently, new types of assurance assertions and procedures are being developed. The flexibility of both accounting standards and XBRL taxonomies seem to lead to severe interoperability and accounting comparability problems, which might be mitigated by for instance adopting strictly template-based accounting standards. Tentative results indicate that XBRL does enhance the usefulness of financial statements by making them more understandable to users, thereby helping them make better investment decisions. The mandatory adoption of XBRL seems to have affected market information conditions in many countries somewhat, but it has not been established yet that XBRL would be affecting the content or relevance of the financial statement information itself. XBRL is viewed by many constituencies as an enabling technology in a longer-term shift from a paper-based to electronic financial reporting paradigm. At present, however, XBRL can be viewed as a regulator-driven infrastructure project, and affordable end-user software will probably be needed for its adoption and acceptance among the investing public. Europe and Finland are lagging behind in introducing XBRL, which may actually help in the end by enabling learning from the mistakes of others.

Key Words

XBRL, harmonization and standardization, interoperability, comparability, interactivity, understandability, faithful representation, relevance, Design Research

AALTO-YLIOPISTON KAUPPAKORKEAKOULU TIIVISTELMÄ
Laskentatoimen tutkielma 20.4.2012
Klaus-Johan Lindfors

XBRL JA HYÖDYLLISEN TILINPÄÄTÖSINFORMAATION LAATUOMINAISUUDET

Tutkimuksen tavoitteet

Tutkimuksen tavoitteena on kartoittaa, tunnistaa, kuvata ja arvioida XBRL-kieleen (engl. eXtensible Business Reporting Language) liittyviä teknologian ja laskentatoimen alojen näkökohtia ja ongelmia ja niiden mahdollisia ratkaisuja, sekä esittää ajatuksia jatkotutkimuksia varten.

Tutkimusmenetelmät ja aineisto

Tutkimus toteutetaan kirjallisuuskatsauksena, jossa tarkastellaan pääasiassa tieteellisiä artikkeleita ja työpapereita. XBRL-kieli on muodostunut yritysten Internet-raportointiin liittyvien monien niin kutsuttujen ”häijyjen” ongelmien ratkaisutavaksi, jollaisissa ennalta määrättyjen teoreettisten ratkaisumallien olemassaoloa ei voida pitää itsestään selvänä, vaan tarvitaan käytännönläheisiä ongelmanratkaisumenetelmiä. Tutkielmassa noudatetaan konstruktiivisen Design Research -prosessin vaiheita, joissa kussakin tarkastellaan ja arvioidaan sekä teknologisia että laskentatointa koskevia XBRL-kieleen liittyviä näkökohtia. Laskentatoimen osalta arviointiperusteina käytetään hyödyllisen tilinpäätösinformaation laatuominaisuuksia, tärkeimpinä merkityksellisyys ja todenmukainen esittäminen, joita puolestaan tukevat vertailukelpoisuus ja ymmärrettävyys.

Tulokset

Tutkimusten mukaan ensimmäisissä virallisissa XBRL-tilinpäätöksissä näyttää olevan vielä monenlaisia huomattaviakin teknisiä virheitä. XBRL-kieli näyttää synnyttävän myös uudentyyppisiä puutteita, jotka vaarantavat tilinpäätöstietojen todenmukaisen esittämisen. XBRL-kielisiä tilinpäätöksiä varten ollaankin kehittämässä uudentyyppisiä varmennettavia väittämiä ja menetelmiä. Tilinpäätösstandardien ja XBRL-taksonomioiden joustavuus näyttää johtavan vakaviin yhteentoimivuus- ja vertailukelpoisuusongelmiin, joita voitaisiin ehkä lievittää ottamalla käyttöön tiukan mallipohjaisia tilinpäätösstandardeja. XBRL-kieli näyttää alustavasti auttavan käyttäjiä ymmärtämään tilinpäätöksiä parantaen näin heidän tekemiensä sijoituspäätösten laatua. XBRL-kielen pakollinen käyttöönotto on joissakin maissa vaikuttanut arvopaperimarkkinoiden epäsymmetriseen informaatioon hieman, mutta sen ei vielä ole osoitettu vaikuttaneen itse tilinpäätösinformaation sisältöön tai merkityksellisyyteen. Monet merkittävät tahot pitävät kuitenkin XBRL-kieltä teknologiana, joka pitkällä aikavälillä mahdollistaa siirtymisen paperipohjaisesta elektroniseen tilinpäätösraportointiparadigmaan. Vielä nykyisin XBRL-kieltä voidaan kuitenkin pitää markkinavalvojien vetämänä infrastruktuurihankkeena, ja sen tuleminen laajojen sijoittajaryhmien hyväksymäksi edellyttää todennäköisesti edullisten, loppukäyttäjille suunnattujen ohjelmistojen tuloa markkinoille. Eurooppa ja Suomi ovat jäljessä XBRL-kielen käyttöönotossa, mutta tämä voi lopulta auttaa oppimaan muualla tehdyistä virheistä.

Avainsanat

XBRL-kieli, harmonisointi ja standardointi, yhteentoimivuus, vertailukelpoisuus, vuorovaikutteisuus, ymmärrettävyys, todenmukainen esittäminen, merkityksellisyys, Design Research

XBRL AND THE QUALITATIVE CHARATERISTICS OF USEFUL FINANCIAL STATEMENT INFORMATION

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1. INTRODUCTION

For about half a century now, general advances in information technology (IT) and telecommunications (collectively known as ICT) have been implemented by western companies, and used for providing tools and automation for many common business needs. The corporate accounting and finance function has not been spared from these changes. As far as investors and listed companies are concerned, the Internet has been the primary distribution channel for financial statements and related reports for more than a decade. Providing financial information in the Internet is nowadays legally required for Finnish listed companies. Their financial statements can be found at their home page, generally in the pdf file format developed by Adobe Systems, Inc. - a facsimile of the traditional annual report printed on paper. Financial statement users such as analysts and investors now have access to the latest financial statements of virtually any listed company in the world at their fingertips.

Debreceny and Gray (2001) divide the activities of analysts and other financial statement users into two major tasks, mechanics and analysis. Human users have cognitive and time constraints, which limit their ability to process financial statement information. The time spent on the mechanical tasks limits the time and resources available for analysis. It should be clear that it would be beneficial to automate the mechanics by making financial statements computer readable. Or interoperable, to use the current term. Interoperability is defined as the ability of systems to exchange and make use of information in a straightforward and useful way (Oxford Reference Online, 2012). This is enhanced by the use of standards in communication and data format. In other words, interoperable data is data that can be transferred from one information system to another without conversions.

Moreover, Debreceny and Gray (2001) claim that despite the advances in technology, analysts and investors must nowadays spend more time on Internet-related mechanics because of the problems inherent in retrieving information from the Internet. They classify these problems into three categories. First, resource discovery problem means the difficulty

in locating the business information, which includes finding the appropriate company web site and locating the investor relations section and the page that contains the financial statements. The second problem, attribute recognition, means that the financial statement information must be formatted and presented in a way that enables identifying and interpreting all the appropriate financial information items in a semantically meaningful way. At least two types of solutions have been proposed to deal with the attribute recognition problem, using advanced computer technologies, such as artificial intelligence or machine learning, to "interpret" financial statements in the existing file formats, or design a special computer language - the eXtensible Financial Reporting Language (XBRL) - for providing information about the financial statement items embedded in a new file format. The third, problem is the question of suitability of the financial statements themselves, prepared complying with accounting standards, for interoperability (the standardization problem). Because this last problem area can be expected to be the most interesting one for accountants, it has a separate focus all along the study.

The topics are highly current considering some trends in the USA, Europe and a few other countries, which use or are introducing the International Financial Reporting Standards (IFRS). Listed firms around the world are subject to dozens of different accounting regimes, and each of the standards allow (or even require in order to give a true and fair view) for several choices in reporting basically the same economic issues. Moreover, there are industry- and company-specific inconsistencies in the way companies apply the standards in practice. Due to the internationalization of the operations of companies and the globalization of capital markets, there is an on-going convergence between the US GAAP and IFRS, which has already led the US Securities and Exchange Commission (SEC) to accept IFRS financial statements of foreign firms listed in the USA without reconciliation with the US GAAP.

A significant event concerning the introduction of XBRL was the decision by the SEC (2009) to require mandatory filing of XBRL financial statements, in force for largest listed companies since June 15th, 2009 and later phased in for smaller listed companies and for companies allowed to file IFRS financial statements. The latter are required to file XBRL financial statement for fiscal years starting on or after June 15th, 2011. This means that a large number of IFRS financial statements are required to be filed in the XBRL format at the time of writing of this study, spring 2012. In the European Union, preparations are under way: the Committee of the European Securities Regulators (CESR) issued a call for evidence

in 2009 to its constituents concerning the matter, and received mostly favorable comments (CESR 2009). XBRL taxonomies for the US GAAP and IFRS are now being published annually, there exist XBRL taxonomies such as IFRS for SME's and Global Reporting Initiative, US and European banking supervisors already require certain reports in XBRL (Finanssivalvonta, 2006), the SEC requires mutual fund reports to be filed in XBRL, to name but a few recent events (SEC, 2008). An XBRL version has even been developed to support the General Ledger.

However, apart from the work done by Prof. Tallberg in the Swedish School of Economics in Helsinki a few years ago, XBRL and interoperable financial statements have not been studied much in Finland. This may be changing, though, as the Aalto University seems to be getting involved in XBRL (Aalto-yliopiston Kauppakorkeakoulu (in Finnish), 2011). For a good reason, because for example the American Institute of Certified Public Accountants (AICPA, 2008) views XBRL as one of the cornerstones in a wider, longer-term paradigm shift from paper-based financial statements and other backward-looking reports towards an enhanced business reporting (EBR) content and practice that is more transparent, timely, forward-looking and relevant, and also necessitates changes within the assurance standards and practices.

Even though XBRL has been developed to support financial reporting, few studies have addressed it with a coherent view to broader financial accounting issues, so an evaluation of its relationship to a few concurrent developments in these may be worthwhile. *The focus and purpose of this study is to explore, identify, describe and evaluate the technological and accounting issues and their potential solutions that are related to XBRL, together with providing some further research questions*. This study is an exploratory literature review along the lines discussed in part 5.2.1 of Ghauri and Grönhaug (2005), aiming at providing a coherent view into this emerging field of research. Bearing in mind that the field is in fact multi-disciplinary, I use the Debreceny and Gray (2001) classification for sorting the technological issues. I found it useful to arrange the review and evaluation of financial accounting issues related to XBRL around the qualitative characteristics of useful financial information laid down in the Conceptual Framework for Financial Reporting, published in 2010 by the International Accounting Standards Board (IASB). The fundamental qualitative characteristics are relevance and faithful representation. Comparability and understandability are here the most significant of the enhancing characteristics.

Due to the multitude of problems and solution approaches drawn from numerous academic fields, such as financial accounting, computer science, perception psychology, and linguistics, financial reporting in the Internet and interoperability can be treated as a so called "wicked" problem, a problem without a single accepted formulation and without trivial solutions. Wicked problems can be approached in a pragmatic way to find solutions that work (Melles, 2009). In order to bring some order to the chaos in the multi-disciplinary literature, I draw from the Design Research (constructive) approach discussed in Kanellis and Papadopoulos (2009) and Kasanen et al. (1993). Both have a philosophical background in the new incarnation of the so-called American pragmatism from the turn of the 20th century. The essence of both approaches is a stepwise pragmatic problem-solving procedure, where problems are identified and solution candidates developed and evaluated until a useful new artifact for a solution has been developed and implemented, with some new research issues possibly identified. In this study I treat XBRL as the solution candidate. Though I make no attempt to develop any solutions myself, this approach allows discussing both technological and accounting aspects of this wicked problem and XBRL as its solution candidate side by side, taking both aspects through the problem-solving phases.

Most of the studies I review seem to come from the United States, though some of them come from Europe and other parts of the world. The particular accounting standards used in the studies seem to vary, but the US GAAP and IFRS are the most common. However, a few of the interesting results have been obtained in studies where the XBRL taxonomy is based on another reporting standard. Due to the relative newness of the subject, many of the more interesting studies are still at a working paper status and have not been published in academic journals, so I try to keep cautious and indicate this.

The way to solve the resource discovery problem has turned out to be providing the documents in a single central database. By now it is safe to say that XBRL has emerged as the solution to the attribute recognition problem, because attempts to solve the problem by using automated software tools to interpret and recognize attributes from financial statements already available in text file formats have not been found feasible. The studies about the technical correctness of the XBRL instance documents have demonstrated that, at least until present, the XBRL financial statements filed to regulator databases were still far from being reliable enough to be trusted. Studies about the degree of fit of XBRL taxonomies to actual reporting practices of firms indicate that though the standard XBRL taxonomies provide a reasonably good fit, the fit is not even close to perfect, unless the underlying

accounting standard itself has strict reporting template requirements. Preparers can extend the taxonomy to accommodate their specific reporting needs, but this leads to severe problems with interoperability and accounting comparability between firms. Ways to overcome these problems are being researched in the so-called semantic web field.

XBRL will affect all of the qualitative characteristics of useful financial information. Faithful representation will be affected by XBRL, because the language introduces numerous new sources of potential technical deficiencies in addition to the traditional ones more familiar to auditors and accountants, and because the users are therefore expected to demand XBRL-related assurance in order to be able to trust the XBRL reports. XBRL also brings another dimension to accounting harmonization and comparability. As long as there is flexibility in the accounting standards themselves, and as long as financial statement preparers can extend the standard XBRL taxonomy to fit their particular needs, there will be interoperability problems that severely limit the comparability of XBRL financial statements. However, ways to overcome these problems are being researched. There is support for XBRL being able to make financial statement information more understandable for users. The studies reviewed showed that, compared to other file formats, XBRL does seem to improve the acquisition, assimilation and integration of financial statement information into decision making, and thereby the decision accuracy and efficiency of the users. XBRL may also reduce the need for the changes proposed by the FASB and IASB to the presentation format of traditional static financial statements. It may be premature to say that XBRL will improve the value relevance of financial statements. However, at least one study did find the XBRL filings in the voluntary filing program value relevant, and a couple studies found that XBRL filings helped reduce information asymmetry and risk on the markets. It remains to be seen, whether the vision of a new electronic financial reporting paradigm (such as the Enhanced Business Reporting (EBR) described in AICPA, 2008) with XBRL as an enabling infrastructural technology will become reality and bring changes to the required or voluntary disclosure of the financial information itself.

Chapter 2 provides more information concerning the background of the subject area, a description of the scientific approach adopted and a discussion about both technological and financial accounting problem areas identified so far. Chapter 3 introduces some of the suggested solutions for the technological and accounting problems, and Chapter 4 attempts a critical evaluation of the solutions from both a technological and an accounting angle. Chapter 5 summarizes and concludes and provides some suggestions for further research.

2. BACKGROUND, PROBLEMS AND METHOD

2.1 Background

General advances in IT and telecommunications have for about half a century been implemented by western companies and used for providing tools and automation for most common business needs. For instance, in addition to using IT for handling highly diverse company-specific needs, companies have recently been streamlining their business processes and organizations by implementing general Enterprise Resource Planning (ERP) software packages.

The corporate accounting function has not been spared from these changes. On the contrary, computers and bookkeeping software have existed for decades now, and modern IT solutions, involving technologies such as spreadsheets, databases, personal computers (PC), client-server architecture, the Internet, application service providers (ASP), ERP, and others, have brought new tools for accounting and finance, greatly enhancing the efficiency, speed, timeliness, and quality of both internal and external financial reporting, while fractioning its costs and manpower needs (Granlund and Malmi, 2004). Indeed, accounting as one of the non-core corporate functions has traditionally been a leading one to introduce new information systems. In principle, ERP and accounting technologies are nearing the capability of online continuous reporting, where an adequately equipped large listed company could, if needed, close its books and publish its financial statements at the end of each business day.

2.1.1 Financial Reporting and the Internet

In addition to the benefits realized in the production of financial information, the above trends have greatly influenced the reporting, distribution and use of financial data. Here, like in so many other areas of business and life, the Internet has been a most influential technological trend over the last fifteen years or so. In Finland, for instance, companies have for a long time been able to file many of their mandatory reports, such as tax returns, payroll withholding tax reports, and reports to pension insurance companies electronically over the

Internet. According to the Finnish Financial Supervisory Authority (2010), the EU Transparency Directive requires that member states of the European Union ensure a central storage of published information (an officially appointed mechanism for storage of regulated information, OAM). The aim is to build a Europe-wide network of these storages (OAM's) serving investors. In Finland, NASDAQ OMX Helsinki Ltd maintains a national release storage (OAM) in accordance with the Directive. Moreover, even most unlisted companies in Europe are required to file their annual accounts with a central national registration authority (Wymeersch 2008). In Finland the authority is called National Board of Patents and Registration, which has begun to receive financial statements directly from the tax authorities (National Board of Patents and Registration (2008)). Financial statements filed with the Finnish Board are also being made available in pdf by a service provider.

As far as stock market investors and listed companies are concerned, the Internet has been an important distribution channel for financial statements and related reports for more than a decade. In addition to the centralized filing requirement to the OAM, providing financial information in the Internet is nowadays compulsory for listed companies, who were required to maintain an Internet homepage by an amendment to the Finnish Securities Markets Act in 2007. A similar requirement had long before been a part of the Finnish Corporate Governance Code (Securities Markets Association 2010). At the Internet homepage, the financial statements of the companies are usually made available in the form of a pdf file - a facsimile of the traditional annual report printed on paper.

Even though financial statements as such represent less than five per cent of all information used by investors for their valuation decisions (Scott 2009, p.197), the focus of this study is strictly in financial statements that companies are required to file periodically. After all, financial statements do have some predictive value of firm performance and they have at least a confirmatory value on the information already provided to the market by the firm and from other sources. Companies do provide all kinds of other information about their activities and products on their web sites. The information usually includes the continuous disclosure information required from listed firms by stock market regulators. Moreover, the data on the company web sites is also provided in all kinds of formats including static, multimedia and interactive formats. These data, which also include financial information, and their presentation and psychological perception, have been the subject of many studies in the Information Systems, Accounting and Accounting Information Systems literatures. See for example Cormier et al. (2009), Rowbottom and Lymer (2009) and Dilla et al. (2010)

and their references for more information about the research in these wider fields of corporate information on the Internet.

As a result from the developments described above, financial statement users now have access to the latest information about virtually any listed company in the world, together with their financial statements. However, it is not clear that investors and company stakeholders are satisfied with the current situation. For instance, in 2012 there is still a demand for financial information provided commercially by third-party intermediaries in the form of comprehensive financial databases, such as Amadeus and Thomson One. Financial and other data of listed companies are presented in these databases in a standardized form enabling e.g. time-series analyses and performance comparisons to industry peers. According to Debreceny and Gray (2001), there are a few problems with this type of financial information provision. First, the financial information is often not up to date, because of the lead-time between the publication of the data and its inclusion in the databases. Another problem is that the data may have been modified from that originally published by the company, because the service provider employees usually reclassify and aggregate the figures in order to provide peer comparability, which may hide some subtleties reported in the financial statements that may be essential to understanding the company's situation.

When performing their part in providing decision-useful information to investors, financial analysts often wish to look into the original financial statements, including notes and textual disclosures, in order to understand the accounting choices made by companies. According to Graham et al. (2002), analysts actually use all parts of the financial statements and notes extensively. One of the primary uses for the data is, however, to construct a proprietary adjusted earnings figure for forecasting the company's future cash flows. While the databases may serve well in identifying companies to be included into closer analyst following, it is obvious that the more precise information included in financial statements is needed for making informed investment and other decisions. On the other hand, analysts have the same cognitive and time constraints as any other people, which limit their ability to process and understand financial statement information.

Debreceny and Gray (2001) divide the analysts' activities into two major tasks, mechanics and analysis. Before proceeding to analysis, the analyst must perform the necessary mechanical tasks, such as locating, aggregating, disaggregating and reformatting the original

financial statement data. All too often, and still in 2012, the mechanical part includes rekeying or copying and pasting figures and text from one software application to another, e.g. from an annual report in a pdf file into a spreadsheet forecasting model. Debreceny and Gray argue that the time spent on the mechanical tasks limits the time available for analysis, which is one of the motives for the users to pay for the database intermediaries for performing a part of the tasks.

2.1.2 Benefits Sought From Financial Statement Interoperability

It should be clear from the above that making financial statements computer readable, or interoperable, to use the current term, would bring many benefits, many of them familiar from automation of other tasks that used to be performed manually. There are the usual benefits of enhanced processing speed, improved accuracy and quality, and lower costs of performing the old tasks.

In addition, computer readability and interoperability will bring new types of benefits (XBRL International 2012a, Debreceny and Gray 2001). These include but are not limited to increased rate of exploitation and relevance of the more detailed quantitative financial statement information as processing figures becomes a task left to the computers; an increased pressure to provide more comparable information (on the other hand, adjusting figures for comparability may become automatic); more pressure for creating just one worldwide financial standard set (on the other hand, users may "create" their own for analysis and have programs that take care of conversions between standards); enabling users to create their own methods of analysis and search self-defined databases for figures tailor-adjusted for their own methods; a more level playing field between domestic and international investors and between institutional investors and retail investors as even the latter get access to basically the same data; listed companies attract more interest from a larger group of investors and become included in more stock market indices, which leads to a more accurate share price and to a more efficient allocation of capital in societies. These and other benefits look tremendous, to say the least. However, they may only be realized if and when a few problems are resolved, and interoperable financial statements become a part of everyday life among the investing public. Next, we turn to these problems.

2.2 Problematic Issues

2.2.1 Problematic Technological Issues

Debreceny and Gray (2001) also claim, that analysts and investors must nowadays spend more time on Internet-related mechanics because of the problems inherent in retrieving information from the Internet. They classify these problems into three categories. Resource discovery problem refers to the difficulties in finding the business information in the Internet. Specific problems include finding the appropriate company web site and locating the page in the investor relations section that contains the financial statements. The financial statement information must also somehow be separated from other information on the same page.

The second problem is called attribute recognition problem, which means presenting the financial statement in a way that allows users to identify and interpret all the appropriate financial information items in a semantically meaningful way, to “understand” it. It should also be noted that nowadays the users may not always be human. At the receiving end, interoperability would require that a parser, a software program designed for the purpose, must be able to process all the information. In the first section of Chapter 3, I discuss some solutions to these technological problems, especially XBRL.

2.2.2 Problematic Accounting Issues

The third, but not the least of the problems listed by Debreceny and Gray (2001), is the suitability of the financial statements themselves, prepared complying with accounting standards, for interoperability and Internet reporting (the standardization problem). Listed firms around the world are subject to dozens of different accounting regimes, and the standards allow (or even require in order to give a true and fair view) for several choices in reporting basically the same economic issues. Moreover, there are industry- and company-specific inconsistencies in the way companies apply the standards in practice.

According to Scott (2009), a company's assets and liabilities would in a perfect world be valued based on present value calculations, which leave no significance to net income in financial statements. When some of the theoretical assumptions are relaxed, asset valuation becomes difficult and the need arises for using several valuation bases, such as cash, historical cost and current value (when reasonably feasible), selected for each asset class by

their reliability and relevance properties. At the same time, relaxing the assumptions leads to a situation where a theoretically sound measure of true net income does not exist anymore.

Consequently, instead of providing theoretically sound asset valuations and net income calculations, financial statements have been given a twofold mission of providing decision useful information for investors and providing stewardship information for assessing how the company's management has performed using the company resources entrusted to them. Making the financial statements decision useful, in turn, involves providing the investors enough relevant and reliable information for rational decision-making. In addition to providing high-quality financial statements proper, i.e. balance sheets, income statements, cash flow statements and statements of other comprehensive income and changes in equity, together with transparent disclosures in the notes, the company management is now more and more often required to provide the best current-value estimates of many balance sheet items, and to provide even more disclosures about the assumptions underlying their estimates. Most listed companies are also required to provide more free-format and verbal information, including forward-looking trend information about their activities in the Management Discussion and Analysis (MD&A) part of their annual reports.

According to Schipper (2007), there is no more a theory of required disclosures than there is a theory of true net income. She defines disclosures as information that has not, for one or another reason, met the criteria for recognition in the financial statements proper. Required disclosures are viewed as economy-level policy choices made by regulators and standard setters, which affect multiple firms that differ in both economic circumstances and contracting arrangements and parties. Schipper (2007) lists five purposes or types of disclosure information : (1) description: describe recognized and unrecognized items; (2) measurement: provide a useful measure of unrecognized items; (3) alternative measurement: provide alternative measures of recognized items; (4) assess risk and reward: provide information useful for assessing risks and potentials of recognized and unrecognized items; and (5) interim solution: use required disclosures to provide information, temporarily, while other solutions are being studied.

Theories have, however, been developed in information economics about voluntary disclosures by individual firms and their managers. According to Wagenhofer (2003), interoperable financial statements have the potential to affect the costs of both required and

voluntary disclosure. Therefore they may well affect the incentives of firms and their managers to provide voluntary disclosures.

One conclusion that can be drawn from the above ideas of the non-existence of theoretical foundations to net income or required disclosures and, indeed, the intersubjectivity of the reality of accounting information as a conceptual scheme created and accepted by humans (Alexander and Jermakovich, 2006), is that theoretically there would not be insurmountable limits to changing the financial reporting information itself in order to make it more feasible for interoperability. Such changes would, however, require the acceptance of the constituencies involved in accounting.

Still, before it makes sense to start making financial statements interoperable, the accounting information itself must meet the criteria for high quality. This means that the financial statements must have the essential fundamental and enhancing qualitative characteristics that make financial statements useful. These characteristics are laid down by the IASB in the Conceptual Framework for Financial Reporting, which was last updated in 2010. The qualitative characteristics were at the same time harmonized with those of the Financial Accounting Standard Board (FASB), the American standard setter. Relevance and faithful representation are the fundamental qualitative characteristics that may be enhanced by comparability, understandability, verifiability and timeliness.

The fact that the accounting standards themselves have not been changed due to the new technologies that have become available might lead to expect that there would be no impact on the fundamental characteristics. Comparability and understandability can be expected to be the qualitative characteristics most affected by interoperability. However, we cannot simply assume that making financial statements interoperable using XBRL would not affect the fundamental qualitative characteristics of useful financial information. Though timeliness and verifiability may also be affected, this impact may be more intertwined and more difficult to distinguish from the impacts related to the fundamental characteristics, and will therefore not be discussed separately in this study. I will discuss developments in the accounting field potentially related to financial statement interoperability and XBRL in the latter part of next chapter.

2.3 Design Research Method

The apparent chaos, or multi-disciplinarity, in underlying literatures mentioned above, and the incomplete and partial solutions they have offered so far give rise to view Internet financial reporting and interoperability of financial statements as a design problem to be solved. According to, for example, Melles (2008), these types of problems are often called "wicked" problems, because all but the most trivial design problems are fundamentally indeterminate. Therefore, the designer does not so much solve a given problem, but must discover or invent a particular subject out of the problems and issues in specific circumstances using any input and help available. There is no obvious solution and, often, no single, accepted formulation of the problem. The answers that can be expected to be found are often more-or-less only such that the designers and constituencies can at best find reasonable, but even the correct formulation of the problem cannot be known until a solution has been developed and accepted. This wickedness gives rise to a pragmatic, iterative problem-formulation and solution-making process that takes circumstances into account, and the solution candidates are evaluated by how useful they turn out to be.

In order to bring some order to the above wicked problem chaos, I discuss the issues using the Design Research (DR) approach as described by Kanellis and Papadopoulos (2009). The approach is quite similar to the constructive approach proposed by Kasanen et al. (1993), often used in management accounting research. Though unorthodox compared to typical financial accounting research, I argue that DR approach with its step-by-step process would in this case be quite suitable for exploring such a multi-faceted emergent area of research in at least somewhat coherent way.

According to Kanellis and Papadopoulos (2009), DR has emerged over the last years as one paradigm for performing research in information systems and information technology (IT). Other alternatives include, but are not limited to, positivism and interpretivism. DR does not fit to the typical view of behavioral or positivistic information systems or financial accounting research, where the socio-technical system is taken as given and treated as an object for analysis. Rather, a DR researcher usually designs visible and functioning, if not outright tangible artifacts. The purpose is to change the socio-technical state-of-the-world by introducing innovative artifacts that are not natural or neutral and cannot be taken as given. The artifacts are shaped by the interests, values, and assumptions of the researchers (or those who order and pay for the research).

DR is not interpretative research either, because reality is considered stable rather than a matter of interpretation, and it is acknowledged that reality brings constraints to the set of possible states of the world. This leaves less room for subjective interpretation of the facts that are assumed and found to be relevant to the wicked problem. For example, suggesting an artifact for solving a real problem is required in the suggestions for solution phase, and keeping to reality is crucial all along the DR process.

Both the DR and constructive approaches have a philosophical background, among others, in a new incarnation of the so-called American pragmatism from the turn of the 20th century (neo-pragmatism). An essence of both approaches is a stepwise pragmatic problem-solving procedure, where problems are identified and solution candidates developed and evaluated until a useful new artifact for a solution has been developed and implemented (for an organization, or for the regulators and the investing public like in this study), with some new research issues possibly identified.

As stated above, in DR the researcher creates and evaluates IT artifacts intended to solve identified organizational and other problems (Kanellis and Papadopoulos, 2009). The IT artifacts may include, for instance, algorithms, human/computer interaction, system design methodologies, and computer languages. In this study I treat the XBRL language as the solution candidate. Though I make no attempt to develop any solutions myself, the DR approach allows for a flexible but coherent discussion of both technological and accounting aspects of the issues and take both aspects through the problem-solving phases.

Adapting from Kanellis and Papadopoulos (2009), a Design Research (DR) process involves the following phases:

1. An awareness of a problem or problems (such as the ones in the earlier sections of this Chapter);

2. Suggestions for solutions to the problems, drawn from the existing knowledge or theory bases that are relevant to the problem area;

3. Development - an attempt to design and implement an artifact according to the suggested theory;

4. Evaluation, where partially or fully successful implementations are compared to theory, following the specifications in the suggestion phase;

5. The outcome of evaluation is fed back to development, and the Development, Evaluation and further suggestions are iteratively performed until ...

6. A conclusion is reached and the specific design project is finished.

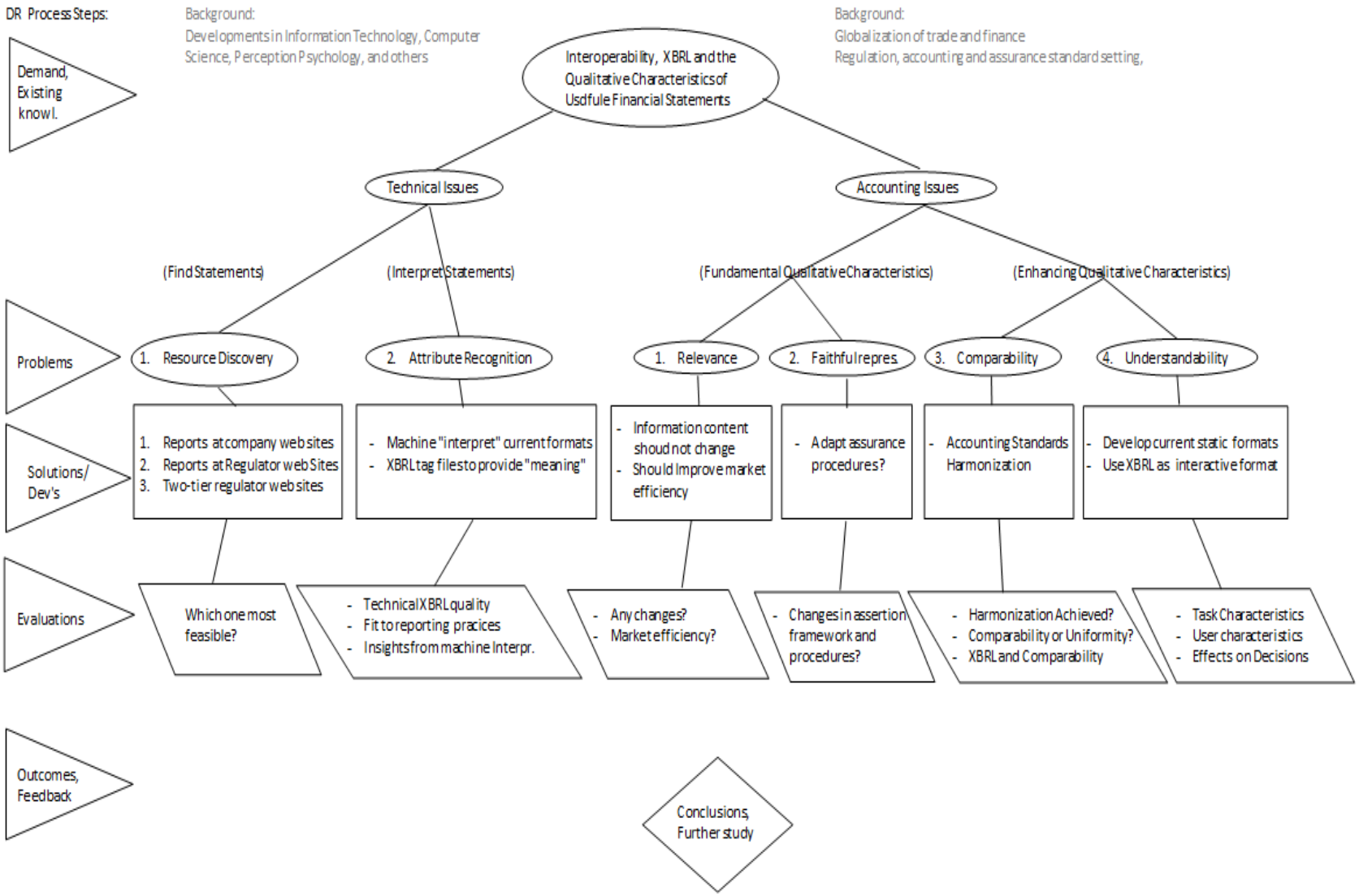
Feedback and move from partial completion of the design research cycle back to earlier phases occurs often in the DR process when experience and new information have been obtained. For instance, going back to the "awareness of a problem" phase is useful in the sense that it adds constraint knowledge to the understanding of the wicked problem theories underlying the suggestion and development of solutions.

As I am not attempting to develop the solutions myself, phase 3 will have relatively less significance in this study. Moreover, the fourth evaluation phase of this study is based on secondary data, studies that have already been conducted. This is acceptable according to Ghauri and Grönhaug (2005, p.97), because there already exist quite a few studies that are useful for the explorative and evaluative purposes of this study, and the sources of available secondary data should always be considered before engaging in the production of new primary data, i.e. original research, especially when this particular kind of study does not seem to exist yet. Original research may be a subject and method for further studies in many of the issues included in this study.

Both Kanellis and Papadopoulos (2009) and Kasanen et al. (1993) give an account of the potential scientific merits of the design research or constructive approach. For those interested, more about their philosophical underpinnings can be found in their articles and for instance in Biggs and Büchler (2007), Lee and Hubona (2009), and Melles (2008), and the references these authors have used.

Figure 1 provides an illustrative summary and overview of the DR process I follow in this study, together with a schematic description of the issues that I am going to discuss. In the next chapter, I move on to discussing solution candidates, especially XBRL, together with some solutions to the accounting issues, even though the development of these has occurred over the decades without having any regard to interoperability or XBRL. They may, after all, be related to or affected by XBRL.

FIGURE 1: Illustration of Issues Related to the Study



3. SUGGESTIONS FOR SOLUTIONS

3.1 Solutions Developed for Technological Problems

3.1.1 Solutions to the Resource Discovery Problem

Debreceny and Gray (2001) discuss ways to solve the first problem of resource discovery. Of course users can, at the lowest level of functionality, manually navigate to the Web site of a corporation to view the desired information. At a slightly higher level of functionality, the user can request particular information from a search engine, such as Google. The highest level of functionality would be the automation of the whole mechanical process of locating, compiling, and analyzing financial information from the web. An intelligent software agent would employ techniques drawn from autonomous programming, information retrieval, artificial intelligence, and inferential statistics, and undertakes an autonomous or semiautonomous information search, retrieval, and decision making on behalf of a human principal. In 2001, intelligent software agents were touted as one promising solution, but to my knowledge the technology has not made a publicly visible progress since then.

As long as the web search process cannot be reliably automated, it looks more feasible to gather the financial statements of all companies into one place, a giant website. This is the approach referred to earlier, when talking about the requirement for all companies to file their financial statements with a national registration authority. Moreover, it seems probable, that issues related to, for instance, data security and integrity or legal matters can be more efficiently resolved under a centralized regime than when left to each listed company alone.

In the United States, the Securities and Exchange Commission (SEC), the surveillance authority responsible for supervising and regulating all stock exchange activities,

including requirements for financial statements of listed firms and their publication, has long required companies to file their financial statements into a database called EDGAR in an electronic text format (txt), Hypertext Markup Language Files (html), and later in Adobe´s Portable Document Format (pdf). Anyone can browse to the EDGAR database and view the official filings. As this way of solving the resource discovery problem offers many benefits to the public, it looks like becoming the dominant one, as many regulators that have begun to require the filing of financial statements in the XBRL format have chosen it. This approach seems to become more widely accepted, as many countries, among others Israel (Markelevich (2010)) and South Korea (Yoon et al. (2011)) have taken this approach.

According to Wymeersch (2008), a somewhat similar development is under way for listed companies in Europe. The EU Transparency Directive states that each home state shall have at least one officially appointed mechanism for the central storage of regulated information. The CESR has advised the European Commission that the most effective way is to organize a decentralized system among national-level exchanges, with CESR serving as the starting point for clicking into the national mechanisms. This two-tier approach is essentially similar to the US solution in that the XBRL filings are gathered into one repository per stock market regulator. The CESR is currently preparing regulations concerning the issue. In Finland the discussion seems to have been minimal so far, apart from implementing the pan-European COREP solution required by the banking supervisory authorities (EBA, 2011). However, the situation has begun to unfreeze in the spring of 2012 as steps are being taken to establish a so-called XBRL jurisdiction in Finland (Aalto-yliopiston Kauppakorkeakoulu (in Finnish), 2011).

3.1.2 Solutions to the Attribute Recognition Problem – Machine Interpretation vs. XBRL

As discussed above, a consensus seems to be emerging about the appropriate solution to the resource identification problem. Solving the second technological problem of interpreting the financial statements in a meaningful way that is understandable to computers, Debreceny and Gray's (2001) attribute recognition problem, is far more difficult. Now that most companies make their financial statements available on their websites, and many regulators require them to file the statements in some electronic

format into a repository for distribution to the public, it can be said that there exists some kind of technological basis for interpreting the information automatically.

There seem to be two basic approaches to enabling computers to perform attribute recognition. We might accept and use the existing financial statement files and formats, and develop some form of automatic computing logic and algorithms capable of extracting information from the files, perhaps even using some form of artificial intelligence and machine learning. The other approach is to have the financial statement files themselves contain the necessary information about the meaning and context of the financial statement data in order to make it readable and interpretable by a parser software program. The latter is the idea behind XBRL.

In the USA, computer scientists and accountants began developing applications for automatic reading and interpretation of financial statements in the 1990's, especially after the SEC mandate to file all statutory reports into the EDGAR financial reporting database in a text file. Studies began to emerge from the late 1990's onwards describing the results of some of the more successful of these projects. For example, Gerdes (2002) developed an EDGAR-Analyzer software tool that helps analyzing SEC filings by emphasizing selections from the unstructured text sections (notes, MD&A) of these documents, and used it in a large-scale study of nearly 19.000 Y2K disclosures made in annual reports filed between 1997 - 1999. The program searched the filing's text section for evidence of user-specified concepts and issues using a keyword search. When a keyword was found, the whole paragraph containing that keyword was extracted and placed in a separate text block in order to capture the context where the keyword was being used. Once the filing text has been completely processed, the system reanalyzed the extracted text blocks for evidence of specific factors of interest to the researcher. For example, the extracted text block could be searched for evidence for that company management feels a certain issue would not have a material impact, or for evidence that Y2K compliance cost figures are provided and so on. The EDGAR-Analyzer managed to reduce the amount of text that had to be manually processed by about 96 per cent.

Grant and Conlon (2006) created an automated prototype called Edgar Extraction System (EES). The EES used technologies such as corpus machine learning, knowledge engineering, and database analysis, which enables the determining of patterns that help in the extraction process. They applied the information extraction techniques to text

and html files containing the financial statements and extracted stock option information from the disclosure notes. Although the information in the notes is sometimes vital for decision making, its complexity and length often prevent users from reading and understanding it. Judging by the reliability of the information extracted and the amount of the relevant information that the system correctly extracts, Grant and Conlon's results indicate that the EES allowed for a quick and easy automatic extraction and comparison of financial statements of companies that use stock options with no significant loss in accuracy.

Bovee et al. (2005) developed a prototype intelligent software agent called Financial Reporting and Auditing Agent with Net Knowledge (FRAANK). It has demonstrated a promising accuracy in searching the EDGAR database for filings, retrieving them, extracting the companies' consolidated financial statements, identifying each line item and account balance in the various parts of the financial statements, and finally translating this information into the XBRL language. The FRAANK prototype, like the EES, has proved its value in providing issues and insights for the development and evaluation of the XBRL Taxonomies and is discussed more in chapter 4.

Apart from the FRAANK, these studies, while demonstrating relatively successful results in using automated software tools to interpret and recognize attributes from financial statements available in text file formats, have so far proved their usefulness only in analyzing limited parts or aspects of the financial statements, and required a great deal of preparatory configuration work before use. Moreover, even though the accuracy rates of 80 - 90 per cent achieved in these studies are quite high, in mass processing they leave quite a large amount of work to be completed manually, the cost of which can become prohibitive. Currently it seems that - apart from providing valuable input into developing a file format (the XBRL) that contains in itself the information needed for interpreting financial statement data - these tools might be more useful in analyzing narrative parts of the filings, such as the Management Discussion and Analysis (MD&A). For instance, Beattie et al. (2004) have suggested a framework for computer-assisted classification and description of narrative accounting information. Demands have also been made to provide XBRL-type tagging to the MD&A, and XBRL taxonomies are being developed for this purpose under for instance the Enhanced Business Reporting (EBR) initiative (AICPA 2008, Arnold et al. 2012).

Due to the relatively early stage of development of XBRL taxonomies that support narrative reporting, they are only discussed when necessary.

3.1.3 XBRL - the Artifact for Solving the Attribute Recognition Problem

As it seems that automatic interpretation of existing financial statement files has not reached a satisfactory level of feasibility, another approach is needed. Debreceny and Gray (2001) describe one solution that is a strong candidate to solving the attribute recognition problem, the eXtensible Business Reporting Language (XBRL). XBRL is a business-oriented dialect of the eXtensible Markup Language (XML), which in turn has been a cornerstone of other Internet data standardization efforts since the late 1990's. XML is developed by the World Wide Web Consortium (W3C) with a view to improve the provision of semantic information in the Internet from the level achievable using the standard Hyper-Text-Markup Language (html) code.

The development of XBRL started in 1998 as a personal initiative by Charlie Hoffman, a Certified Public Accountant (CPA), who became troubled by the inefficient manual and paper-based financial reporting process (Chang and Järvenpää, 2005). Hoffman developed a prototype of financial statements and audit schedules using XML. The development of XBRL was initially funded by the AICPA. XBRL International (XII), a non-profit organization of volunteer members representing constituencies such as the Big Four audit firms, financial institutions, software vendors, regulators and other interested parties was established in July 2000. Since then the membership of XBRL has grown to over 600 companies and agencies (XBRL International 2012b), and, as stated above, a Finnish jurisdiction is being established in the spring of 2012. At the turn of the millennium there was a great deal of hype around the language, but since then it had been developed more quietly, even forgotten.

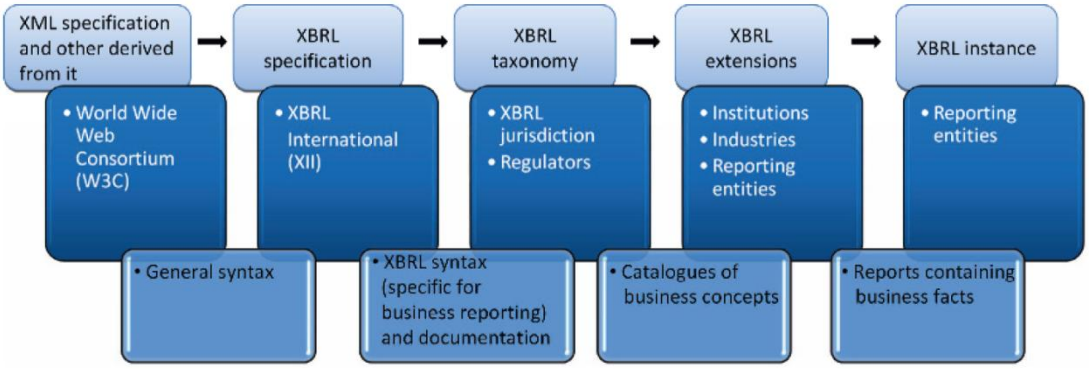
XBRL is claimed to support the income statement, balance sheet, cash flow statement, statement of shareholders' equity and even all the disclosure notes to the financial statements required for listed firms (IASB 2011a). The idea is to assign each different financial statement line item a tag containing information about how to interpret, classify, calculate and present the piece of information in its relevant contexts. This is done with the help of an XBRL taxonomy, which is an electronic description and classification system for the contents of financial statements and other business reporting documents. Tags are elements in XBRL taxonomies and represent hundreds

or even thousands of individual business reporting concepts, mathematical and definitional relationships among them, together with text labels in multiple languages, references to accounting standards and other regulation, and information about how to display each concept to a user. Taxonomies are usually developed to support a particular financial reporting standard, there is one for IFRS and another for US GAAP.

XBRL Building Blocks

The main building blocks of the XBRL technology are XBRL specifications, XBRL taxonomies and XBRL instance documents. The XBRL specification, developed by the XII, defines the syntax for reporting based on the language. It is a business reporting-specific extension to several XML specifications. XBRL 2.1, published in 2003, is the latest version of the specification. XBRL International has announced that the specification is going to remain unchanged over the next few years (Piehocki et al, 2009). New features that are being developed include support for hypercubes (XBRL dimensions), formulas, and rendering.

FIGURE 2: Relationships between XML Specifications, XBRL Specifications, XBRL Taxonomy and Extensions, and XBRL Instances



Source: Debreceny et al. (2009), p. 39

XBRL taxonomies are developed by regulators or local jurisdictions responsible for a certain market or geographical area, and they consist of business concepts for further reporting in the form of catalogues or thematic vocabularies. Extensibility means that the preparers (i.e. the listed companies) of XBRL financial statements may expand the XBRL tag set to meet their particular reporting needs, as long as they do not change the

core tags specified in their respective accounting standard taxonomies. Finally, the reported business facts are encoded in instance documents. The relationship and roles of XML specifications, XBRL specifications, XBRL taxonomies and XBRL instance documents is illustrated in Figure 2.

XBRL Elements

Next, a brief introduction is provided to the logic and basic features of the XBRL language and taxonomies. The discussion is mainly from Debreceny et al. (2009) and IASB (2011a). The purpose is to understand a little about XBRL code and some of the technical and accounting problems that can be expected in enabling computers to process and communicate accounting data meaningfully.

In XML and XBRL, the easy transferability and interoperability of data such as financial statements are made possible by the fact that the actual files containing the data have the common and simple flat text file format. In XBRL, the financial data is tagged so that it can be easily understood and processed by computers, for example <Assets>1000</Assets>. The word Assets together with brackets < and > is called a tag. XML distinguishes opening tags: <...> and closing tags: </...>. Between the tags there is a value. What computers understand from the example above is that something called Assets has the content 1000.

FIGURE 3: Accounting Concept "Assets" Presented as an XBRL Element

```
<element
name="Assets"
id="Assets"
periodType="instant"
balance="debit"
abstract="false"[30]
substitutionGroup="item"
type="monetaryItemType"/>
```

Source: Debreceny et al. (2009), p. 54.

But how do computers know what Assets are? Business facts are meaningless unless seen in some context. Metadata provides that context. Metadata is information about a set of data. For example, a programmer has to explain to a computer how it should

understand the term Assets and what kind of values should be assigned to this concept. An element is a business concept (such as Assets, Liabilities, Income…) presented to a computer in such a way that it can understand the main characteristics of the concept. To achieve this, definitions of the elements are constructed according to a specific set of rules. An example of the business concept “Assets” described as an element in the XBRL language is shown in Figure 3.

As can be seen in the figure, information for at least three characteristics should be provided to a computer in order for it to understand <Assets> in an accounting way. The most important element parts provided in this example, from a business point of view, are name, type, balance, and periodType. The first component assigns the element a unique name. Apart from the name, for an accountant, the concept Assets is associated with a set of characteristics that are defined by other components, such as periodType, which relates to the accounting distinction between flows and resources. Because it is natural to provide a value for Assets for a particular date and time (usually the end of the reporting period), the value of the periodType for <Assets> would be set to “instant”. Flows such as Payments, Revenue or Profit would have the periodType value set to “duration”.

Another accounting characteristic that computers need to “understand” is the balance nature of an element. According to the basic rule of double entry accounting, Assets and Expenses have normal balances in debit, while Equity, Liabilities and Revenues have normal balances in credit. To reflect this in XBRL, each element (or more precisely, each item) falls into one of these categories and has a monetary value that contains in its definition a specification of whether it has a normal debit or credit balance. This requirement was introduced due to the need for comparable data and in order to be able to perform accounting calculations.

Although using a balance attribute is useful and straightforward in the case of Balance Sheets or Income Statements, it creates difficulties when calculating Cash Flows for some elements which do not necessarily obey credit/debit rules. There are new technologies under development such as formulas and functions that make XBRL more programmable and are therefore likely to help in resolving these issues.

Another important characteristic of an element that has to be defined is its type. In financial reports, companies present information in the form of figures with monetary

units (e.g. £100), numbers (e.g. number of employees), percentages (e.g. interest rates), strings (regular text) and others. The most common types that appear in financial statements are monetaryItemType, stringItemType and decimalItemType.

Some of the business reporting concepts need XBRL elements that are defined and constructed in a significantly different way from the ones above. These are called tuples and they were designed, for instance, to define tables with an unknown number of rows or columns, such as those found in many disclosure notes to the financial statements.

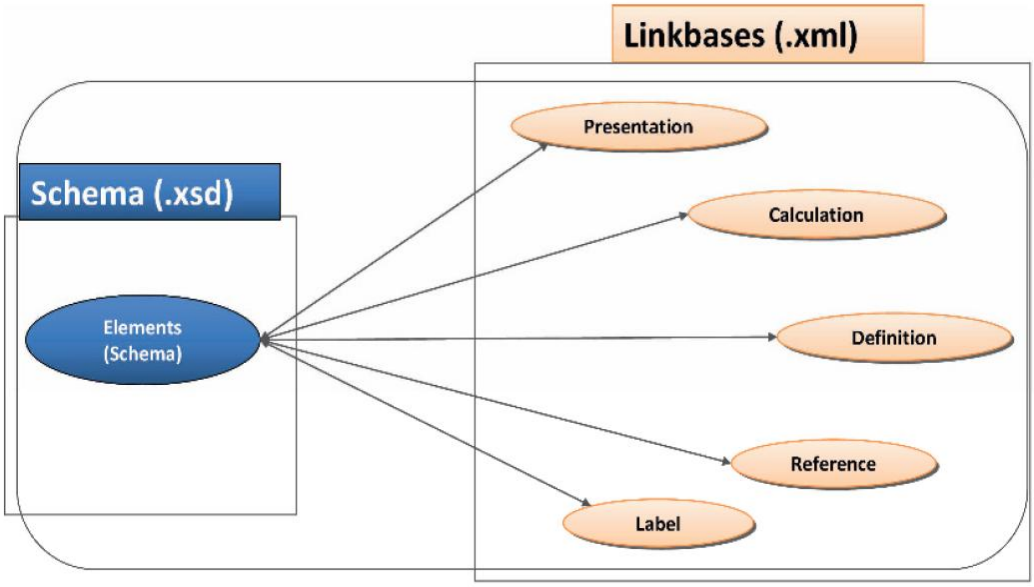
It should be noted that in order for computers to process the element names quickly and efficiently, a standard format has been specified for them. For example, the use of spaces is not allowed, and therefore Cash and cash equivalents would be named CashAndCashEquivalents. Large taxonomies such as the IFRS Taxonomy also obey other specific rules of naming and labeling to ensure consistency.

XBRL Taxonomy Architecture

There are thousands of accounting concepts that must be described using XBRL. Moreover, there are different regulations concerning financial reporting, which means that the definition of Assets under International Financial Reporting Standards (IFRS) may differ from the one provided by a national set of generally accepted accounting principles (GAAP). Therefore, there is a need to describe interactions between financial concepts within each individual GAAP. This means to define whether or not there is any relation between Assets and, for example, Receivables and if there is, how it looks in terms of accounting knowledge and how to create references for elements to express the accounting standard to which they are applicable. To do that, XBRL uses technology called XML Linking (XLink).

The general structure of an XBRL taxonomy consists of the core part, the schema (or more schemas), and linkbases. The schema is the part that contains the definitions of the elements (financial concepts such as Assets). An XBRL schema stores information about taxonomy elements (their names, IDs and other characteristics). The schema can be visualized as a folder where an unstructured list of elements and references to linkbase files is stored. See Figure 4 for an illustration of the XBRL taxonomy architecture.

FIGURE 4: XBRL Taxonomy Architecture



Source: Debreceny et al. (2009), p. 53

To distinguish between elements defined in different schemas, XBRL uses namespaces and their prefixes. The same element may be defined in multiple schemas, each of which would assign it a different meaning (for example the concept Assets may be defined differently in various national GAAP). If a taxonomy defines for example that ifrs=http://xbrl.iasb.org/ifrs/, then, instead of having to write the whole URI in front of an element name, the string ifrs can be used as a shorthand (for example <ifrs:Assets/>).

Linkbases are the taxonomy components that provide information about relationships between elements and link them with specified external resources. So typically, as well as defining XBRL elements, the creation of an XBRL taxonomy, regardless of its purpose, involves defining relations between elements according to different criteria, labeling elements in specified languages in order to make the taxonomy readable to humans, and referencing elements to the external resources that justify their existence, and explaining, defining or providing examples of the use of the particular financial concept.

There are five different kinds of linkbases. Each has a special purpose:

1. It is possible to create an element (concept) in the taxonomy with labels in different languages and or for different purposes e.g. an abbreviation PPE compared to its long label Property, plant and equipment. Those labels are stored and linked to their respective elements in a label linkbase.

2. The reference linkbase stores the relationships between elements and the references, for instance IAS 1, pararaph 68. The linkbase does not store the regulations themselves, only identifies the name and paragraph of the source.

3. The presentation linkbase stores information about relationships between elements in order to organize the taxonomy content.

4. The idea of a calculation linkbase is to improve quality of an XBRL report (XBRL instance). The calculation linkbase defines basic calculation validation rules for addition and subtraction), which must apply for all instances of the taxonomy.

5. The definition linkbase stores other pre-defined or self-defined relationships between elements. For example a relationship can be defined that the occurrence of one concept within an XBRL instance requires the occurrence of other concepts.

Taxonomy Releases and an Example

Currently, new XBRL language taxonomy versions are being released annually on both sides of the Atlantic by the FASB and the IASB (2011a). The IFRS Taxonomy release time line is aligned with the IASB's time line for publishing the IFRS Bound Volume, therefore a single version of the Taxonomy is released each year. The taxonomies support the entire US GAAP and IFRS accounting standards, including their disclosure notes. Consequently, the number of elements in both taxonomies is quite large. For example, the US GAAP taxonomy currently has more than 10.000 standard elements. The number of standard elements in the current (2011) version of the IFRS Taxonomy is 2.534 (IASB 2011a).

To illustrate the current level of support of XBRL for accounting standards and their notes, and the types of data and elements that are needed, a piece of IFRS disclosure note illustration is provided in Figure 5.

FIGURE 5: Excerpt from IFRS Taxonomy Illustrated 2011

[817000] Notes - Business combinations		
Disclosure of business combinations [text block]	text block	IFRS 3 - Disclosures Disclosure
Description of nature and financial effect of business combinations during period	text	IFRS 3.59 a Disclosure
Description of nature and financial effect of business combinations after reporting period before statements authorised for issue	text	IFRS 3.59 b Disclosure
Explanation of financial effect of adjustments related to business combinations	text	IFRS 3.61 Disclosure
Additional information about nature and financial effect of business combination	text	IFRS 3.63 Disclosure
Disclosure of detailed information about business combinations [text block]	text block	IFRS 3 - Disclosures (application of paragraphs 59 and 61) Disclosure
Disclosure of detailed information about business combination [abstract]		
Disclosure of detailed information about business combination [table]	table	IFRS 3.B64 Disclosure
Business combinations [axis]	axis	IFRS 3.B64 Disclosure
Entity's total for business combinations [member]	member [default]	IFRS 3.B64 Disclosure, IFRS 3.B67 Disclosure
Business combinations [member]	member	IFRS 3.B64 Disclosure
Aggregated individually immaterial business combinations [member]	member	IFRS 3.B65 Disclosure
Disclosure of detailed information about business combination [line items]	line items	
Name of acquiree	text	IFRS 3.B64 a Disclosure
Description of acquiree	text	IFRS 3.B64 a Disclosure
Date of acquisition	yyyy-mm-dd	IFRS 3.B64 b Disclosure
Percentage of voting equity interests acquired	X.XX	IFRS 3.B64 c Disclosure
Description of primary reasons for business combination	text	IFRS 3.B64 d Disclosure
Description of how acquirer obtained control of acquiree	text	IFRS 3.B64 d Disclosure
Description of factors that make up goodwill recognised	text	IFRS 3.B64 e Disclosure
Acquisition-date fair value of total consideration transferred [abstract]		
Cash transferred	X instant, credit	IFRS 3.B64 f (i) Disclosure
Other tangible or intangible assets transferred	X instant, credit	IFRS 3.B64 f (ii) Disclosure
Liabilities incurred	X instant, credit	IFRS 3.B64 f (iii) Disclosure
Equity interests of acquirer	X instant, credit	IFRS 3.B64 f (iv) Disclosure
Number of instruments or interests issued or issuable	X.XX	IFRS 3.B64 f (iv) Disclosure
Description of method of determining fair value of instruments or interests	text	IFRS 3.B64 f (iv) Disclosure
Total consideration transferred, acquisition-date fair value	X instant, credit	IFRS 3.B64 f Disclosure
Contingent consideration arrangements and indemnification assets recognised as of acquisition date	X instant, debit	IFRS 3.B64 g (i) Disclosure
Description of arrangement for contingent consideration arrangements and indemnification assets	text	IFRS 3.B64 g (ii) Disclosure

Source: International Accounting Standard Board 2011b

The first column of the document represents the hierarchy of the IFRS. Column headings indicate the name of an IFRS or IAS component, and the rows below them represent the elements belonging to this component, which are IFRS or IAS disclosure requirements. The second column illustrates the possible formats that a given disclosure element may take.

These are:

- text block - Denotes that the disclosure format is a text block (such as a description of accounting policies).
- text - Denotes that the disclosure format is text.

- yyyy-mm-dd - Denotes that the disclosure format is a date.
- X - Denotes that the disclosure format is a monetary value.
- (X) - Denotes that the disclosure format is a negative monetary value.
- X.XX - Denotes that the disclosure format is a decimalized value.
- shares - Denotes that the disclosure format is a number of shares.
- _____ - Denotes that the disclosure format is the total sum of the preceding rows.
- table - Denotes the beginning of a two-dimensional disclosure.
- axis - Denotes an axis on a two-dimensional disclosure.
- member - Denotes a member on an axis.
- line items - Denotes the beginning of a series of disclosures for a table.
- A blank column denotes that no disclosure is required.

For monetary values:

- instant or duration - Denotes that the disclosure represents a stock (if instant) or a flow (if duration).
- credit or debit - Denotes the natural balance of the disclosure.

The third column indicates the corresponding IFRS or IAS paragraph/section for a given disclosure, together with the nature of the reference:

- Common-practice - Denotes a common-practice reference.
- Disclosure - Denotes an IFRS disclosure requirement.
- Example - Denotes an IFRS example.
- Presentation - Denotes an IFRS presentation requirement.

Creating and Validating Instance Documents

To create the actual XBRL instance documents to be filed, the companies can do the tagging and taxonomy extension work manually using tools like a Microsoft Excel add-on, outsource the work to an expert, or use a bolt-on software interfaced with their accounting information system, or an integrated tagging module within the company's Enterprise Resource Planning (ERP) system. However, one of the objectives in developing XBRL is to make it a pervasive accounting information system technology that can be used throughout the financial reporting chain from individual transactions to the financial statements. XBRL International has designed another taxonomy for this purpose, the XBRL GL (General Ledger) taxonomy. It remains to be seen, though,

whether the XBRL GL will become a part of the ERP systems currently in use in most listed companies.

Based on the above discussion and examples, it is not difficult to imagine that there are many possibilities for technical mistakes when companies prepare XBRL instance documents and extend the basic taxonomies. Fortunately, validation software programs have been developed to make sure that the extended taxonomies and the instance documents comply with all the syntax and structural requirements laid down in the XML, XBRL and taxonomy specifications. Regulators like the SEC also provide guidance documents and tools for validation purposes on their websites. In Israel, the local stock market regulator has assumed the responsibility of technical validation of the filings altogether (Markelevich et al. (2010)).

Moreover, at least in the USA, a three-year testing and development program called Voluntary Filing Program (VFP) was launched by the SEC before making XBRL filings mandatory (Boritz and No, 2009). In the program, voluntary filers were allowed to furnish "XBRL-Related Documents" (including XBRL instance documents, taxonomy schema, linkbase files, and perhaps an independent auditor's report) into the EDGAR database in addition to the regular official filings, such as the Form 10-K (annual report) and Form 10-Q (quarterly report) filings. The main purpose of the VFP was to encourage companies to experiment with and learn from the process of creating XBRL filings and to assist the SEC in assessing the feasibility of XBRL as a potential filing format in the future. Some interesting studies regarding the quality of the XBRL filings were conducted under the VFP, to be discussed in Chapter 4.

After the SEC had analyzed the results and experience gathered in the VFP, it adopted rules requiring companies to provide financial statement information in the SEC and on their corporate Web sites in an interactive data format using the eXtensible Business Reporting Language (XBRL). The requirement was phased in over a three-year schedule beginning with a company's first quarterly report on Form 10-Q, or annual report on Form 20-F or Form 40-F (foreign listed firms), that contains financial statements for fiscal periods ending on or after:

- June 15, 2009 — SEC Rule applies only to domestic and foreign large accelerated filers that use U.S. GAAP and have a worldwide public float above $5 billion.

- June 15, 2010 — All other domestic and foreign large accelerated filers using U.S. GAAP are subject to interactive data reporting (public float $700 million or more).

- June 15, 2011 — All remaining filers (non-investment companies) using U.S. GAAP, including smaller reporting companies, and all foreign private issuers that prepare their financial statements in accordance with IFRS as issued by the IASB.

One significant implication from the current move to the third stage is obvious. At the time of writing this study, European and other IFRS filers listed in the USA are now required to file their financial statements using the latest IFRS taxonomy. Filings should be pouring into the SEC over the spring 2012. This will provide a timely opportunity for researchers to evaluate actual IFRS filings in XBRL. There are also significant transition-phase alleviations including the possibility to tag the financial statement notes as just text blocks during the first year and the safe harbor from legal liability granted by the SEC with respect to the mandatory filings for the first two years.

Adoption of XBRL in Other Parts of the World

Apart from the USA, the use of XBRL has recently gained momentum in many parts of the world, including Asia. The organization responsible of developing the language, XBRL International, has coordinated the development of local jurisdictions, currently more than 20 (XBRL International, 2012c), which represent countries, regions or international bodies and focus on the progress of XBRL in their areas as well as contributing to international development. Members join through their local jurisdiction, except in areas where no jurisdiction has yet been formed. In this case they can join XBRL through a special direct membership category. In Finland, the Aalto University is currently taking steps to form a Finnish jurisdiction (Aalto-yliopiston Kauppakorkeakoulu (in Finnish), 2011). Jurisdictions promote XBRL and organize or sponsor the creation of taxonomies, notably for the main accounting standards for business reporting in their area. They provide an important education and marketing role, explaining the benefits of XBRL to government and private organizations and supporting implementation of XBRL.

Results have already begun to show from the efforts of the jurisdictions outside the USA. According to Boritz and No (2009), regulators and government agencies around the world are increasingly implementing XBRL for regulatory filings, and many software developers are launching XBRL applications onto the market. The U.K. has

had plans to make XBRL mandatory for company tax filings in 2010. The Canadian Securities Administrators (CSA) launched an XBRL voluntary filing program on January 19, 2007, and Korea instituted a voluntary XBRL program in October 2007. The Tokyo Stock Exchange (TSE) introduced an XBRL reporting system in 2006. China already requires interactive data filing for the full financial statements of all listed companies in quarterly, half-year, and annual reports. In the European Union, preparations are under way. In 2009 the CESR issued a call for evidence concerning the matter to its constituents, and received mostly favorable comments (CESR 2009). Moreover, the European Banking Authority (2011) has required the use of the COREP-Taxonomy for providing an XBRL representation of the Common Reporting Framework for many years. COREP is the common solvency ratio reporting framework for credit institutions and investment firms under EU capital requirements regime.

One conclusion can be made from the above discussion. The move towards XBRL looks driven by regulators. This is consistent with the conclusions by, for instance Chang and Järvenpää (2005) and Locke and Lowe (2007), who suspected that despite its great potential benefits, technologies like XBRL would not be adopted without being required by regulators.

Moreover, apart from a few articles in accounting and IT trade journals, there seems to have been little discussion so far about concrete ways to use XBRL or about software products for end users. The SEC provides a web page where users can select and view XBRL financial statements from multiple companies at the same time, and add-in tools are being provided for the Microsoft Excel spreadsheet, which has supported XML for years. However, products like Rivet Inc´s Crossfire Analyst Suite that help leveraging the potential of XBRL are not many, widespread or affordable yet, so XBRL has not yet begun to deliver on the promise for more level playing field between institutional and non-professional investors.

However, XBRL should be viewed as a long-term infrastructure project, and the project is not completed yet. This will become clear from the discussion on quality and other technological and accounting-related aspects in the next chapter. Meanwhile, the field is open for developing applications that use XBRL. There were a few working papers, not included in this study, demonstrating the use of XBRL for quite innovative accounting-related purposes. The ultimate success of XBRL will depend on whether it

can be used by a wider audience, and for other purposes than just complying with regulator filing requirements.

3.2 Developments in Accounting Related to Interoperability and XBRL

3.2.1 About the Developments in Accounting

As to what Debreceny and Gray (2001) called the third problem with Internet financial reporting, the standardization problem, little seems to be known or done so far. This might be due to the relative newness of the entire idea of making the financial statements themselves interoperable. It might also be due to the traditional thinking of the accounting and auditing profession, reflected in that the XBRL has all along been required to comply with for instance the IFRS in a way that does not allow for any changes in any of the standards themselves. Moreover, the issue may even have been considered trivial in the sense that accounting standards are regarded by accountants to take strict precedence, and no changes to any standard under any regime seem to have ever been considered due to making this or that reporting requirement computer readable. And, judging by for example the large number of elements in the IFRS or US GAAP taxonomies (over 10.000 in the latter), XBRL has indeed been developed to support the reporting requirements in the accounting standard and the actual reporting practices of the firms, not the other way around.

However, for instance Wagenhofer (2003) predicted, that developments in Internet reporting and especially the XBRL are likely to lead to a demand for more standardized financial information (that is interoperable). Regulators in many of the countries with the most advanced capital markets, such as the SEC in the USA, are now requiring financial statements to be filed in XBRL alongside the traditional formats. In the next chapter, I will discuss some studies evaluating the technological aspects in more detail, but at this point it can be said that fitting XBRL with the accounting standards, let alone the actual reporting practices is challenging, to say the very least. Moreover, accounting standards are constantly being developed independently of the developments in the XBRL language. In any case, the requirements of the accounting standards will probably affect the extent to which XBRL will be able to deliver the benefits expected.

Still, there would be little point in interoperability and XBRL tagging, if the financial statement information itself is not of high-quality and useful. The fundamental qualitative characteristics for useful financial information, relevance and faithful representation, must apply regardless the file format. And even for XBRL financial statements, the usefulness is enhanced, if the underlying information is comparable, understandable, verifiable and timely. These essential qualitative criteria of useful financial statement information are laid down in the Conceptual Framework for Financial Reporting (IASB 2010), and they have recently been harmonized with the US GAAP. In this section I provide a brief description, in the light of the fundamental criteria, comparability and understandability, of some of the general developments in financial reporting regulations and accounting standards that may have significance with respect to XBRL and Internet financial reporting, or which may be affected by them.

3.2.2 Developments Regarding Fundamental Financial Statement Quality Characteristics

As no information content in the financial statements has been changed due to the Internet or XBRL until now, one might expect that XBRL has not directly affected the developments in the fundamental qualitative characteristics of relevance and faithful representation of financial statements. Accounting standards and disclosure requirements are constantly being developed with a view of providing relevant and decision useful information and these developments are now routinely being taken into account in developing the XBRL taxonomies. Moreover, XBRL and Internet financial reporting have probably had little impact on accounting or auditing standards, or on the way that the faithful representation of the financial statement figures themselves is assured by auditors. Therefore, one may expect that XBRL may have more impact through the enhancing characteristics of financial statement usefulness than by the fundamental ones. Of these criteria, comparability and understandability are discussed in more detail in the next sections.

However, changes may be under way even regarding the fundamental characteristics. In 2008, the AICPA Assurance Services Executive Committee published a White Paper under the title “The Shifting Paradigm in Business Reporting and Assurance” (AICPA 2008). I think some developments described in the White Paper are worth mentioning

in this study, because they may bring changes even to requirements related to the fundamental characteristics of financial reporting. The AICPA describes XBRL and the Internet as technologies enabling more transparent, relevant, and efficient reporting practices and processes that can be leveraged all over the world to drive the evolution of a paradigm of internal or external business reporting and assurance. Moreover, according to AICPA, the current static, paper-based model is inadequate for the effective allocation of capital in today's global markets. The standards, technology, and tools exist to automate and enhance reporting and assurance. These new capabilities both facilitate and require a fresh look at the information that is produced and consumed.

According to Boritz and No (2009), introducing XBRL actually marks the beginning of a transfer away from paper-based reporting, moving to the second of three evolutionary phases. The first of these phases is the pre-XBRL period, where html or pdf versions of the financial statements were based on the paper documents with the same content. The focus of assurance is on whether the paper financial statements, taken as a whole, present fairly in accordance with applicable accounting principles, and this assurance is not extended to the same information provided in html and pdf. XBRL filings are just agreed with paper documents, if anything.

With the adoption of XBRL, the financial reporting environment is shifting from pure paper paradigm to a second, transitional phase, where the current paper paradigm financial statements and XBRL-tagged instance documents coexist. Companies first create the paper paradigm financial statements and only afterwards create the XBRL instance documents by mapping the information in the paper paradigm financial statements to elements in XBRL taxonomies. There is currently no requirement to provide independent assurance on the XBRL version of the ''official'' financial statements in any regulatory filings around the world, though a need for the assurance is beginning to be recognized.

In the third phase, pervasive adoption and use of XBRL may replace the paper paradigm financial reporting altogether. At least the paper paradigm reports will no longer be generated as an intermediate product to be translated into XBRL. The XBRL-related documents will be created directly from the accounting information system instead. Assurance may be needed, perhaps not on the translation of the paper

paradigm documents into XBRL, but directly on the process used to prepare the information in the XBRL-related documents. This assurance might focus on the fair presentation of the business facts, the compliance of XBRL-related documents with the relevant XBRL specifications and regulatory requirements, and the effectiveness of the XBRL generating process.

For example, and in addition to similar developments undertaken by the SEC, the Enhanced Business Reporting Consortium (EBRC), a market-driven initiative to support and promote the reporting of relevant information that complements traditional financial reporting, issued an Enhanced Business Reporting Framework (EBR) in 2008 with a view to providing more detailed and forward-looking financial reporting information (AICPA, 2008). Under the EBR framework companies must - in addition to traditional GAAP performance reporting - provide detailed information on things like their operating environment, customer base and competitors, together with information about the technological, social, legal, political and environmental conditions that affect the company. After describing the starting point in the above dimensions, the report must define the company's mission, objectives and strategies, as well as its business operations and the organizational structure, which will support the strategies. In addition, the report must describe the resources and processes that can be used to implement the firm's strategies and achieve its objectives, classified into two tangible assets (physical and monetary) and intangible assets.

Many of the information requirements listed above are not new in the sense that they are already included in the requirements regarding disclosures in e.g. MD&A. What is new is the amount of detailed information and standardization required, together with the suggestion to require the provision of even this narrative information accompanied with XBRL tags, and the moves towards a more continuous, even real-time reporting and assurance with a more forward-looking orientation. Though the EBR and other similar developments are probably more a matter of the future than today, they need to be taken into account when thinking about potential impacts of XBRL on the fundamental usefulness characteristics of financial reporting.

Meanwhile, voluntary and mandatory XBRL filings have already generated issues related to the need for XBRL-specific assurance. Similarly, market-based studies have begun to emerge concerning the characteristics of the firms that voluntarily furnished

XBRL financial statements and the impact of the first mandatory filings on the information characteristics on the markets. Studies on these and other developments are discussed in the evaluation phase of this study in Section 4.2.2 and 4.2.5.

3.2.3 Developments Regarding Comparability

As discussed above, XBRL and reporting in the Internet have probably had little impact on the fundamental characteristics of useful financial information. This may be changing, if the financial reporting paradigm shifts into the direction discussed above. Until then, one may expect that the impact of XBRL is channeled more through the enhancing qualitative characteristics of financial statement usefulness than by the fundamental ones. Of these enhancing characteristics, comparability and understandability can be expected to be more affected by XBRL and interoperable financial statements. Comparability may, at least tentatively, be considered the most important for interoperable financial statements, because providing financial statement users with tools for making easier comparisons between investment opportunities is often mentioned as one of the very reasons for developing the XBRL language, or for the international harmonization of the financial reporting standards themselves. In this section I focus on general developments regarding accounting harmonization and comparability. Understandability will be discussed in the next section.

According to Wunder (2008), for instance, the need for an access to international capital markets is the most important factor responsible for the growing support for international financial reporting standards. To facilitate this, it is necessary to provide comparable and credible financial data. Sources of current pressures to harmonize financial reporting standards include investors and analysts as financial statement users, multinational companies as preparers of financial statements, regulators as capital markets supervisors, the securities industry (including stock exchanges), and developing countries (which often lack the resources to develop accounting standards of their own). The need to provide interoperable, computer readable financial statements that comply with the harmonized financial reporting standards might be added as a new item to this list.

International harmonization of accounting standards has been under way for decades. In Europe, one of the first “harmonizations” of accounting standards was performed in 1941. After Nazi Germany had occupied France, it imposed its own accounting system,

developed by Professor Schmalenbach in the 1930's, on the French (Standish (1990)). This system had a detailed chart of accounts and later formed the base of the Plan Comptable Général, the template-based French accounting standard still in use. The Treaty of Rome established the predecessor of the European Union (EU) in 1957, with the general goal of harmonizing the legal and economic systems of its Member States. The EU has been involved in the international harmonization of accounting and financial reporting since the mid-1960s as part of its Company Law harmonization program.

The harmonization program eventually led to the Fourth and Seventh Council Directives laying down a minimum level of individual company and consolidated financial statement harmonization for the Member States, to be transposed into their national accounting laws (Gornik-Tomaszewski, 2005). Incidentally, the French Plan Comptable seems to have certain similarities with the later template-based accounting system laid down in the EU Directives. Like other newer Member States, Finland substantially reformed its own financial accounting legislation to harmonize it with the EU after it joined in 1995. Moreover, the EU Commission, a politically independent institution representing the interests of the EU as a whole, has enforcement powers over the Member States through the Company Law Directives. Another reason for mentioning the Directives here is that one study, to be discussed later, had interesting results regarding XBRL and Italian template-based financial statements.

Because of the options in the Directives and the relatively low level of harmonization, national accounting standards across Europe were still quite different from each other. During the 1990s, the European authorities realized that the efficiency of EU capital markets was seriously undermined by the lack of comparability between financial statements published by listed companies (Gornik-Tomaszewski, 2005). The growing importance of the capital markets for corporate financing and the goal of taking full advantage of the introduction of a common currency, the euro, the European Commission proposed that all listed EU companies report under the same accounting framework. Consequently, the EU Council of Ministers approved a new accounting Regulation (the IAS Regulation) in June 2002 requiring EU-listed companies to prepare consolidated financial statements in accordance with International Financial Reporting Standards (IFRS) for fiscal years beginning on or after January 1, 2005.

The IAS Regulation was a step forward in that the high cost of parallel reporting (for companies active in many countries that require reporting under national standards for domestic authorities and under IFRS for international investors at the same time) could at least be reduced (Gornik-Tomaszewski, 2005). Transition to higher-quality accounting standards such as the IFRS should also improve the ability of investors to make more informed financial decisions and eliminate confusion arising from different measures of financial performance across countries, and lead to a reduced risk for investors and a lower cost of capital for companies. The new rules increased the overall quality of financial reporting by exposing costs that were often hidden under national accounting standards. For instance, companies were now required to treat stock options as expenses, book pension obligations as liabilities and record derivatives and other financial instruments at fair value rather than at historical cost. Increasing comparability by introducing the IFRS should indeed help to attain the goal of enhancing the usefulness of financial statements.

All of the other major economies have established time lines by now to harmonize with or adopt IFRS in the near future. Even in the United States, the Financial Accounting Standards Board (FASB) has worked together with the IASB since signing the Norwalk Agreement in 2002 (Gornik-Tomaszewski, 2005). The goal of the agreement is to achieve convergence of IFRS and the US GAAP towards a common set of high quality global accounting standards. The agreement identified problem areas where accounting treatment was still different from that on the other side of the Atlantic, and joint projects were initiated in each problem area in order to agree about a common accounting rule. After some significant progress towards this end, the SEC agreed in 2007 to remove the requirement for non-US companies listed in the United States to reconcile their financial reports with US GAAP, provided that their accounts complied with the IFRS, and has recently been considering allowing even US listed companies to do the same in the near future (IASB 2011c). However, even though harmonization has progressed to a point where one global set of high-quality accounting standards seems to be within reach, there are in fact many more subtle issues with an impact on comparability in their way. The XBRL adds yet another twist into this discussion, to be continued in the evaluation chapter.

3.2.4 Developments Regarding Understandability

According to the IASB Conceptual Framework (IASB, 2010), understandability is one of the qualitative characteristics that enhances the usefulness of information that is relevant and faithfully represented, and may also help determine which of alternative equally relevant and faithfully representative ways should be used for presentation. To be understandable, information must be classified, characterized and presented clearly and concisely. Some phenomena are inherently complex and cannot be made easy to understand, but their exclusion would make the information incomplete and therefore potentially misleading. Financial statement preparers should make the information understandable for users who have a reasonable knowledge of business and economic activities, and who analyze the information diligently. Understandability should be maximized to the extent possible.

On both sides of the Atlantic, there have recently been changes in the standards concerning financial statement presentation in order to make them more understandable and in order to bring the reporting requirements closer to each other. One of the changes concerned the presentation of the so-called dirty surplus items or other comprehensive income (OCI), and led to convergence of the requirement included in the IAS 1 standard on financial statement presentation with the equivalent American regulations.

One of the projects laid down in the Norwalk Agreement in 2002 was a joint project between the IASB and FASB concerning new financial statements presentation formats that should make the statements more understandable. This was because presentation probably affects the financial statement user's interpretation and perception of the information, which in turn may affect the decisions they make. These developments have occurred independently from the development of the XBRL, but the way the information is presented and formatted may also be relevant to this study, because XBRL can be used for providing financial statement users with interactive tools which help them better select the content and format of the financial statement information they want.

One of the proposed formats was called the matrix format, and it would have brought considerable changes to the presentation of comprehensive income. It is a single statement of income, with three columns of presentation based around re-

measurements of financial statement items. The usefulness of the matrix format has already been the subject of a lab experiment (Tarca et al, 2008).

However, in late 2008, the Boards proposed another, even more fundamentally changed presentation format in a joint Discussion Paper for public comments (FASB, 2008). The Boards stated three objectives for the new format. Information should be presented in financial statements in a way that a) provides a cohesive financial picture of an entity's activities, b) disaggregates the information so that it is useful in assessing the amount, timing, and uncertainty of an entity's future cash flows, and c) helps users to assess an entity's ability to meet its financial commitments as they become due and to invest in business opportunities.

A cohesive financial picture would mean that the relationship between items across financial statements is clear and that the financial statements (balance sheet, income statement and so on) complement each other as much as possible. Cohesive financial statements would present the data in a way that clearly associates related information across the statements so that the information is understandable. The disaggregation objective means that financial statement items with essentially similar economic characteristics should be better grouped together. On the other hand, items with essentially different economic characteristics should be disaggregated. In practice this would mean requiring far more disaggregated line items than today. Fulfilling the liquidity and financial flexibility objective would - in addition to providing information about a company having sufficient resources to satisfy external debt and existing liabilities - also provide information about the company's ability to earn returns on investments, to fund future growth, and to take effective action to change the amounts and timing of cash flows so that it can respond to unexpected needs and opportunities.

The Boards argue that these objectives would be achieved by reconfiguring the presentation of financial statements to offer parallel income statement, balance sheet and cash flow statements with standardized partitions of each financial statement into five categories: business activities, financing activities, income taxes, discontinued operations, and equity. The allocation of transactions within these partitions would crucially depend on management's assessment of each transaction, the management approach. Figure 6 gives an overview of the new format proposed by the FASB and IASB.

FIGURE 6: Financial statements in the format proposed by FASB and IASB

Statement of Financial Position	Statement of Comprehensive Income	Statement of Cash Flows
Business • Operating assets and liabilities • Investing assets and liabilities	***Business*** • Operating income and expenses • Investment income and expenses	***Business*** • Operating cash flows • Investing cash flows
Financing • Financing assets • Financing liabilities	***Financing*** • Financing asset income • Financing liability expenses	***Financing*** • Financing asset cash flows • Financing liability cash flows
Income taxes	***Income taxes*** on continuing operations (business and financing)	***Income taxes***
Discontinued operations	***Discontinued operations,*** net of tax	***Discontinued operations***
	Other comprehensive income, net of tax	
Equity		***Equity***

Source: FASB (2008), p. XV

The proposal has received comments since 2008, but recently the presentation project seems to have had a lower priority than some of the more urgent ones related to the Norwalk Agreement. The interesting question related to this study might be that interoperable and interactive financial statements might actually make these types of static (paper) financial statement presentation issues less relevant with respect to how financial statements are perceived by users. Making financial statements interoperable is bound to affect the perception somehow. For example, XBRL has already been used for transforming financial statements from the current format to the one proposed by the FASB (Swanson and Miranova, 2010). I will return to these topics in the evaluation phase, where I also discuss the impact of introducing interactivity to financial reporting with the help of XBRL on the understandability qualitative characteristics.

4. EVALUATION OF XBRL AS THE SOLUTION

4.1 Technological Evaluation

4.1.1 About Studies on the Technological Aspects of XBRL

The development of XBRL has come to a point, where it is becoming a de facto standard of providing interoperable financial statements. It is being mandated by governments and regulators in many parts of the world for filing statutory financial reporting information alongside the traditional paper-based formats. More countries, such as the Member States of the European Union, are currently considering introducing similar filing requirements. A prerequisite for such mandated requirement should be that XBRL has reached a sufficient technological maturity. Only this way users may trust that the information provided using the format is sufficiently free from errors, and that the XBRL taxonomies sufficiently support the reporting requirements and practices of the firms.

Fortunately, learning from the experiences of others is possible. Studies have begun to emerge regarding various aspects of the quality of the standard. Many of the studies report research from the USA, but there are quite a few interesting ones from other countries as well. In this section I review the studies I have found, some of which are currently tentative in the sense that they have only been made available in the Internet as working papers. It seems useful to classify the studies into four categories. First, there are a few studies on the technical quality of the actual XBRL files that have been furnished or filed with a stock market regulator. Then there are a few studies that analyze how well or badly the standard XBRL taxonomies cover the actual non-XBRL reporting practices of the listed companies. Third, some very interesting studies discuss taxonomy design and quality issues from an information systems design perspective. Finally, there are a couple of studies, where some forms of advanced information technology have been used for extracting data from historical non-XBRL financial reports for providing insights about the reporting practices of firms for taxonomy

development purposes. Table 1 provides a summary of the studies related to the technological aspects of XBRL.

4.1.2 Studies on the Technical Quality of XBRL Filings

As mentioned in Chapter 3, validation software programs have been developed to make sure that the taxonomies, especially when extended by the preparers of financial statements, and the instance documents comply with all the technical syntax and structural requirements laid down in the XML, XBRL and taxonomy specifications. XBRL International, regulators who require XBRL filings (such as the SEC), and taxonomy developers such as the IASB also provide extensive technical guidance documents and tools for validation purposes on their websites. In Israel, the local stock market regulator assumed the responsibility of technical validation of the filings altogether (Markelevich et al, 2010).

In the USA, XBRL went through a three-year (2005 - 2008) testing phase called Voluntary Filing Program (VFP) in order to explore the application of XBRL to U.S. financial reporting (Bartley et al, 2011). The SEC invited public-company registrants to experiment with data tagging and to file the resulting documents online. Given the inexperience of registrants with XBRL, and the fact that XBRL technology and support tools underwent continuous development, the VFP allowed registrants to gain hands-on, evolutionary XBRL experience under a safe harbor provision reducing their risk of legal liability.

Bartley et al. (2011) provide a systematic analysis of the XBRL data and their accuracy. They identify common errors occurring in the VFP filings and track the development of their frequency from the first to the last filings. They manually compared labels, values, and signs line-by-line between a total of 33 XBRL and traditional 10-K US GAAP financial statements in 2006 and 2008. Errors were detected in the XBRL filings of all 22 companies in 2006, and almost all (10/11) companies in 2008. They classified the numerous errors and inconsistencies detected in the initial 2006 voluntary filings into 1) missing financial statement elements, 2) incorrect amounts, 3) incorrect signs, 4) duplicate elements, 5) incorrect tags for financial statement concepts, and 6) inaccuracies in the display of the financial statements. In the 2008 filings, there was a notably large decrease in the number of errors. Even the frequencies of display errors, which do not affect the usability of the data items themselves, decreased dramatically

from 2006 to 2008. Bartley et al. (2011) concluded that, given the improvements in the XBRL standard and related technologies over the course of the program, the VFP appears to have successfully accomplished its main goal of generating feedback that later led to significant improvements in XBRL document creation.

Debreceny et al. (2010) studied the degree of correctness of mathematical relationships in the first filed mandatory instance documents. They downloaded 393 US GAAP first-round XBRL filings from the SEC website and used a custom-made automatic software tool that computed all sums in all filings using the calculation rules specified in the calculation linkbase of the US GAAP taxonomy used by the filer to capture all calculation errors. The overall result was that one quarter of the first-round mandatory filings by almost 400 of the largest US corporations had mathematical calculation errors.

They categorized the mathematical errors into six types. The most common type was inappropriate treatment of underlying debit and credit assumptions specified in the taxonomy (43 per cent). Most monetary concepts have their natural debit/credit balance specified in the US GAAP taxonomy, and this has been mentioned in the guidance documents. Still, filers seem to be fixated to adding a sign to the figure, resulting in a reversal of the sign specified as the natural balance. Two of the error types, missing figure (15 per cent) and extraneous figure (11 per cent) are related, because erroneous exclusion of a value from one calculation hierarchy and erroneous inclusion of the same value into another calculation hierarchy are often related. It is likely that if a concept is excluded from the correct calculation hierarchy it will be included as part of a different hierarchy. As a result, there will be two errors in the instance document. Moreover, there were incorrect values (13 per cent), rounding errors (7 per cent) and an error in original (3 per cent), which means that the calculations do not sum up correctly due to an amount that does not come from rounding.

When the SEC makes all these filings available to the public on the Internet, it hopes that there will eventually be many productive uses of this information further down the information value chain. Debreceny et al. (2010) conclude that the quality of the XBRL data is obviously an important factor in the development of this ecosystem and the ultimate success of the XBRL financial statement filing program. Moreover, they

conclude that the SEC should provide better validation or warnings on submission. Other conclusions by Debreceny et al. (2010) include that filers should develop quality assurance processes on the production of instance documents, software vendors should improve the diagnostics for users, professional accounting and auditing firms should provide assurance on XBRL filings, and, finally, that the XBRL jurisdictions in the USA and elsewhere, together with the XBRL International should further educate the user community on issues such as the cause of these errors and techniques to prevent and detect such errors.

The errors mentioned in the two studies above might be partially avoidable, if the filers had access to more validation expertise. This would suggest an approach where the stock market regulator undertakes the responsibility of technical validation of the filings before they are posted on the Internet. In their working paper, Markelevich et al. (2010) study the technical quality of XBRL filings under this approach, taken by the Israel Securities Authority (ISA). Filers file their financial statements using a web form, and the ISA converts the data into XBRL. Markelevich et al. manually examined and compared traditional (pdf) annual reports filed to the MAGNA database of 565 publicly traded Israeli companies to their respective reports filed in XBRL for 2008. The results show that despite validation performed by Israeli regulator, 34 per cent of all XBRL filings were inconsistent with the traditional-format filings. Some data was missing from 11 per cent of the filings, 27 per cent had other inconsistencies (including incorrect signs and others), and some had several overlapping types of inconsistencies. The results from Markelevich et al. (2010) seem to indicate, that having the regulator do the conversion does not necessarily help in improving the quality of filings. However, they remained optimistic about the possibility to correct the deficiencies over time by refining the procedures and control among all constituencies.

It seems that at least until 2010, the filings analyzed in the above studies demonstrate that XBRL filings were still far from being reliable enough to be trusted as the (only) source of financial information, and substantial improvement in quality is needed. However, there was some optimism in Markelevich et al. (2010) about future improvement, and this may justified at this point in that all of the above results were from studies that were conducted using data from an experimental phase of XBRL taxonomy and filing process development, or from the very first round of mandated filings. There is room for improvement and development efforts are under way.

Moreover, these types of problems in technical details tend to decrease in number over time as all constituencies concerned advance on their respective learning paths.

4.1.3 Studies Analyzing the Fit between XBRL and Reporting Practices of Companies

The fit or the degree of compatibility of actual reports by firms with a standard XBRL taxonomy has been the subject of a few studies over the years. Bovee et al. (2002) first describe the types of problems that are caused by mismatches between the two, and then analyze the fit between the actual financial statements by firms and the year 2000 version of the US GAAP taxonomy. Bonsón et al. (2008) conduct a similar study on an IFRS taxonomy, and Valentinetti et al. (2011) used the XBRL taxonomy designed to support Italian template-based accounting standards compatible with the EU Directives.

According to Bovee et al. (2002), the design of an XBRL taxonomy potentially affects at least one of the fundamental characteristics of useful financial statement information. The XBRL taxonomy might provide a single, standardized tag for an account that many firms prefer to describe with several near-synonyms. This raises the question, whether the XBRL tag in question faithfully represents what it purports to represent. Moreover, the comparability enhancing characteristic can be affected.

Financial reporting involves aggregation of similar data (Bovee et al, 2002). Aggregation of accounting data leads to a loss of detail, but it is not always clear that the data becomes less useful. Accountants and managers typically use judgment when aggregating accounting data. The aggregation of data does not always end at the master account level (such as Accounts Receivable). Managers can decide how much further they wish to aggregate the accounts when designing financial statements. For example, a firm might disclose an amount for "Property and Plant, Net" and an amount for "Equipment, Net" on its balance sheet. Alternatively it could combine the two into an account titled "Property, Plant, and Equipment, Net." The latter choice provides the user with data that are more aggregated than the former choice. The level of aggregation desired by managers is likely to vary with their incentives and with the firms' circumstances.

Differences between an XBRL taxonomy and the actual reporting practices potentially cause loss of information. Bovee et al. (2002) argue that an XBRL taxonomy should capture information at the same level of detail as that of the preparing firms. However, they argue that the taxonomy should specify one particular collection of control accounts. It is impossible to create a taxonomy that would accommodate the reporting practices of every firm. Firms that only need the same level of disaggregation available in the taxonomy (or less) can achieve complete comparability for their data by using the taxonomy as written. Firms that want greater disaggregation than the taxonomy provides can create custom tags that extend the taxonomy. In fact, at least in the USA, the companies are not allowed to make any changes to the US GAAP base taxonomy, only extensions (Debreceny et al, 2011) The custom tags generated by the firms involve a potential loss of interoperability and comparability across firms.

For example, if a firm has a noncurrent assets account titled "Investment in ABC Company," and another titled "Investment in XYZ Company", each of these accounts can be mapped to the tag titled "Long-Term Investments." One option available to the firm is to use that tag twice - once for each investment. Using the same tag several times preserves comparability with amounts tagged as "Long-Term Investments" by other firms. However, this does not preserve all the information in the firm's balance sheet. If the firm wants to preserve the information that one "Long-Term Investment" amount is associated with ABC Company and the other with XYZ Company, it can create custom tags as children (extensions) of the parent tag "Long-Term Investments", or as completely customized tags.

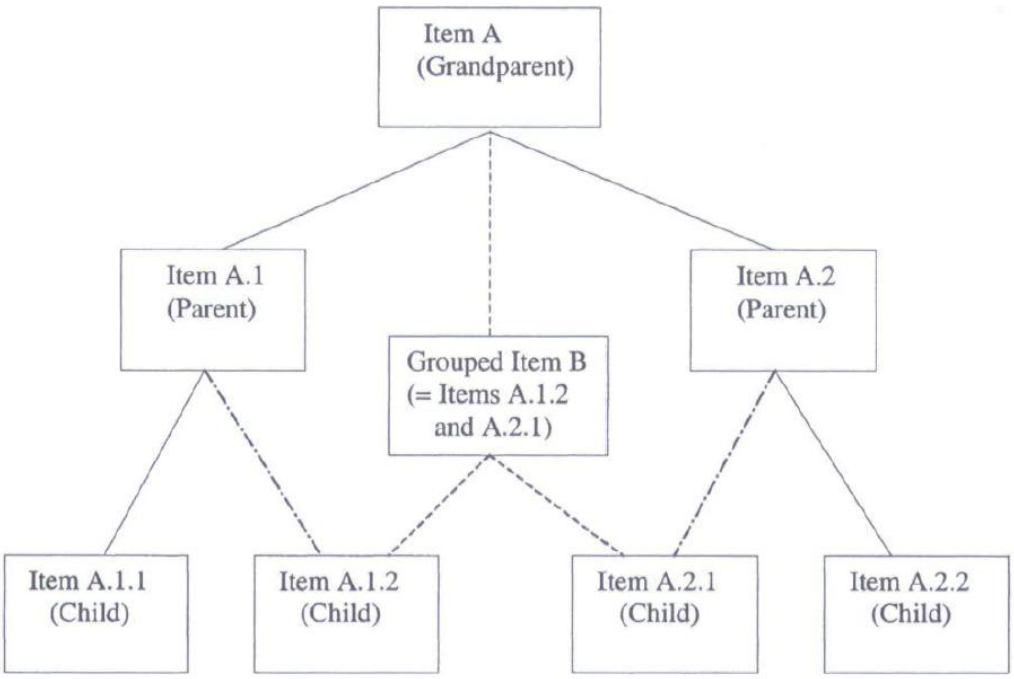
Custom tags allow a firm to preserve more detail n this way, but at the possible cost of comparability. XBRL-enabled software will not recognize custom tags such as "Long-Term Investment in ABC" and "Long-Term Investment in XYZ" as equivalent to the taxonomy's "Long-Term Investment." However, the amounts associated with the custom tags should roll up into the sum associated with their parent account, and comparability can in this case be restored at the level of the parent account and, in turn, on the grandparent level.

According to Debreceny et al. (2009), XBRL documents are structured as hierarchical trees. Unfortunately, firms often want to aggregate information in a way that violates the taxonomy hierarchy. A firm might to present an account that is equivalent to the

aggregation of children from two or more different parent accounts. This requires a custom tag and, again, leads to loss of information when comparing financial data across firms.

Figure 7 shows an example of this case. Comparability is lost up to the second level above the point of grouping. When items A. 1.2 and A.2.1 are combined into grouped item B, items A.I and A.2 are no longer comparable with companies that use the original taxonomy as written. Comparability is preserved only for existing siblings of A. 1.2 and A.2.1, and for the grandparent item A. Such coarsening of information and loss of comparability may get even worse when the grouping of items spans levels of a hierarchy as well as branches at one level.

FIGURE 7: Fracturing of Taxonomic Parent-Child Relationships by Grouping Items



Source: Bovee et al. (2002), p. 174

The Bovee et al. (2002) study used a representative sample of 67 US listed firms from 10 industries for providing statistical data of the degree of fit between the taxonomy and actual financial statements. They made a simple analysis by first comparing individual line items from the sample firms' financial statements with the taxonomy, and assigned

a taxonomy tag to each item when possible. Line items that could not easily be mapped were put aside as "special attention items" (SAI) for later review. Three types of SAIs were identified: line items for which a tag did not exist in the taxonomy (proposed new tags), line items used by only one or few of the sample firms (assumed firm (or industry) specific tags), and grouped items like in figure 7.

Bovee et al. (2002) found that typically more than 85 percent of the financial statement line items could be matched directly with a tag in the first US GAAP taxonomy from the year 2000. Grouped items occurred least often, new tag items more often, and firm specific items most often. In general, mismatches occurred less often in the Balance Sheet (BS) and Income Statement (IS) than in the Statement of Cash Flow (SCF). When viewed by financial statement and SAI type, it is clear that the new tag and firm-specific items dominated grouped items for the IS and SCF, but in the BS there were more grouped items than the other SAIs. According to Bovee et al, this was logical considering that the BS was the most disaggregated part in the year 2000 taxonomy, and the dominance of grouped items for that statement type suggests that sample firms often actually disaggregated their data less than the taxonomy would permit. Conversely, the IS and SCF taxonomies were less disaggregated, which resulted in the sample with IS and SCF having relatively more numerous proposed new tags or firm specific tags.

The analyses by industry indicated that the XBRL taxonomy from the year 2000 did not accommodate reporting practices in some industries as well as it did in other industries. This suggested a need to develop industry-specific extensions to the taxonomy. These extensions need to be consistent with the existing taxonomy to maintain semantic consistency across its levels and across contexts of intended use. The taxonomy might have fit better with the reporting practices, if it had provided a less disaggregated BS and more disaggregated IS and SCF.

It should be noted, that the Bovee et al. (2002) is old and it used even older data. Still, the degree of fit was reasonably good even between this first version of the US GAAP taxonomy and actual reporting practice, and the results from this study were used for further development of the taxonomy. For instance, the number of tags has since then been increased to over 10.000 to accommodate the needs of reporting firms, which leads to quite different types and levels of problems regarding interoperability and

comparability. According to Debreceny et al. (2011), this development has partially been done with a view to include as many industry-specific tags as possible in the base taxonomy.

Bonsón et al. (2009) conducted a similar study in Europe using the year 2004 version of the IFRS General Purpose Taxonomy. They obtained an optimal random sample (stratified by country) of 73 listed European firms that were from five broadly defined industry sectors. The degree of fit between the IFRS-GP Taxonomy and the financial statements prepared according to IFRS (72 per cent overall) was analyzed. It was demonstrated that a majority of the concepts included by companies in their reported financial information appear to be covered by this particular taxonomy. However, there were numerous deviations identified and the fit was clearly far from perfect and far worse than in the Bovee et al. (2002) study from the USA. The results of this study were also used for the further development of the IFRS taxonomy in a couple of ways. The sample contained banking and insurance companies (usually left out of studies) with significantly lower degrees of fit than regular commercial and industrial companies. This is due to the fact that banking and insurance companies use quite different accounting concepts. These should then be incorporated into future taxonomies. Moreover, the Statement of Changes in Equity section of the 2004 taxonomy had a greater degree of misfit than the other three financial statements. According to Bonsón et al, this has already been corrected in later taxonomy versions.

Valentinetti and Rea (2011) argue that the above studies focused on principle-based accounting standards, which offer guidelines and then allow at least some flexibility in the presentation of financial statements. According to them, the analysis of the level of misfit between financial reporting practices and the taxonomies could be understood as a suggestion for the further evolution of the taxonomies. Further, Valentinetti and Rea argue that there is a lack of studies of XBRL and template-based standards, which provide a stricter specification for financial statement presentation. It is not known, whether the possible misfits are caused by the immaturity of the XBRL taxonomies or by the preparers, who do not comply with the accounting standards themselves. Both the IFRS and US GAAP are relatively vague in their presentation requirements, so the standards themselves might take a large part of the blame in this respect.

Valentinetti and Rea (2011) analyze the fit between XBRL standard taxonomies and accounting concepts of financial statements prepared under local Italian standards to fill this specific gap in the above literature, to analyze the applicability of XBRL in the context of template-based standards like the ones laid down in the EU Directives (also applicable in Finland). Using a similar method as the above studies, they selected an optimum sample of 264 companies and assessed the fit between the Italian XBRL Taxonomy (released in December 2008) and the traditional annual pdf reports of Italian non-listed companies, which are required to file their financial statements in XBRL as of 2009.

The results by Valentinetti and Rea (2011) show an almost perfect fit (around 96 per cent) between the taxonomy and the financial statement items retrieved in Balance Sheets and Income Statements, but a considerably lower degree of fit (67.5 per cent) in Memorandum Accounts (the notes to the financial statements). A second result concerns the type of misfit observed and the differences in the aggregation of data between the reporting practices of firms and the taxonomy hierarchy. Firm specific and new tag items are more prevalent than grouped items. This means that the companies tend to report more disaggregated information than required. Therefore, if the firms apply the taxonomy as written without any changes, they can achieve complete comparability of data but with a loss of detailed information. In addition, the degree of misfit, when it occurs, again depends on the sector, the size and the level of disaggregation of information provided by the companies. However, if the firms prefer to extend the taxonomy by creating custom tags, they can, again, preserve the detailed information but with a potential loss of comparability. Specifically, comparability can be preserved at least at the taxonomy hierarchical level, but not for the extensions that do not represent agreed-upon concepts. A further problem was that different firms can create different tags for the same account.

The results by Valentinetti and Rea (2011) are important in that they seem to confirm the intuitive idea that more strict rules on financial statement presentation, like the template used in Italy, would potentially improve the fit of XBRL and financial statements prepared under the IFRS or US GAAP as well. It would be interesting to know, where the degree of fit stands for the later versions of the IFRS taxonomy, but such studies are not available so far.

4.1.4 Studies Related to Taxonomy Design and Quality

The following three studies regarding the technological aspects of XBRL provide important insights for the accounting side of this study, especially regarding comparability. The first is Debreceny et al. (2011). According to them, the fit between the reporting practices of firms and the concurrent US GAAP taxonomy has improved since the Bovee et al. (2002) study, but not much. The study used data from the first round of mandatory XBRL financial statements (all of them from between April 2009 and June 2010) furnished to the SEC's EDGAR database. One result of the study was that some 12 per cent of the elements in the instance documents with a monetary value were extensions, which would translate to a degree of fit for the base taxonomy of about 88 per cent. This suggests an increase of about three percentage points in the degree of fit over the decade. The results look comparable enough with the Bovee et al. (2002) study, because even this study only analyzed elements in the three main financial statements, excluding even the statement of equity. The financial statement notes were not analyzed, because they were only required to be tagged as text blocks for the first year, with detailed tagging being required from the first-round filers only from after June 2010.

However, the purpose of the Debreceny et al. (2011) study was not just to provide an update of the Bovee et al. (2002) study, but to analyze the appropriateness or otherwise of the taxonomy extension choices made by the filers. In its rules and guidance, the SEC requires filers to maintain a very high degree of alignment between their traditional HTML filings on EDGAR and their XBRL filings and lays down a set of rules for matching reporting concepts in the financial statements to elements in the US GAAP taxonomy. The filer should search the taxonomy for possible matches and resort to creating an extension element only when it has, after careful analysis, concluded that a suitable match does not exist.

Debreceny et al. (2011) refined the classifications of SAIs by Bovee et al. (2002) and the other studies discussed in the previous section, and classified the taxonomy extensions into five categories: filer-specific, unnecessary, aggregation, disaggregation, and other extensions. An extension is filer-specific, when there are no semantically equivalent elements in the foundation U.S. GAAP taxonomy to support the concepts contained in the filer's financial statements (and, later, note disclosures). Moreover, in this case the

extension is even required by the SEC to ensure that the XBRL filings mirror the disclosures in the HTML filings on the EDGAR database. An unnecessary extension is, conversely, one that has been made in error despite there being semantically equivalent concepts in the base taxonomy. It should be noted that assessing whether the concept is "semantically equivalent" is sometimes quite difficult as there can be quite subtle similarities and differences between the concepts in the original financial report and the XBRL taxonomy. This difficulty is aggravated by the general complexity of financial reporting and the large number of elements and inherent complexity of the U.S. GAAP taxonomy. All in all, there is always the possibility that filers will unnecessarily extend the taxonomy.

The third and fourth classes of extensions are those that either aggregate or disaggregate existing elements in the foundation taxonomy. An aggregation is made when a corporation includes an extension element that combines two or more existing elements from the foundation taxonomy. A disaggregation is where the filer includes an element in their extension taxonomy that refines a concept from the foundation. Other types of extensions include a range of technical extensions created for various reasons. One of the many is for providing consistency with an already published newer version of the taxonomy.

Debreceny et al. (2011) first downloaded all the elements in the filings made between April 2009 and June 2010, which had the monetary data type and were provided with financial fact values. The 1565 quarterly and annual reports from 540 filers (excluding financial and insurance institutions) had a total of 410.079 reported monetary fact elements (145.053 after eliminating multiple occurrences of the same elements). To assess the nature and extent of extensions in more detail, they took a subset of the first quarterly financial statements of 67 filers between June 15, 2009 and August 31, 2009. There were three groups of filers in the subset. All pharmaceutical (12) and software vendor (15) companies were included, because they were expected to have a high level of distinct intellectual property that may not be reflected in the foundation taxonomy. The third group was a random sample of 40 filers from the remaining population.

Initially, the subset had 695 monetary extensions. The result of about 12 per cent of all monetary tags being extensions held in even the detailed analysis. Only 30 per cent of the extensions were appropriate firm-specific extensions necessary for aligning the

XBRL filing with the required EDGAR filing in html. However, many of even these filer-specific extensions were variations of existing elements, rather than being radically new concepts. About 40 per cent of the extensions were unnecessary, 17 per cent were aggregations, 4 per cent disaggregations, and 8 per cent were other, technical extensions. A significant number of extensions made in the first filing were later dropped, although some were brought back in later filings, while some 134 new extensions were introduced during the period. These types of extension changes in the filings by the same company over time raise issues about the consistency, or comparability over time of the filings. There was a reduction in the number of unnecessary extensions across the period in the detailed subset from the first to the second filing, but the number of unnecessary extensions was consistent for the remainder of the period. Finally, the quality of the extensions was not high, partially due to poor element selection by the filers or their advisers.

The results by Debreceny et al. (2011) are significant to the interoperability, comparability and consistency of XBRL instance documents. Moreover, they provide important insights into the way that the US GAAP taxonomy has been designed, and its extensibility. These issues are discussed more after bringing in the results of the following two more technically-oriented studies with related results, and further when discussing XBRL interoperability and accounting comparability together in Section 4.2.3.

Zhu and Wu (2011) take a data standard quality angle to XBRL, and point out that in computer science, data quality and data standard quality can have multiple dimensions, but argue that since one of the primary purposes of data standards is to produce interoperable data, the quality of data standards can be assessed by the interoperability of the data resulting from the use of the standard. Zhu and Wu develop a framework and a set of metrics to do this.

Data standard quality has at least two dimensions, completeness and relevancy. Zhu and Wu define completeness as the extent to which the data standard specifies all the data elements needed by the users of the standard, and relevancy as the extent to which the data standard specifies only the data elements that the users of the standard need. These definitions explicitly consider users and the way they use the standard. Zhu and Wu point out that the dimensions depend on the user's context. The completeness and

relevancy of the same data standard can be different to different users. Further, they can be different between an individual user and the user community as a whole. Interoperability between a pair of instance documents is based on the proportion of the common data elements used in the instance documents, though the concept is defined in a more refined way in the Zhu and Wu study.

To assess the framework for data standard quality, Zhu and Wu developed a set of methods and computer tools to support data acquisition, processing, and analysis. They collected, processed, and analyzed the XBRL GAAP taxonomy and all (1.231) official XBRL filings submitted to the SEC (by 481 companies) as of February 26, 2010. The results are interesting.

All companies taken together used 2.558 of the standard GAAP elements and introduced 10.168 custom elements. As far as completeness is concerned, the average listed firm can find 87 per cent of the US GAAP XBRL elements it needs in the taxonomy. This ratio is the equivalent to the degree of fit in the above studies. The high level of completeness is hardly surprising as the taxonomy had 10.799 elements at the time, nor is it any surprise that an average filer only needs about 1 per cent of all the standard tags available for their own reporting. The equivalent figures for the user community (all firms together) were 32 per cent and 19 per cent. The lower completeness is due to the large number of custom elements needed and introduced by the user community as a whole. The higher relevancy is due to the fact that the user community taken together uses a larger fraction of the taxonomy elements, because not all the individual preparers choose the same elements.

The highest interoperability score between two firms was 76 per cent, but on average, the score was significantly lower, 37.24 per cent. This means that when extension tags are included, investors can conveniently (automatically) compare only about 37 per cent of the tagged financial statements of two randomly selected US companies. If users would only want to compare the base taxonomy elements, the average pair-wise interoperability would be 42.5 per cent. Zhu and Wu (2011) also give results for comparisons among three companies, where the equivalent figures were only 24 per cent and 28 per cent, and even lower scores are to be expected when the number of firms increases further.

Moreover, the fact that users have great discretion in the choice of the elements leads to a situation where only 41 per cent of filers used all of even just 22 of the most common standard elements. In other words, only 41 per cent of the companies can be compared for 22 of the most widely used standard elements despite conforming to the US GAAP taxonomy. According to Zhu and Wu, this level of comparability is low for analysts and investors to support practical decision making.

To sum up, the quality of the US GAAP taxonomy seems quite low for providing practical comparability and interoperability between two firms, and even lower when more than two firms are compared at once. It should be borne in mind that this analysis was a technical one, and it was applied to an XBRL taxonomy with a significantly higher number of elements than for example the IFRS taxonomy. Still, the results by Zhu and Wu (2011) seem to suggest that allowing filers to choose XBRL tags almost as they please and even create their own extensions severely undermines comparability among firms. According to Debreceny et al. (2011), this in turn increases the need for costly human intervention and interpretation and therefore undermines the prospects for reaping the benefits expected from XBRL.

The second of the other interesting technological studies with potential implications for XBRL taxonomy design and accounting is Piehocki et al. (2009). They discuss the above ideas on a more general level. Piehocki et al. argue that even though the XBRL specification developed by the XBRL International constrains taxonomy design somewhat, the taxonomy designers are left with a wide discretion to design taxonomies for various reporting purposes. Moreover, the taxonomy designers can decide how much additional discretion they should leave to the preparers of the actual instance documents. The solutions to these types of design issues affect the level of challenges faced by the information providers, intermediaries and consumers.

According to Debreceny et al. (2011), regulators and intermediaries basically take one of two approaches to taxonomy design and extensions. Some allow no extensions to their foundation taxonomy (the closed approach). A well-known case of this approach is the taxonomy developed by the U.S. Federal Financial Institutions Examination Council (FFIEC) for the long-established supervisory call reports of American financial institutions. The FFIEC took a closed approach that prohibits all extensions. At the other extreme, the SEC encourages or even requires extensions to the US GAAP base

taxonomy to meet instance document provider-level differences (open approach) in order to guarantee a complete alignment of their XBRL report with the traditional HTML report filed to the EDGAR database.

In their case study on XBRL taxonomies to support the COREP (the COmmon solvency ratio REPorting) financial solvency reporting framework of the European Banking Authority (EBA) for financial institutions, Piehocki et al. (2009) discuss the way one of the main XBRL taxonomy design criteria contradicts with the others. There are three important design criteria underlying the COREP framework. First, flexibility and extensibility leave the national supervisors discretion to decide on the scope of adoption and aggregation of data elements. The second criterion is consistency and the third is standardization for uniformity through a common approach to calculating and reporting the key data elements. Flexibility available to the national banking supervisors to extend the base taxonomy was stated as the most important design objective.

Piehocki et al. (2009) characterize the European banking surveillance system as a complex, hierarchical, and multi-jurisdictional environment. In fact, they came to describe a third type of taxonomy design, where national supervisors are allowed adapt the base COREP taxonomy within certain limits, but the European financial institutions seem to be bound by their respective national taxonomies when creating their instance documents. They analyzed the national versions of the COREP taxonomy from six EU countries, including Finland. The contradictory objectives stated above were exemplified in the difficulties the EBA had when designing a common approach to the COREP data model, given the differences in national regulation. For example, one country had a dramatically larger number of taxonomy elements than the others, and the number of elements differed among the other countries as well. This indicates that there are a large number of potentially inconsistent elements between the national jurisdictions. The inconsistencies can lead to redundancies between the national supervisors, because conceptually identical elements are expressed differently in the various national extensions, and because there is no mechanism provided by the standard setter to inform the other national supervisors about such equivalencies.

A similar problem was found by Debreceny et al. (2011), who discovered cases where US firms had provided mutually inconsistent extensions to the US GAAP base taxonomy

for reporting semantically the same economic phenomenon. Piehocki et al. (2009) also observed differences in the number of increases beyond the number of calculation and definition linkbases in the base taxonomy, which describe the numeric and other relationships between elements in the taxonomy. This was said to mean that even radically different national data models are being used despite the common base model and taxonomy. This in turn adds even more to the inconsistencies between the national taxonomies.

Piehocki et al. (2009) point out that the situation leads to severe problems for especially cross-border financial institutions, which are required to file COREP reports with more than one national supervisor. Such financial institutions typically run their solvency reporting on the group level. The institutions might even be able to find all the data in a central data source (data warehouse), but the data must nevertheless be mapped to potentially dozens of national extension taxonomies. The use of different data models makes such mapping an almost impossible task. In this way, the tasks that should be handled by the supervisors (convergence between national data models and standardization of reporting) but are neglected by them cause significant and costly challenges to the reporting banks (information producers).

Moreover, those who consume the information must also cope with the inconsistencies and obtain an understanding of the complexities and subtleties of the national extensions, and adjust their data collection techniques appropriately. Piehocki et al. share the argument given by Debreceny et al. (2011) in the US GAAP taxonomy extension context, about the difficulty of seeing how information consumers, for their part, can manage the information flows within the COREP system without significant monetary and human investment.

It is difficult to balance the need for flexibility and extensibility with the understandable desire for comparability and consistency. Still, Piehocki et al. (2009) concluded that when XBRL-based business-reporting solutions are being designed and proposed, there must be a clear understanding of the costs and benefits of flexibility. Flexibility does indeed come at a cost in the form of the types of constraints and challenges mentioned above for information producers and consumers, and an increased lack of comparability. This may in turn negatively affect transparency when the underlying

data models are inconsistent. All of these costs must be traded off against the benefits of increased flexibility.

These and other problems with taxonomy design, especially the loss of comparability due to the discretion left to filers and lower-level regulators to extend the base taxonomy, are compounded when coupled with the problems in the comparability of the accounting standards themselves. This discussion is continued in Section 4.2.3.

4.1.5 Other Technological Studies Related to XBRL

Two other studies illustrate the use of automatic tools that have been demonstrated to be useful for automating the mass processing of historical data from actual financial statement for taxonomy development. In the already mentioned Bovee et al. (2005) study, a computer system called FRAANK was developed together with a method to "understand the meaning" of financial statement line items by mapping every line item (if possible) to a tag in an XBRL taxonomy. For this, they used a knowledge source of accounting term synonyms, stored in a relational database, to cope with the variation that was encountered in corporate use of terminology, and subsequently identify and parse the appropriate substitute terms. The knowledge source was based on an XBRL taxonomy, with each taxonomy tag mapped to (possibly many and a growing number of) synonyms encountered in previously analyzed SEC filings.

According to Bovee et al. (2005), the FRAANK is an automatic weak-type artificial intelligence software agent with capability to retrieve, extract and “interpret” accounting numbers from natural-text financial statements, and convert them to XBRL and combine this data to other types of financial information. The FRAANK parsed the US financial statement line items, and provided mismatch data for human update of the synonym knowledge database. It is capable of identifying tabular data and checking and calculating sums and subtotals.

Bovee et al. (2005) followed a standard approach in machine learning, where they first trained the FRAANK using a dataset of 10-K's containing 78 companies' (from 12 industries) financial statements for 1999. After this they used another dataset contained the latest 10-K reports of 50 random companies for actual testing. When the test data was used, the overall accuracy of tagging line items was 80.4 per cent, and the accuracy of tagging monetary amounts was 85.5 per cent. Higher percentages were achieved at more aggregate levels of taxonomy, and for the balance sheet, where more effort had

been expended for training data. All these figures excluded the type of mismatch situations, where a new XBRL tag would be needed. Though good accuracy, a significantly higher level of accuracy would be very difficult to achieve without tremendous human work. Still, the FRAANK has been proved to be a useful tool for developing new taxonomy versions by providing a way for an automatical, empirical evaluation and improvement of XBRL taxonomies by assessing their fit to actual, historical data. The FRAANK has been developed further since the Bovee et al. (2005) study, and it has also lately been used in research that explores auditing and assurance issues around XBRL (Srivastava and Kogan, 2010).

A newer study by Chakraborty and Vasarhelyi (2010) compared a taxonomy created using semi-automatically extracted actual historical pension footnote disclosure data - a more challenging information extraction task than the above - with the equivalent elements in the US GAAP XBRL Taxonomy. To do this they used software programmed for a method called agglomerative hierarchical clustering. A training dataset contained pension disclosure notes of EDGAR 10K financial statements for 2007 of 80 companies, and the test dataset consisted of 40 other companies.

The overall accuracy of the semi-automatically created taxonomy using the test data set of actual financial statements had 95 per cent same tags as in the actual US GAAP XBRL taxonomy itself. Companies tended to aggregate pension note data slightly more than the XBRL taxonomy, and sometimes they used terms that do not exist in the taxonomy. They also positioned them differently. The same software tool was subsequently used for the evaluation of 10-year line item label consistency of historical filings. Added and removed labels and even sections were found, often due to changes in reporting requirements. This software, too, has been proved to be useful in gathering actual data for taxonomy development.

An evaluation of accounting issues related to XBRL is provided in the next sections. A summary of the findings from these technological evaluations is provided in Chapter 5.

TABLE 1: Studies on Technological Issues Related to XBRL (* denotes a working paper reference without peer review)					
Reference	Research Question(s)	Method/tool	Task	Data/Subjects	Key Results
Issues Regarding Quality of Actual XBRL Filings:					
Bartley et al. (2011)	Types and frequencies of errors in SEC's XBRL Voluntary Filing Program (VFP), and their development from 2006 to 2008	Manual	Compare labels, values, and signs line-by-line between XBRL and traditional 10-K	33 US GAAP XBRL financial statements furnished in VFP in 2006 and 2008	Errors were detected in the XBRL filings of all 22 companies in 2006, and almost all (10/11) in 2008. However, frequencies of display errors which do not affect the usability of the data items themselves decreased dramatically from 2006 to 2008.
Debreceny et al. (2010)	Degree of correctness of mathematical relationships in mandatory instance documents filed	Custom-made automatic software tool	Compute all sums in all filings to capture all calculation errors and categorize	393 US GAAP first mandatory round XBRL filings, downloaded from the SEC website.	One quarter of initial mandatory filings by 400 large corporations had mathematical calculation errors. Most common type was inappropriate treatment of underlying taxonomy debit/credit assumptions (43%); others were missing figure (15%), extraneous figure (11%), incorrect value (13%), rounding (7%), and error in original (3%)
Markelevich et al. (2010)*	Compare traditional annual (pdf) financial reports to their XBRL filed counterparts	Manual	Quantify inconsistencies	Reports submitted to MAGNA by 565 listed Israeli companies.	Despite validation performed by Israeli regulator, 34% of all XBRL filings inconsistent with traditional, 11% had missing data, 27 % other inconsistencies (incorrect signs and others); some had several types of inconsistencies. Industry sector distribution relatively even.
Studies on Fit Between XBRL and Reporting Practices					
Bovee et al. (2002)	Degree of fit between actual financial statements and US GAAP C&I XBRL Taxonomy 2000	Manual	Match each line item in US listed firms' annual 10-K financial statements filed at SEC with a tag from the taxonomy	Representative sample of 67 US listed firms from 10 industries	Typically more than 85% of financial statement line items could be matched directly with a tag from the taxonomy. Distribution of unmatched line items was uneven across financial statement types, industries, and reasons for unmatch, with mismatches in aggregation and firm-specific practices, and mismatches most common in cash flow statements

TABLE 1: Studies on Technological Issues Related to XBRL (* denotes a working paper reference without peer review)					
Reference	Research Question(s)	Method/tool	Task	Data/Subjects	Key Results
Bonsón et al. (2009)	Degree of fit between actual financial statements and IFRS-GP XBRL Taxonomy 2004	Manual	Try to match each financial statement line item from annual report with a tag from the taxonomy	Stratified random sample of 73 listed European firms from 5 sectors	Typically 72 % of financial statement line items could be matched directly with a tag from the taxonomy. Distribution of unmatched line items analyzed across financial statement types, industries, firm size, and home country, with statement of changes in equity, banking industry exhibiting greatest mismatches
Valentinetti and Rea (2011)	Degree of fit between template-based financial statements and the Italian GAAP XBRL Taxonomy	Manual	Match each financial statement line item from annual report with a tag from the taxonomy	Random sample of 268 non-listed Italian companies	Good average fit (around 96%) for balance sheet, income statement due to standard template in originals, lower for voluntary notes (67%). Reports more disaggregated than taxonomy, complete comparability when taxonomy applied as written, but more detailed information than in template comparability may be lost, extensions problems as tags for same concepts may differ among firms
Studies Related to Taxonomy Design and Quality					
Debreceny et al. (2011)	Analyze aspects of appropriateness and inappropriateness of taxonomy extensions made by filers	Manual with automatic preliminaries	Classify taxonomy extensions into appropriate, unnecessary, aggregations, disaggregations, and others	Taxonomy elements with monetary value from 1565 by US first-round annual and quarterly filings, 67 filers selected for detailed analysis	About 12% of all monetary tags were extensions. Only 30% of them were completely appropriate and necessary filer-specific extensions for aligning the XBRL filing with the required EDGAR in html. About 40% of the extensions were unnecessary, 17% were aggregations, 4% disaggregations, 8% other, technical extensions.

TABLE 1: Studies on Technological Issues Related to XBRL (* denotes a working paper reference without peer review)					
Reference	Research Question(s)	Method/tool	Task	Data/Subjects	Key Results
Zhu and Wu (2011)	Evaluate certain quality aspects of US GAAP Taxonomy as a data standard	Develop and empirically evaluate framework and metrics for data standard quality aspects	Compute values for completeness, relevancy, and interoperability metrics of US GAAP XBRL Taxonomy by examining instance document filings	1.231 US XBRL filings submitted to the SEC by 481 companies listed in the USA	The average listed firm can find 87% of the XBRL elements they need in the US GAAP taxonomy (completeness), but it only needs 1% of them for reporting (relevancy). Equivalent figures for all listed firms together were 32% and 19%. Average pair-wise interoperability is 42.5% for US GAAP elements used, but 37% with custom elements included (24% and 28% for triples). Only 41% of filers used all of even just 22 most common standard data elements. Interoperability low for practical comparability.
Piehocki et al. (2009)	XBRL extension flexibility vs. interoperability in a hierarchical multi-jurisdictional environment	Case study	Implications of taxonomy extensions allowed by European COREP taxonomy to national banking supervisors	Features of extended national versions of COREP bank supervision taxonomies from six EU countries	Use of taxonomy design flexibility allowed in XBRL is severely constrained by inherent problems. Differences in extension taxonomies indicate large differences in underlying data models despite standardized common core. Significant costs of interpretation for both producers and consumers forced to use many different data models. Another cost is added lack of comparability when information providers are allowed to use extensions. New "maximal data model" taxonomy approach needed?

TABLE 1: Studies on Technological Issues Related to XBRL (* denotes a working paper reference without peer review)					
Reference	Research Question(s)	Method/tool	Task	Data/Subjects	Key Results
Other Technological Studies Related to XBRL					
Bovee et al. (2005)	Retrieve, extract and interpret accounting numbers from natural-text financial statements, and convert them to XBRL	Automatic weak-artificial-intelligence software agent called FRAANK	Extract US financial statement line items, match with XBRL tag synonyms, and provide mismatch data for human update of synonym knowledge database	Training dataset: 10-K's containing 78 companies' (12 industries) financial statements for 1999. Test dataset: latest 10-K's of 50 random companies	Overall accuracy using test data of tagging line items 80.4%, accuracy in tagging monetary amounts 85.5%. Higher percentages achieved at more aggregate levels of taxonomy, and for balance sheet where more effort had been expended for training data. (All figures excluding mismatches where a new XBRL tag would be needed). Though good accuracy, a significantly higher level of accuracy would be very difficult to achieve without great human effort. FRAANK useful tool for developing new taxonomy versions
Chakraborty and Vasarhelyi 2010	Compare auto-extracted Taxonomy for pension footnote disclosures with US GAAP Taxonomy	Automatic software using method called agglomerative hierarchical clustering	Use semiautomatic taxonomy creation method, compare structure of created taxonomy to XBRL US GAAP taxonomy, demonstrate use for more exploratory research	Training dataset: pension disclosure notes of EDGAR 10K financial statements for 2007 of 80 companies, 40 others used as test dataset	Overall accuracy of semi-automatically created taxonomy using test data set of actual financial statements had 95% same tags as the US GAAP taxonomy. Companies tend to aggregate pension note data slightly more than the XBRL Taxonomy, sometimes use terms that do not exist in the taxonomy, and position them differently. Same tool used for evaluation of 10-year line item label consistency. Added and removed labels and even sections found, often due to changes in reporting requirements. Useful tool for gathering actual data for taxonomy development.

4.2 Accounting Evaluation

4.2.1 About Accounting Issues Related to XBRL

As stated in Chapter 3 above, accounting standards are constantly being developed independently of the developments in the XBRL taxonomies. Still, their requirements will probably affect the extent that XBRL will be able to deliver the benefits expected from it. Moreover, there would be little point in interoperability and XBRL tagging, unless the financial statement information itself is of high-quality and useful. The fundamental qualitative characteristics for useful financial information, relevance and faithful representation, must apply regardless the file format. And the usefulness of even XBRL financial statements is enhanced, if the underlying information is comparable and understandable. In this section I evaluate some of the general developments in financial reporting regulations and accounting standards, together with some assurance issues that may have significance to or be affected by XBRL and Internet reporting, and try to relate some of the results from the technological evaluations to them.

4.2.2 Issues with XBRL and Faithful Representation: Need for XBRL Assurance

About Deficiencies in XBRL Financial Statements and the Demand for Assurance

Having regard to all the technical quality problems with XBRL filings discussed above, which could not be completely removed even though the preparers and the regulators had access to guidance and used automated technical validation tools, it should be clear that the some form of further technical quality control must be required from the filings. The instance documents provided by the filers cannot, at least not yet, be relied on for making investment decisions, even though they are made available on the regulator web site. It will take several rounds of filings by the preparers, new software tools, and practical learning by regulators and other relevant constituencies before the instance documents can be called reliable.

As discussed above, Bartley et al. (2011) classified the deficiencies they detected in the initial voluntary filings into missing financial statement elements, incorrect amounts, incorrect signs, duplicate elements, incorrect tags for financial statement concepts, and inaccuracies in the display of the financial statements. Debreceny et al. (2010) brought in a partially similar categorization of mathematical deficiencies. The most common of these was an

inappropriate treatment of underlying taxonomy debit/credit assumptions. Filers seemed to be fixated to adding a sign to the figure, resulting in reversal from the sign of the natural balance. The missing figure and extraneous figure errors are often related, because a double error is often due to a misplacement of an element within the taxonomy structure. Other mathematical errors included incorrect values, rounding errors, and an error in original, meaning that the calculations do not sum up correctly due to an amount that does not come from rounding. Debreceny et al. (2011) analyzed the concern whether the extensions to the base taxonomy made by the firms were appropriate and necessary.

Srivastava and Kogan (2010) first gathered and classified the above and other risks of deficiencies in XBRL instance documents into deficiencies in the data itself and deficiencies in the meta-data within and external to the instance document. The former pertains to possible deficiencies in the facts that are marked up in the XBRL instance document, and the latter refers to the possible deficiencies of the mark-up itself, including both the deficiencies of the mark-up in the instance document and deficiencies in the possibly extended XBRL taxonomies. They argue that even though this decomposition of risks is useful for structuring the assertions that assurance attests to, the deficiency risk types are closely interlinked and should often be tested together.

Plumlee and Plumlee (2008) argue that users will want to be confident about the reliability of the data in the XBRL filings. Now that XBRL-based financial data has become a required part of SEC filings, the potential for material misstatements due to just the tagging process required to convert the information into XBRL documents is becoming a real concern. This concern is enhanced after the initial 24-month modified liability provisions granted by the SEC for mandatory filers ceases to apply in each of the three phase-in categories (Debreceny et al, 2011).

Plumlee and Plumlee (2008) also point out that tagging financial statements with XBRL creates documents that are computer readable and searchable. XBRL enables extracting individual pieces of data from the files without paying attention to the context of the financial statements as a whole, and these single pieces of XBRL-tagged information may then be extracted across a broad sample of companies. The pieces of data extracted may be used in many imaginable ways, and the users may even be computers. Plumlee and Plumlee argue that this idea of data-centric financial statement information is a crucial extension of the traditional reporting system, which leads to demands that the focus in auditing should,

in addition to the standard auditing of the financial statements as a whole, be shifted more towards assuring that even all the individual data items are correct.

The demand for XBRL assurance was also studied by Venkatesh and Armitage (2012) in an online survey among 39 CPAs from all levels of an audit team from staff auditors to partners. (Nine hundred CPAs were invited to participate between December 2009 and February 2010, 84 of them did, but only 39 managed to complete the survey.) The results suggest that accountants and auditors believe that assurance on XBRL financial statements is important, that they will need to adjust their auditing methods to incorporate the use of XBRL information in the audit process, and that independent assurance provided on XBRL information will improve the accuracy and reliability of the XBRL tagged financial statements.

The discussion about a demand for assurance of XBRL financial statements is also related to the visions by the AICPA (2008) and others about the paradigm shift in financial reporting and assurance described in Section 3.2.1. In this context, introducing mandatory XBRL marked the beginning of a move away from paper-based reporting to the second phase of a three-phase evolutionary process sketched in Boritz and No (2009). In the first phase, the focus of assurance is on whether the paper financial statements present fairly as a whole. XBRL filings were just agreed with paper documents, if anything. The paper paradigm financial statements and XBRL-tagged instance documents coexist in the current second phase, where companies first create the paper paradigm financial statements and then, only afterwards, create the XBRL instance documents. No independent assurance has been required on the XBRL version of the ‘‘official’’ financial statements in regulatory filings around the world so far.

In the third phase, XBRL financial statements may replace the paper paradigm financial reporting altogether. Rather than being generated as an intermediate product to be translated into XBRL, the XBRL-related documents will be created directly from the accounting information systems. Assurance might focus on the fair presentation of the business facts, the compliance of XBRL-related documents with the relevant XBRL specifications and regulatory requirements, and directly on the effectiveness of the process and controls being used in generating the XBRL-reports.

A Suggested Conceptual Framework for XBRL Assurance Assertions

As stated above, investors and other users can be expected to demand for third-party assurance on the XBRL reports, the tagging process and their compliance with technical specifications and regulatory requirements. According to Plumlee and Plumlee (2008), institutions like the AICPA and the Public Company Accounting Oversight Board (PCAOB) had issued guidance on attest engagements regarding the XBRL information for the Voluntary Filing Program (VFP) in the USA. This attestation included the auditor merely "agreeing" a paper version of the XBRL-related documents to the information in the official EDGAR filing. As stated above, this is likely to be insufficient especially in the second and third phases of the expected reporting paradigm shift, when XBRL becomes more widely used and mandatory and perhaps replaces paper-based reports altogether. Consequently, there is a need for further development in the field of assurance and XBRL.

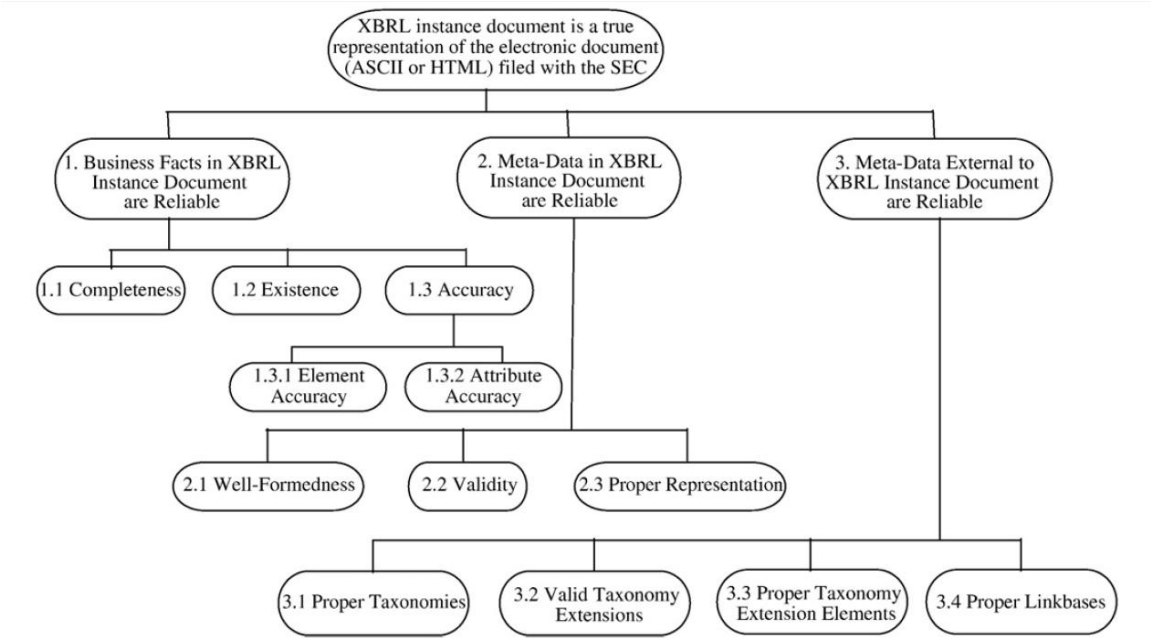
Boritz and No (2009) went through a case of a model XBRL assurance engagement on one of the VFP filers (UTC Corporation). They followed a procedure based on the International Standard on Assurance Engagements (ISAE) 3000, but adapted for electronic business reporting. The process had its four usual steps – the client acceptance, planning, testing and evidence, and evaluation and reporting phases. The idea was to obtain XBRL-related experience from each phase and to identify types of deficiencies that can be expected to be found in the XBRL financial statements. The results served as one basis for AICPA and PCAOB and later Srivastava and Kogan (2010) for developing ideas for testable audit assertions related to XBRL, and are included in the latter.

Srivastava and Kogan (2010) argue, that the content of an audit assertion is the claim that a specified set of deficiencies affecting the audit subject matter is not present. Applied to XBRL, an assurance process should be driven by assertions, which state that possible and identifiable deficiencies (e.g. the mathematical errors mentioned in Section 4.1.2) are not present in the XBRL instance documents. Satisfying the set of the pre-defined assertions based on known potential deficiencies will in turn assure that the audited instance document faithfully represents the (originally paper-paradigm) document filed.

Based on the risks of deficiencies in XBRL documents that had been identified before, Srivastava and Kogan (2010) developed a set of assertions they propose for use as a framework for assuring that the XBRL instance document "is a true representation of the

electronic document (ASCII or html) filed with the SEC". Figure 8 provides a schematic representation of the proposed assertions and their sub-assertions.

FIGURE 8: A Conceptual Framework of Assertions for XBRL Instance Documents



(Source: Srivastava and Kogan (2010), p. 267)

Each of the assertions is next discussed in turn, together with some evidence gathering procedures for each that can be performed by an expert auditor along with the possible use of more or less intelligent software tools. The assertions and procedures have been refined by Srivastava and Kogan from earlier ones provided for discussion by for instance the AICPA and the PCAOB. The main assertion is true if the sub-assertions specified below are true.

1. Assertions about business facts in an XBRL instance document:

Completeness (1.1). All relevant business facts including footnotes and other non-financial information that are required to be reported in the traditional format document are tagged in the XBRL instance document. This may be assured by tracing from the source document all items that are required to be tagged to the XBRL instance document and checking that all these business facts are tagged.

Existence (1.2). There is no tagged business fact in the XBRL instance document that is not present in the traditional format document. Trace from the XBRL instance document to the original document to check if the tagged facts exist in the original document.

Accuracy (1.3). The values of all business concepts tagged in the XBRL instance document and the corresponding attribute values (such as context, unit, etc.) accurately represent the facts in the traditional format document. This assertion actually has two sub-assertions: Element Accuracy (1.3.1.), which can be ascertained by tracing from the text document to the XBRL instance document to check that the values of all the business facts are the same as the values on the rendered document. The other sub-assertion is called Attribute Accuracy (1.3.2), which can be ascertained by tracing from the text document to the instance document to check if the values of all the attributes are the same as the values of these attributes in the instance document.

2. Assertions about meta-data within the XBRL instance document:

Well-formedness (2.1). The XBRL instance document must be well-formed, i.e. it must comply with all XML syntax rules. This can be verified by evaluating the error messages generated by the software or by using any approved XML parsing software to verify that the instance document is well-formed.

Validity (2.2.). The XBRL instance document must be valid, which means that it must comply will all the rules of XBRL and the XBRL taxonomies referenced. This is ascertained by evaluating the error messages generated by the software or by using any approved XBRL parsing software to verify that the instance document is valid.

Proper representation (2.3). The tagged business fact in the XBRL instance document must properly represent the facts in the traditional format document. This can be checked by tracing from the instance document to the text document to see if the tags, as defined in the XBRL taxonomies, properly represent the facts of the traditional format document.

3. Assertions about the meta-data external to the XBRL instance document:

Proper taxonomies (3.1). The business facts tagged in the XBRL instance document should use appropriate general and industry-specific XBRL taxonomies. This can be ascertained manually by comparing the instance document's discoverable taxonomy set (DTS, a set of one or more XBRL taxonomies used to validate an instance document) with the available

approved and acknowledged XBRL taxonomies to check that all the appropriate taxonomies are used and that all the used taxonomies are appropriate. An XBRL processing software can also be used to identify and visualize the discoverable taxonomy set in the instance document.

Valid taxonomy extensions (3.2). The XBRL taxonomy extensions referenced in the XBRL instance document must be valid. This means that they must comply with all rules of XML and XBRL. The error messages generated by the software used for verifying validity can be evaluated, or an approved XBRL processing software used to verify that the taxonomy extensions are valid.

Proper extension elements (3.3). The new elements in the XBRL taxonomy extensions referenced by the XBRL instance document must be introduced appropriately. This means that the extension tag is provided with its appropriate attributes, and it has been created only when there is no standard tag available. New elements in XBRL taxonomy extensions should be analyzed to verify that they are defined properly and that they do not unnecessarily duplicate existing standard taxonomy elements. An XBRL processing software might also be used to examine the new elements in XBRL taxonomy extensions.

Proper linkbases (3.4). The linkbases in the XBRL taxonomy extensions referenced by the XBRL instance document must be appropriate. New and changed arcs (a term in XML related to linking technologies) in the linkbases of XBRL taxonomy extensions should be analyzed to verify that they are defined properly or an XBRL processing software should be used to examine new and changed arcs in the linkbases of XBRL taxonomy extensions. The "proper linkbases" assertion includes the respective sub-assertions for each type of linkbases in the XBRL taxonomies. In particular, the verification of the "proper label linkbase" assertion requires ascertaining that the labels assigned to new elements or re-assigned to the standard elements in the extension taxonomies are chosen appropriately. The verification of the "proper presentation linkbase" assertion requires ascertaining that the hierarchical structure described by the introduced arcs is appropriate for the filer. Similarly, the verification of the "proper calculation linkbase" assertion requires ascertaining that the aggregation rules described by the arcs are appropriate for the elements. The verification of the "proper definition linkbase" assertion requires ascertaining that the introduced dimension relationships are appropriate. Finally, the verification of the "proper reference

linkbase" assertion will require ascertaining that the linking arcs refer to appropriate external regulations or standards.

In the survey by Venkatesh and Armitage (2012), the participants were also asked to rank a few of the above XBRL-related assertions (accuracy, completeness, existence, proper taxonomies, proper extensions, valid extensions and validity and well-formedness) by importance. Accuracy and completeness assertions were ranked the most important, and assurance on validity and well-formedness the least important.

In principle, the assurance process is similar to the traditional audit, where evidence is collected, evaluated and aggregated to ascertain that each assertion is true at a high level of confidence. In addition to the assertions and assurance procedures mentioned above, Srivastava and Kogan (2010) discuss materiality, sampling and other issues raised by Plumlee and Plumlee (2008). The questions include, for instance, whether sampling can be sufficient to ensure that there are absolutely no mistakes in the XBRL document (otherwise computer reading may fail). Another important question is, whether there is a need for assuring materiality on each line item in addition to the financial statement as a whole? Moreover, it is so far unclear what inherent risk, detection risk, control risk, analytical procedures risk and detection risk components of the traditional audit risk model actually mean in the context of an XBRL assurance engagement.

According to Srivastava and Kogan (2010), some of the assertions above ("well-formedness", "validity" and "valid taxonomy extensions") can be easily verified automatically using XBRL processing software. However, some of the other assertions ("completeness", "existence", "accuracy", and "proper taxonomies") require human analysis of intermediate level of expertise. The rest of the assertions ("proper representation", "proper extension elements", and "proper linkbases") require a high level human judgment and a high level of expertise.

However, results by Venkatesh and Armitage (2012) suggest that auditors have a limited knowledge about XBRL and have received well below average training in XBRL. Moreover, the auditors do not feel they have the skills, expertise and training to provide assurance on XBRL. The situation may have improved since the time of the survey, but there is reason to believe that making assurance of XBRL filings mandatory would be extremely challenging for the profession. Srivastava and Kogan (2010) also propose automating many of the more demanding assurance procedures by using intelligent software agents like the FRAANK discussed in Bovee (2005). However, such software agents seem to be in an experimental

stage, and it will take some time before they become affordable and widely available tools for XBRL auditors.

Trites (2010) criticizes the assertions developed by Srivastava and Kogan (2010) for targeting the XBRL document rather than the tagging process used for producing it, because this might lead to excessive and costly assurance procedures. According to him, it may be sufficient to check the appropriateness of the tagging process (along the lines of a common information system audit), because the original financial statements have already been audited. Even more so in the third phase of the evolutionary process of financial reporting paradigm shift described above.

White (2010) shares the concerns by Trites and suggests a simpler outline for such a tagging process and documentation that an assurance engagement client should have, together with a far less complicated evidence collection process for the assurance provider.

According to White, an entity should complete the following activities when preparing their financial statement instance documents:

- Cho0se an appropriate XBRL taxonomy for the intended purpose of the financial reports. For a European listed firm, this would typically be the IFRS taxonomy.
- Map the financial reports to the concepts in the chosen XBRL taxonomy.
- Identify all intended changes and extensions to the XBRL base taxonomy.
- Chose a software tool to create and validate their instance document package.
- Create and validate the instance document package. The instance document package would include the instance documents with financial information together with information about the document and entity taxonomy, the extension taxonomy, and all associated linkbases.

When collecting evidence for providing an assurance opinion, an assurance provider should, according to White (2010), perform the following activities:

- Review the intended purpose of the instance document package. This would require that the auditor is familiar with the most recent guideline documents.

- Obtain the client's instance document package and all supporting documentation.

- Perform the appropriate assurance procedures using manual techniques and reliable software to collect the evidence necessary to render an assurance opinion.

This section discussed potential impacts of XBRL financial reporting on the faithful representation characteristics of useful financial information. As can be seen from the above discussion, the debate about the nature of the changes needed in assurance due to XBRL has not been resolved yet, apart from perhaps recognizing the need for such assurance. It also seems clear that the assurance needed is in some respects quite different from the traditional, and that assurance providers need more training to be able to perform their part. Moreover, XBRL-related assurance seems to be in a phase of intensive development at least in the USA, and there are definitely going to be lessons to be learned from the American experience, if XBRL is to be introduced for companies listed in Europe.

4.2.3 Issues with Accounting Harmonization and Comparability

Accounting Harmonization

International accounting harmonization has been in progress for decades and dozens of empirical studies have been published. According to the IASB (2010), some degree of comparability is likely to be attained by simply satisfying the fundamental qualitative characteristics of financial information, because a faithful representation of a relevant economic phenomenon should naturally have some degree of comparability with a faithful representation of a similar relevant economic phenomenon by another company. However, it is not clear that even one single standard like a globally approved IFRS would lead to complete harmonization, for reasons discussed in more detail below. Harmonization between countries that were using different standards, such as the US GAAP and IFRS, may have led to better comparability than before, but the remaining differences are still significant. This can be seen both by looking at the remaining differences in the accounting treatment of same economic phenomena in the standards themselves and by looking at some recent studies that use market-based data. (See for instance Troberg (2007) or Wunder (2008) for remaining differences between the IFRS and US GAAP standards.)

Some earlier studies calculated various forms of harmonization indices of accounting treatment differences in the regulations and their use by companies between countries. More recently, there have been many studies that used stock market data, and there are more with

a working paper status. The results are mixed and depend on the viewing angle. For instance, introducing IFRS may increase the comparability between the countries that are requiring it, but at a cost of reduced comparability within the countries between IFRS users and those companies that continue using the national GAAP (Callao et al. (2007), Guggiola (2010)).

Most of the market-based empirical studies have focused on convergence within one EU country, among several EU countries or within the EU as a whole, before and after the IAS regulation, or between the US GAAP and IFRS for firms listed in the USA. The studies indicate that some significant differences have remained, though they may be smaller than before the harmonization took effect. This is not surprising because of the remaining differences in the accounting standards. Parts of these differences are already being eliminated in Norwalk agreement projects.

For instance, Liu and Yao (2010) studied the comparability between net income reported under EU-IFRS and US-GAAP among EU companies in 2007, right before the SEC relieved them from disclosing the reconciliation between the US GAAP and IFRS (the time when these two standards had been converged as far as possible, but both were still in use by the EU companies). The evidence shows that significant differences still exist in the net income reported by the EU companies under EU IFRS and US GAAP. Such differences were primarily a result of different accounting treatments of research and development expenditures, pensions, business combinations, and deferred income taxes.

Callao et al. (2007) studied the effects of the new standards on comparability of financial reporting in Spain. They looked for significant differences between accounting figures and financial ratios under the two sets of standards (local Spanish and IFRS). The results show that local comparability has worsened. The study reveals that local comparability is adversely affected if both IFRS and local accounting standards are applied in the same country at the same time. Reforms to bring local rules into line with international standards would therefore be needed even after introducing IFRS for listed companies.

In a working paper by Beuselinck et al. (2007), comparability of accounting earnings for 14 EU countries was analyzed for the period 1990 - 2005. They focused on the association between accruals and cash flow, and demonstrated that accruals were substantially affected by the business cycle stage and firm specific reporting incentives. Incentives arise from the equity capital market, debt financing and labor markets. These incentives were intensified by

a country's institutional framework, such as stock market development, importance of bank financing and labor union membership. In addition, their results suggest that the mandatory introduction of IFRS in 2005 did not, at least instantly, bring about the expected improvement in earnings comparability across Europe.

Uniformity vs. Comparability

It should be noted, that all of the above discussion was about whether bringing the rules of the accounting standards closer together results in more comparability between firms, measured one way or another. The reasons for a lack of expected improvement in comparability in for instance the Beuselinck et al. (2007) study lead to suspect that achieving comparability is not as simple as just harmonizing the accounting rules. The IASB (2010) does acknowledge that comparability is not uniformity. The above harmonization can be said to increase uniformity between the standards concerned. However, it is not clear, and there is limited empirical support to the idea that a more true comparability of the actual financial statement figures would be an automatic result from convergence of the mere letter of the standards.

According to the IASB Conceptual Framework (2010), information about a company is more useful if it can be compared with similar information about other companies (and with similar information about the same company for another time), because it enables users to identify and understand similarities and differences among them. Unlike the other qualitative characteristics, comparability does not relate to a single item, but at least two. For information to be comparable, like things must look alike and different things must look different. This means that comparability of financial information is not enhanced by making unlike things look alike any more than it is enhanced by making like things look different. For instance, both of types of the mistakes often happen in lease accounting when preparers choose the way they formulate the agreements and when they choose the way they apply accounting standards to them.

The IASB admits that although a single economic phenomenon can be faithfully represented in several ways, permitting alternative accounting methods for the same economic phenomenon diminishes comparability (IASB, 2010). Barth and Schipper (2008) point out that both the US GAAP and the IFRS clearly contains instances of this type of violations of comparability, in the sense that items that apparently are similar are not accounted for the same way in all cases even within the same accounting standard (for example accounting for

leases). The standards also contain explicit free choices (for example classification of financial assets).

Zeff (2007) lists other factors that may potentially impede comparability of accounting figures even under the same accounting standard such as the IFRS. First, there are differences in business and financial culture, such as differences in incentives for executive compensation or corporate structures. Then there are differences in accounting culture (such as in the role of tax accounting) and auditing culture (true and fair view or by the book). Regulatory and stock market cultures also differ from one country to the next. There are problems of interpretation, problems with language and terminology and more. Differences in other aspects of the general corporate governance regimes have also an impact on accounting.

Sunder (2009) shares the criticism by Barth and Schipper (2008) regarding accounting choice, and points out that there may also be a contradiction between the IASB objective of principle-based standards and comparability, because a general principle is concise and calls for judgment in its application. Judgment, in turn, is likely to vary across individuals and situations. This gives rise to potentially greater variability in applying the standards in real-world situations than a more detailed rule, presumed to call for less judgment.

The issue of uniformity vs. principle-based judgment has been the subject of a couple of interesting studies. Rentfro and Hooks (2004) conducted an experiment with 145 financial statement preparers in U.S. corporations to find out whether financial reporting comparability is, from their point of view, adversely affected when standards allow for high levels of professional judgment. The participants made two financial reporting decisions, one guided by an accounting standard requiring a relatively high level of judgment, and one by a standard requiring a relatively low level of judgment. The results supported the hypothesis that financial reporting is less comparable when accounting standards rely more heavily on professional judgment. The participants' years of experience, management level, gender, and age did not affect this finding. However, the results provided some evidence that comparability may improve as financial statement preparers become more experienced and hold a higher organizational rank.

In their working paper, Branson et al. (2009) report results from a survey of 295 IFRS financial statement users - 91 analysts, 79 auditors and 125 other users - for their views on comparability matters. The result was that when given the option, most respondents prefer

to define comparability by creating a balance between uniformity and flexibility. When forced to choose, most respondents prefer uniformity, which means that comparability is reached when all companies apply the same accounting methods. Comparability of financial statements over time and of financial statements of companies within the same industry was considered the most important forms of comparability. These results suggest that the introduction of the IFRS in Europe and the goal of the IASB to limit the options within the IFRSs are viewed as positive for the comparability of the European financial statements. The frequent changes in the IFRSs themselves are, however, compromising the comparability of these statements over time.

The importance attached to the factors that influence the comparability of financial statements differed significantly among respondents. The factors look similar to those in Zeff (2007) above, however. Besides the accounting methods used, the interpretation differences of the applied standards, judgments made by preparers, and industries were viewed as important factors. True accounting comparability of financial statements was concluded to be hard to reach. Auditors, analysts and other users differ in opinion on several matters. The preference for uniformity is for example less clear for the auditors although they attach more importance to the comparability of financial statements of all listed companies. Auditors also attached more importance to the influence of the judgments made by preparers and the industry the companies operate in on the comparability of financial statements. Analysts were more optimistic about the comparability of IFRS financial statements.

The more experience and the less focus the respondents had, however, the less they believed that IFRS financial statements are comparable. This was probably because they believed more often than the inexperienced respondents, that the influence of the judgments made by preparers on the comparability of financial statements is higher. Fourteen areas problematic to the accounting comparability were identified in the IFRS standards (such as derivatives and fair value), and the more experienced of the respondents also viewed more of the areas as problematic for the comparability of these statements.

Other Accounting Comparability Issues

Given the above difficulties in achieving a more true comparability than mere uniformity between the actual accounting numbers, it is not surprising that comparability is controversial as a qualitative characteristic of useful financial statement information. At

least it has been said to need more support from the accounting standards in the sense that some degree of comparability is likely to be attained by satisfying the fundamental qualitative characteristics. Barlev and Haddad (2007) argue that in order to reach an international accounting harmonization and comparability, more is needed than just a set of internationally implemented Generally Accepted Accounting Principles (GAAP). They assert that a common denominator for measuring, recording, and reporting business transactions, assets, liabilities, and equities is necessary to reach "complete harmonization", and propose fair value accounting (FVA) as the common denominator. They argue that under fair value accounting, the financial statements represent the fair value (or the market value) at the time the comparison is made. Therefore, the data are comparable and relevant. The FVA data, viewed at the time of comparison, are not affected by what Barlev and Haddad call timing differences, such as changes in the purchasing power of local currencies, changes in local price structure, variations in asset maintenance, or the location of the original purchase transaction. Though the idea by Barlev and Haddad looks elegant, fair value is known to cause problems in practical use.

Stecher and Suijs (2008) make another interesting point by demonstrating mathematically, that dual disclosure in the form of reconciliation is always at least as informative as harmonization, and that reconciliation will typically be an information improvement. If a common standard is even feasible across jurisdictions, it can only convey the information that has been commonly agreed on. Reconciliation gets closer to pooling the information. Empirical results obtained from a sample of Finnish listed companies, which had separate series of shares for domestic and foreign investors and used to provide both Finnish GAAP and IAS earnings figures in the 1980's, might be interpreted as providing some partial support to this idea (Kinnunen et al. (2001)). Stecher and Suijs argue that harmonization works multilaterally, while reconciliation works bilaterally. One jurisdiction with sufficiently coarse or idiosyncratic standards is enough to destroy the information carrying capacity of a common standard. Stecher and Suijs mention XBRL as one tool for making these types of reconciliations easier, but no software products with such capabilities seem to have emerged so far.

Miller and Bahnson (2008) go even further. First they criticize comparability along the lines discussed above, that is, because it leads to satisficing with mere uniformity. In their view, uniformity only provides comparability if the accounting standard in use is of a high enough quality, so that it enables providing relevant and reliable information about the underlying

economics of the firm. Then they go on to argue that instead of comparing two or more firms, investors compare one firm's intrinsic value at a time to its stock market price, and decide whether to go short or long. Miller and Bahnson claim that this would significantly reduce the need for comparability. Though this view might be in line with the propositions of finance theory and perfect credit and capital markets, it may be considered extreme and idealistic. Peer review and competitive strategy analysis would be necessary even in this case in order to form an estimate of the company's earning potential.

To sum up, international accounting harmonization can help the comparability of accounting information across jurisdictions, if the common standards are of a high enough quality. Harmonizing accounting rules is not enough, however, because despite uniform standards there remain differences among countries and companies in their application and enforcement, and because the standards themselves allow options for treatment of essentially the same economic situations. Accounting comparability is not (anymore) one of the fundamental characteristics of useful financial information (IASB 2010), and it is not a top priority in accounting standard setting. A complete international harmonization might require the use of fair value as the common measurement base.

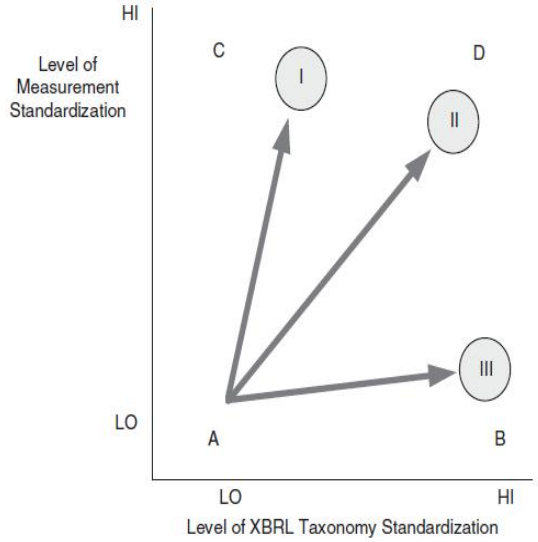
Accounting Comparability and XBRL Interoperability

Achieving comparability by international accounting harmonization looks difficult. However, it must be noted that the accounting comparability discussion so far had nothing to do with the earlier discussions about the comparability and interoperability of the XBRL financial statements. Bringing XBRL back to the discussion adds another dimension to the field of comparability problems.

According to Piehocki et al. (2009), XBRL taxonomy design may be viewed as a case of ICT standard design. As stated earlier, the designers of XBRL taxonomies have a wide discretion when they design taxonomies for their intended reporting purposes. The taxonomy designers must also decide how much additional discretion to create taxonomy extensions they leave to the preparers of the actual instance documents. The designers should be concerned with ensuring compatibility and computability between information transfers not only within in the reporting environment they are designing for themselves, but also to support potential information transfers in XBRL-enabled reporting value chains, at least those that are known to be related to the own taxonomy.

Piehocki et al. (2009) point out that the level of standardization is a key factor for comparability in two dimensions – in this case both when designing taxonomies and instance documents and when harmonizing accounting standards. As long as the standard designer is only concerned with one of the dimensions alone, design choices, however difficult, can be significantly less complex than when comparisons or connectivity is needed with other dimensions. The level of standardization in XBRL adoption is important when the information is expected to be compared with other XBRL-enabled data flows.

FIGURE 9: Interaction of Taxonomy and Measurement Standardization



Source: Piehocki et al. (2009), p. 230

Figure 9 illustrates the two dimensions of standardization. The first dimension, the level of XBRL taxonomy standardization, measures the extent of standardization among the various taxonomies within the potential range of information comparison or exchange. The second dimension is the level of measurement standardization. This dimension measures the extent to which the accounting content is standardized, i.e. the level of accounting harmonization. It might be added that there may even be a third dimension. As stated in Chapter 3, the XBRL label linkbase is used for providing the name of the individual element, and the name from the linkbase is the one that is rendered and displayed as the line item name. The label linkbase is intended to be used for e.g. foreign language translations and abbreviations. However, it is imaginable that labels can also be fraudulently misused to display the

elements under other names than the meaning and logic of the technical element suggests (Srivastava and Kogan, 2010).

The question here is whether a given accounting concept has the same meaning in different taxonomies. Or, conversely, whether a given taxonomy element represents the same accounting concepts under different accounting standards. The level of comparability can be affected by moving across either or both of these dimensions. As shown in Figure 9, four types of conditions might be possible. At condition A, there is low standardization in both the accounting measurements and the XBRL taxonomy. The probability that information coming from different taxonomies can be compared is low in this combination, as is the probability of comparability between information provided using different accounting standards. Judging by the results from the technical evaluations above, this can be said to represent the situation with the US GAAP and COREP taxonomies. Moving along vector III to Condition B brings a very high standardization level of XBRL taxonomies. Although there may be different underlying accounting measurement techniques, there will be high levels of interoperability of the concepts. For example, constructing identical taxonomies for US GAAP and IFRS would allow comparison at the concept level, but it would not allow reconciliation of different measurement techniques.

In condition C, again, the degree of measurement comparability is high but the level of standardization at the taxonomy level is low. A situation like this might occur in accounting, if fair value accounting became the common unit of measure as in Barlev and Haddad (2007), but the taxonomies would only provide mutually incompatible ways to express the measure, such as dollars and, say, squirrel skins. The highest level of standardization would be achieved in Condition D, where both the taxonomy and content dimensions are highly standardized.

Piehocki et al. (2009) also remind that ICT standards are not designed in isolation. There is often a need for both backwards and sideways integration. Backwards integration is the need to accommodate pre-existing standards. Sideways integration is the need to allow interoperation between the standard in question and other standards. Meeting these integration needs may result in data overhead and complexity that may make the new standard too heavy to be useful.

This may, in a sense, be the case for some accounting standards and XBRL taxonomies. As stated earlier, accounting standards are viewed to take precedence over XBRL, which means

that XBRL must accommodate the pre-existing accounting standards. For instance, the XBRL filings provided by firms listed in the USA must follow the original html filings in the EDGAR database (Debreceny et al, 2011). Given the especially great level of detail in the reporting requirements of the US GAAP accounting standard, together with the discretion left to the preparers in presenting the accounting information, the need for backward integration and the desire to integrate industry-specific tags to the base taxonomy has led to developing an XBRL taxonomy for the US GAAP accounting standards with a quite high number (10.799) of base elements (Zhu and Wu, 2011).

Even this number of elements was not enough for the US filers. According to Zhu and Wu (2011), the average degree of completeness - or fit to use the term by Bovee et al. (2002) - of 87 per cent means that on average, each company would have to use an extended taxonomy for 13 per cent of their reporting needs. The lack of suitable elements in the standard taxonomy together with the discretion left to the companies in the US GAAP accounting standards led the preparers to use 10.168 extension elements. In the extreme, this would mean that more than 20.000 different elements have been used in the filings. According to Brands (2011) and Debreceny et al. (2011), unnecessary taxonomy extensions were one of the problems identified by the SEC after the XBRL mandate, and some 40 per cent of the extensions were unnecessary (Debreceny et al., 2011).

Many other elements were probably redundant in another sense. According to Debreceny et al. (2011), in addition to the need to add an extension element because an element necessary for disclosure didn't exist, some of the filers had created their own extensions that were different for even similar accounting concepts as those of their peers. Some may even have chosen a wrong existing element. Comparability and interoperability were undermined in all of these situations.

To overcome these problems, some companies have recently been adopting a peer review approach to XBRL extensions in order to help them make informed extension choices. Because the XBRL documents become publicly available after filing to EDGAR, the filer companies themselves compare their own financial statement tagging elements with those selected by the company's industry peers, as well as with all filers. They perform the peer review each quarter to find tags used by their peers but not by themselves, and vice versa. One of the benefits of peer review is to have meaningful conversations about XBRL element usage with the peer companies. Another forum created for helping to improve XBRL

interoperability is the XBRL Best Practices Board (Frankl, 2009). However, it remains to be seen how far the peer reviews or the Board can help mitigate the low interoperability and comparability problems.

The interoperability and comparability problems look quite severe. However, analogously with the suspicions by Miller and Bahnson (2008) about the need for comparability in accounting, it is another question altogether, whether the interoperability and comparability is needed at the single XBRL tag level as long as the entire XBRL instance document is of a high quality, both technically and accounting-wise. According to Scott (2009), the most important accounting figure investors need for valuing a firm's stock is the earnings figure, and most of the other financial statement information has not been found to have independent informative value for other than assessing the quality and persistence of earnings in order to predict future cash flows. However, all the other financial statement information is still needed to do the necessary adjustments, just like peer review accounting information is needed for comparative analysis of competitors to assess the company's earnings potential. The comparability and interoperability of XBRL financial statements are currently low at least in the USA. However, even the views by Miller and Bahnson do not seem to offer an easy way out from the need to make the XBRL filings more interoperable and comparable and useful. A way forward might be to develop more intelligent processing software in the future for the receiving end of the information value chain to enable automatic context-specific adjustments to a common valuation basis and automated generation of key ratios for analysis. This is probably not going to be an easy task.

When extensions are allowed by information providers, there is an increased lack of interoperability and comparability. As stated above, Piehocki et al. (2009) pointed out that when XBRL-based business-reporting solutions are proposed, there must be a clear understanding of the costs and benefits of this flexibility. This way it may be possible to anticipate the problems in the design phase, perhaps by moving towards the closed approach to taxonomy design. The problems with the diverse national COREPs have, according to Piehocki et al. (2009), in a way led the EBA consider turning its thinking upside down. Instead of allowing extensions to the base taxonomies, the EBA has lately begun to consider introducing a so-called maximal data model, where the base taxonomy provides support for as many different reporting practices as possible, but where no extensions would be allowed, only deletions. The reasoning behind this type of data model seems to be that when all practices that can possibly be allowed are known in advance, there may be more chances to

design systems that can interpret and compare the instance documents regardless the particular taxonomy design and extension choices that are actually made.

Judging by the sheer number of elements, the US GAAP taxonomy might be a candidate for turning into such a maximal data model. As demonstrated by Zhu and Wu (2011), however, the data standard quality and interoperability problems seem no easier for the US GAAP taxonomy than with the COREP taxonomy. The problems could be getting even worse. According to Debreceny et al. (2010), the SEC has taken an approach to XBRL that emphasizes the importance of sophisticated base taxonomies (with a large number of standard elements), while at the same time the companies are required to report any material entity-specific accounting transactions (increasing the need for XBRL taxonomy extensions). Two points should be noted on these developments. First, they are in contrast to other implementations of XBRL, where the taxonomy was designed to support a template-based accounting standard with strict presentation rules, which seemed to be the main reason for the better fit and comparability observed in Italy (Valentinetti and Rea, 2011). Second, they seem to be a step in the opposite direction from the EBA maximal data model approach.

It may be a good idea to point out that the COREP situation also has analogies with the EU accounting Directives, which only lay down a part of the reporting requirements as common for the whole Union. Therefore it may well be that other types of companies established in several countries with national accounting standards, or even within one country with different requirements between e.g. tax and accounting, probably have similar problems as discussed here. Even the IFRS does not seem to help much, though its use is allowed even for national financial reporting in many countries. A simple reason at least here in Finland is that even the Finnish subsidiaries of listed firms prefer to do their statutory reporting complying with the Finnish accounting standards, and only provide reconciliation data for consolidation to the head office, domestic or foreign.

To my knowledge, there are no studies available investigating the above ideas in an XBRL filing context, where the underlying accounting standard is IFRS. In the Valentinetti and Rea (2011) study, the fit was found to be much higher (96 per cent) between the Italian XBRL taxonomy and the reporting practices under the Italian template-based accounting standards than between their US GAAP counterparts. This and the somewhat more standardized presentation requirements in IAS 1 (than in the US GAAP) suggests, that the

need for standard and extension elements, though probably greater than for the Italian taxonomy, may well be smaller for the IFRS taxonomy than for the US GAAP taxonomy. This in turn might suggest that the interoperability and comparability problems would be less severe for the IFRS than the US GAAP taxonomy, though an estimate would be difficult without further research.

The comparability and interoperability problems would probably not be negligible even for the IFRS or a template-based standard and a template-based taxonomy, however, unless perhaps when both the use of the template and the use of XBRL taxonomies were fixed to closed approach, where no true-and-fair-view overrides or taxonomy extensions were allowed. The above discussion suggests, that as long as there is flexibility in the accounting standards themselves, and as long as financial statement preparers can extend the standard XBRL taxonomy to fit their own needs, there will be more or less severe comparability and interoperability problems with XBRL financial statements, at least at the single taxonomy element level. According to Debreceny et al. (2011) and Piehocki et al. (2009), this in turn brings costs for the consumers of the information, who need human resources to understand the information provided in the extensions and cannot increase the degree of automatic processing. These problems are likely to be aggravated further after the companies are required to start providing detailed tagging for disclosure notes (and later perhaps even more with mandatory XBRL tagging for narrative MD&As).

4.2.4 Issues with Financial Statement Understandability

There may be severe problems with the interoperability and comparability of XBRL financial statements, but they can be more useful in other ways. According to the IASB Conceptual Framework (2010), financial information must be classified, characterized, and presented clearly and concisely to make it understandable. XBRL may be a helpful tool for this. Something is required from the users, too, in that financial statement preparers should seek to make the information understandable for users, who have a reasonable knowledge of business and economic activities, and who review and analyze the information with appropriate diligence. According to Barth and Schipper (2008), making financial statements more understandable would mean that unlike items should be disaggregated to include enough detail to be helpful for financial statement users in making economic decisions, but not so much detail to make it difficult for the users to understand the underlying economics.

For instance, the components of income should be presented in a useful way so that users can understand which of them have already been realized.

Understandability, Static Presentation Formats, and XBRL

There exists an old and rich tradition of Information Systems and Accounting Information Systems literature of research related to static presentation in text, tables, graphics and multimedia (see Kelton et. al (2010) for a recent literature review). On both sides of the Atlantic, there have recently been changes in the accounting standards concerning the presentation and understandability of the text and tables that form the financial statements. For instance, the presentation requirements were changed recently to help users better understand the separation of the realized (profit and loss) and unrealized other comprehensive income (OCI) components.

Further development of presentation formats has also been under way. One proposed format has been the so-called matrix format, a single statement of income with three columns of presentation based around re-measurements of financial statement items. Supporters argue that it would enhance transparency and assist users to analyze performance and predict future earnings and its components more efficiently. Tarca et al. (2008) conducted extensive experiments with nearly 500 professional and non-professional subjects to test the format, and found that it does improve the accuracy of the participants in extracting information from the financial statements. The overall improvement reflects insignificant change in accuracy on items reported in the IAS 1 net income, but a strongly improved accuracy on other comprehensive income items reported in the statement of changes to equity. The greater accuracy on comprehensive income items would seem to reflect the increased transparency of the matrix format, which separately displays remeasurement items and shows them all in one income statement. Despite the participants' lack of familiarity with the matrix format, its use did not appear to increase the time taken or difficulty in extracting information, nor did it appear to decrease the users' confidence in their results.

In late 2008, the Boards published a joint Discussion Paper for public comments about making far more fundamental changes than those related to the OCI to the financial statement presentation standards (Financial Accounting Standards Board (2008)). As discussed in Section 3.2.4, the Boards proposed reconfiguring the presentation of the financial statement data to offer parallel income statement, balance sheet and cash flow statements with a standardized partitions of each financial statement into five categories:

business activities, financing activities, income taxes, discontinued operations, and equity. Furthermore, the allocation of transactions within these partitions would crucially depend on management's assessment of each transaction, the management approach.

Bradshaw et al. (2010) considered the objective of providing a cohesive picture of activities through a uniform standardization of each financial statement by activity to be desirable. However, they criticized the complexity of the new format, suspecting that the proposed criteria for how activities are categorized would be confusing, and that that the new format would merely succeed in changing the type of the problems related to the presentation of financial statements. The new format would also have a single statement of comprehensive income. Goncharov and Hodgson (2010) criticize this by arguing, based on European market data, and on evidence from other studies conducted in the USA, that empirical evidence consistently supports keeping the realized and unrealized items in separate income statements. There was no compelling evidence that OCI should be relocated into net income.

The FASB and IASB (2008) argue that although each financial statement presents information in a particular way, the statements are derived from the same underlying data. This opens the door for using computer tools to control the presentation and convert the presentation from one format to another. The working paper by Swanson and Miranova (2010) reports developing and testing a procedure for converting the current form of financial statements into the proposed format. The procedure is applicable by anybody, because it only uses data and tools that are widely available. Swanson and Miranova used XBRL for making a one-to-one database transformation. First they used Microsoft Excel and tagged each line item of the financial statements of Intel Corporation with a unique XBRL tag, and then merged the XBRL-tagged file with the database that had XBRL tags and designation fields for the proposed presentation standard, deleting the XBRL tags that did not "match" the Intel tags from the file. Then they used the merged file to produce the financial statements in the proposed format.

The procedure was simple, but sufficient for performing the transformation. The only problem reported by Swanson and Miranova (2010) was that some of the original line items were too aggregated to support division into the operating, investing and financing categories specified in the new format. Even this could be avoided by increasing the granularity requirements of the original traditional-format data, which would mean to make a larger proportion of the detailed information used by management available to the public.

Understandability and XBRL as an Interactive Presentation Format

Financial statement preparers, who have access to all underlying data, might be able to use the more detailed general ledger data and have tools for selecting directly the format in which they want to display the information. One of the key features of XBRL is that it is designed to make some of this functionality available to users outside the company, who used to have to make do with static information. XBRL is designed to support making financial statements interactive. However, it should be borne in mind that the ultimate goal of using interactivity is to making financial statements more understandable and useful.

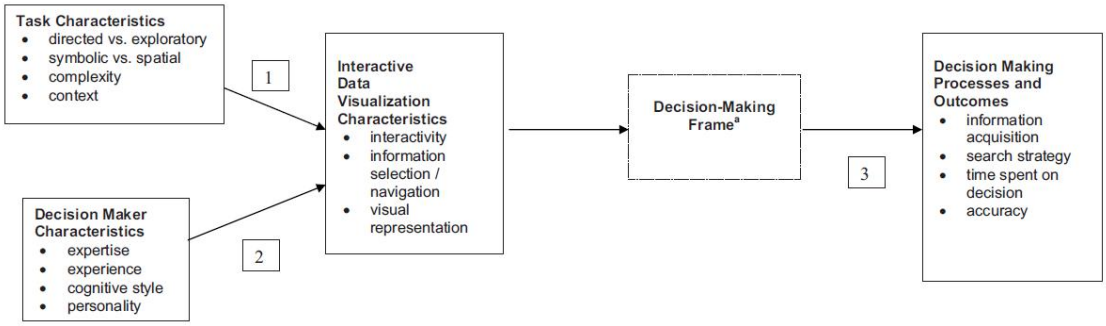
Dilla et al. (2010) use the term information visualization to refer to the "use of computer-supported, interactive, visual representations of data to amplify cognition, or the acquisition and use of knowledge". (For our purposes it might have been be sufficient to use some more restricted term, because many of the formats discussed in Dilla et al. (2010) are not used in financial reporting contexts.) According to Dilla et al, information visualization consists of three elements: interactivity, selection, and representation. The latter means the way the data are depicted. Interactivity involves a dialogue between the decision maker (user) and the information system as he or she explores the data set to find information. Selection refers to navigating through large or complex data sets and choosing a subset for display and processing. Information representation involves the mapping from data to representation and the way the representation is rendered on a computer display. In interactive information visualization users can choose which data to display, how to present it, or both. This is in contrast to the static presentation, where the preparers are the ones who select the financial statement information items and their display format on behalf of the users.

The representations in information visualization could be in text or in a variety of graphical or multimedia formats. However, the studies related to interactive financial statements and XBRL that are available so far have mostly been focused on interactive viewing of tabular financial statement data. Therefore, no references are made in this study to research related to graphical visualizations or multimedia. Moreover, for the purposes of this study, presentation, amplifying cognition and acquisition and use of information and knowledge in decision making are viewed as aspects of improving financial statement understandability, one of the enhancing characteristics of useful financial statement information.

Dilla et al. (2010) used cognitive fit theory (originally developed by Vessey in 1991), together with an interactive visualization research framework developed by Lurie and Mason for

research related to interactivity and visualization in the marketing field, to develop a framework that can be useful in analyzing experimental interactivity studies related to financial accounting and XBRL. According to the theories, as adapted by Dilla et al, there are three key linkages that are useful for developing a classification of research questions. The linkages are illustrated in Figure 10.

FIGURE 10: Characteristics of Interactive Data Visualization and their Implications for Decision Making



Source: Dilla et al. (2010) p. 6

The first link is between task and the interactive data visualization characteristics. Research questions related to this link include the influence of task characteristics to information navigation and selection behavior, and on information representation choices. The task characteristics include the general complexity of the task, whether the task requires processing spatial or symbolic information, the situation and context where the task is performed, and whether the information search strategy that is needed is sequential (reading from beginning to end) or directed, like when a trained financial analyst knows directly what to look for and where.

The second link is between decision maker characteristics and interactive data visualization characteristics. User expertise, domain-specific experience, problem-solving ability, and personality style in general may have an influence to whether a given information representation is the best fit for a given decision maker (and, further, on decision processes and outcomes). Research questions related to this link include the way that decision maker characteristics affect information navigation and selection behavior, information representation and choosing the appropriate navigation and representation features for the task.

The third link is between interactive data visualization and the decision-making processes and outcomes. This link can be said to be the one that is the most directly relevant to the characteristics of useful financial statement information. Research questions related to this link include the effect of interactivity on decision-making processes and outcomes compared to static representations, the effect of information navigation and selection on decision-making processes and outcomes, and the effect of representation choice on decision-making processes and outcomes. The arrow runs through a box called decision making frame in the individual's mind, which is usually unobservable.

Results from Experimental Studies Related to Understandability

I searched for studies related to financial statements, reporting, and XBRL, that addressed at least one of the link relationships in Figure 10. See Table 2 for a list of studies related to interactivity and understandability. All in all, there were not many such studies, and it should also be noted that many of them are unpublished working papers. The studies were experimental, meaning that the participants were assigned a task that they were asked to perform, usually related to financial statement analysis or investment decision making, by using tools as instructed by the researchers.

I found no studies related to the first link between task and interactive data visualization characteristics that were related to financial accounting and XBRL. However, the financial statement analysis tasks that were used in the experiments I found were relatively simple and directed in nature. Adding complexity and making the tasks more exploratory or time-constrained, thereby increasing the need for tools to perform the tasks, might help to make the experiments more realistic and would perhaps serve as a better test bench of the usefulness of XBRL.

As to the second link, between decision maker characteristics and interactive data visualization characteristics, there were a few studies related to the level of the financial statement users' work experience, expertise, familiarity with particular presentation formats and their perceptions, and preferences related to the tools made available for them. As providing a more level playing field to investors is one of the stated objectives of XBRL development, many of these studies used graduate or MBA students as proxies for non-professional investors.

Ghani and Juzoff (2009) studied whether work experience and familiarity of professional users with the presentation format would influence the users' preference on a presentation

format. Sixty-two public accounting practitioners from New Zealand participated as professionals. They were allowed to try using XBRL, html, and pdf for an investment decision task. They also answered a questionnaire, which is customary in experimental research for obtaining background data, and for manipulation checks. Ghani and Juzoff found that, contrary to expectations based on studies in other fields, work experience or familiarity with a format were not found to be important determinants of preferred presentation format. The results also indicate that the users' familiarity with two of the presentation formats, Adobe's Portable Document Format (pdf) and XBRL did not influence the users' preferred presentation formats, whereas familiarity with Hypertext Mark-up Language (html) was found to be an important determinant of preferences towards html.

Using the 62 New Zealand accountants again, Ghani et al. (2009) examined the link between how the users perceived the usefulness and ease of use of pdf, html, and XBRL. They also asked which of the format the participants preferred. The participants were asked to make an investment decision using pdf, html, or XBRL financial statement information that had been assigned to them by the researchers. Results suggest that XBRL was perceived as a more useful tool for investment decision tasks than pdf and html. Ghani et al. (2009) also found that all formats were perceived equally easy to use, and that perceived ease of use is almost as equally important as perceived usefulness when participants determine preference among the formats. The participants still preferred other formats than XBRL despite the usefulness perception found.

Pinsker and Wheeler (2009) tested the effects of providing XBRL or paper financial statements to users on their perceptions about their own efficiency and effectiveness at performing financial statement analysis tasks. They also analyzed the participant's perceptions about the efficiency and effectiveness of firms, who provide their financial information in the XBRL format rather than on paper. The participants, 64 MBA students as proxies for nonprofessional investors, were asked to analyze two companies using either XBRL or paper-based tools over a 2-year period, and choose one as the 'better' investment choice. The tools were randomly assigned to them. The results were that analyzing financial statements of firms that provide XBRL-enabled information was perceived more efficient by investors, who use XBRL than by investors who use paper-based information. Moreover, analyzing financial statements of firms that provide XBRL-enabled information was perceived as more effective and accurate by the participants using XBRL than by investors, who used paper-based information. As predicted, the participants also perceived the firms

that provided their financial reports in XBRL as more effective and efficient than their non-XBRL counterparts. Pinsker and Wheeler suggested one implication of the results to be that obtaining experience in using XBRL-enabled analysis tools seems to increase perceptions of the value of these tools beyond what can be gained from reading about them, or hearing about them in class, or seeing others demonstrate their use like the group that was assigned to use paper-based tools did.

Janvrin et al. (2011) criticized the study by Ghani et al. (2009) for not allowing the participants to choose the reporting technology. Their question was which reporting technology non-professional investors would choose and the reasons for their choice. The participants, 53 graduate business students, were first trained on each of the reporting technologies - pdf, Excel, and XBRL. Then they were asked to choose one and calculate three financial statement analysis ratios of two firms before deciding which of them to invest in. When given the choice, XBRL was chosen by 66 percent, Excel by 34 percent, pdf by none. Perceived efficiency (task takes less time) was indicated as the main reason to choose XBRL, and prior experience as the main reason to choose Excel. Contrary to Ghani et al. (2009), Janvrin et al. (2011) found no support for perceived usefulness or perceived ease of use as choice criterion.

Two of the above studies, Ghani et al. (2009) and Janvrin et al. (2011), which provided information on user preferences and perceptions related to the file formats, also examined the third link on the impact of the file formats to decision outcomes. The result in the Ghani et al. study was that perceived usefulness of html and XBRL did correspond to decision accuracy, but that of the pdf format did not. The perceived ease of use of pdf did correspond to the cognitive effort expended for pdf, but that of html and XBRL did not. Janvrin et al, on the other hand, found no differences in decision accuracy related to the chosen technology.

Hodge et al. (2004) laid the foundation to studying the third link related to XBRL by asking whether search-facilitating tools really facilitate acquisition of related financial information dispersed around the financial statements, together with the integration of the information into their decisions, in other words whether the users understand the information better and actually use it for decision making. They argue, that the searchability of XBRL-tagged financial statements helps users display dispersed but related information at the same time regardless where it is located in the financial statements. This makes the financial statements more transparent, because the choices made by management regarding the

related information become more visible. Users may start to consider managers' motives for their choices. When making comparisons between two firms, this in turn helps users notice potentially different choices about the same economic phenomena. Consequently, Hodge et al. hypothesized, that investors who use XBRL are more likely to acquire information from various places of the financial statements and notes than those who do not.

Moreover, Hodge et al. (2004) argue that XBRL will assist users' integration of information into their decision making in other ways. First, the XBRL data tags themselves provide expert guidance about the relations among financial information items. This is because if a number of items are coded with the same or similar tag, this would suggest that someone with knowledge of these items (e.g. management) has a reason to classify them as related to each other. Simultaneous presentation of related information also reduces users' cognitive costs of integrating the information. As a result users will integrate more of the related information that might otherwise be ignored due to dispersed placement. For these reasons Hodge et al. hypothesize that XBRL users will integrate more of the dispersed information than non-users.

Hodge et al. (2004) used 96 MBA students as proxies for non-professional investors, again because XBRL is hoped to help them more than professionals in a task where participants were asked to compare two companies. One of them recognized stock option compensation in the income statement, and the other disclosed the information in the notes. Half of the participants were assigned an XBRL-enabled search tool while the other half used a pdf document.

The results by Hodge et al. (2004) indicated support for both hypotheses. Participants who actually used an XBRL-enhanced search engine were more likely to acquire footnote information that was related to the information recognized on the face of the financial statements, and also use it in making investment decisions. However, the use of even a superior tool is not automatic. One surprising finding was that half the participants chose not to use XBRL even when given the chance.

These results may have implications. Some known differences related to recognition difficulties are partly due to cognitive processing difficulties of the investors. These difficulties are likely to be more severe for non-professional investors, and XBRL may indeed help them overcome them. If XBRL becomes widely used, it will be easier to see through managers' reporting choices that "artificially" make the firm look better than it is, and

managers may lobby less for such choices to be made available. Moreover, Hodge et al. (2004) predicted, that appropriate tagging might become a topic to be debated like the actual accounting issues. As stated by Brands (2011), such discussions are now being conducted.

Another topic related to recognition, disclosure, and XBRL is called functional fixation. It is the subject of a conference presentation paper by Ghani et al. (2008). Functional fixation is a psychological phenomenon that exists in most human behavior. People tend to attach a meaning to an object and be unable to recognize the alternative meanings or uses. People intuitively associate a value with an item through past experience, and often do not recognize that the value of an item depends, in fact, upon the particular moment in time and other context factors. In accounting, functional fixation occurs when users of financial information fail to adjust for differences arising from the adoption of different accounting policies and methods. Firms with otherwise identical economic circumstances, except for their choice of allowable accounting alternatives, may therefore sometimes be judged as different from each other. In the literature, recognition of financial information within the financial statements themselves or disclosure of the same information in the notes (disclosure policy) has been found to lead users of financial statements to functional fixation when comparing financial statements of firms that adopt different accounting policies. That is, decision-makers and users do find cognitive convenience in looking for information in a to-be-expected location, and the acquisition and integration of information located outside of the normal situation may be less common.

The sixty-two New Zealand public accounting practitioners were volunteer participants in this, still another study by Ghani et al. (2008). They were allocated a particular digital presentation format, which they used for making an investment allocation decision between the firms after calculating four key ratios. A key finding in this study was that functional fixation exists in the decision outcome stage when the information is either recognized within the financial statements or disclosed in the notes. The evidence points to the conclusion that none of the digital presentation formats have assisted professionals in overcoming the limitations of humans as decision-makers in relation to functional fixation, not even XBRL. This would support the view that until presentation technology provides better tools to assist users, the alternative options of either recognizing or disclosing the same key financial information may lead to different economic consequences.

Tagging narrative Management Discussion and Analysis (MD&A) information with XBRL is one of the enhancements being proposed in the Enhanced Business Reporting initiative as part of the new financial reporting paradigm. Initial taxonomy development for narratives has been under way and even tested as part of the SEC's voluntary filing program from 2005 to 2008. Arnold et al. (2012) proposed and tested several hypotheses to analyze the impact of presenting narrative information in a tagged form (XBRL) on both nonprofessional (208) and professional investors' (101) ability to search and assimilate key qualitative financial information and to incorporate that information into their performance and stock price predictions.

The participants were randomly assigned either an XBRL-enabled or standard pdf-like format, and asked to assess company risk, forecast its future stock price and answer background questions. To perform the tasks, they needed to search the MD&A of a real company (made unidentifiable) for relevant information. The search behavior of the participants was traced and analyzed. In the MD&A, the participants were expected to be able to find and use a disclosure on a possible violation of a law against corruption abroad. The violation would potentially lead to civil or criminal penalties and an ensuing decline in stock price.

The results from the Arnold et al. (2012) study suggest, first, that tagging narrative MD&A information with XBRL has important implications to investor search behavior. For nonprofessional investors, the evidence was consistent with the expectations that their information search behavior becomes more directed and efficient when they use the tagged presentation tool. A similar effect was found even on professional analysts.

The results by Arnold et al. (2012) were said to be consistent with prior research indicating that professional analysts can incorporate new information efficiently without spending more time doing so. However, the focus of regulators has been on nonprofessional investors, who are expected to gain most from tagging financial information by using XBRL. The results by Arnold et al. suggest that even professional analysts can benefit from tagging narrative information with XBRL. This is because Arnold et al. found that both professional and nonprofessional users of the XBRL-enabled tool incorporated the key risk information much more strongly and accurately into the mental image they formed about the company. Moreover, their decision processes were more efficient in that they spent relatively less time and effort on the task. The result that tagged presentation facilitates incorporating risk

information into investment decisions can be interpreted as making the reported information more understandable, thus enhancing the usefulness of the financial statement information in the IASB (2010) sense.

Summary about XBRL and Understandability

To summarize this discussion about interactivity and understandability of XBRL financial statements, it can be stated that no studies were found related to the first link between task and interactive data visualization characteristics. However, the financial statement analysis tasks that were used in the experiments that were found were relatively simple and directed in nature. Adding complexity and making the tasks more exploratory or time-constrained, thus increasing the need for tools to perform the tasks, might help to make the experiments more realistic and would perhaps serve as a better test bench for the usefulness of XBRL.

Topics and results in studies related to the second link, the perceived usefulness and ease of use of XBRL, were mixed. A couple of studies demonstrated that XBRL was the preferred tool, when users were allowed to choose, while the result of another was that work experience does not affect the preferred format. Results about user perceptions of ease of use and usefulness were mixed.

In most of the few and relatively simple experiments that studied the third link between use of interactive data and decision making processes and outcomes, XBRL seemed to help financial statement users make better decisions. Three of the studies showed that the use of XBRL does seem to improve decision accuracy relative to other formats, though one did not (Janvrin et al, 2011). The use of XBRL also seems to decrease cognitive effort and help users to better acquire and integrate the information. Thus, a tentative conclusion can be made that XBRL does enhance the usefulness of financial statements in the IASB Conceptual Framework (2010) sense. However, due to the mixed results and the preliminary status of some of the studies, these results should be interpreted cautiously, and further research is needed.

Last, it may be said that XBRL may affect the need for the changes proposed by the FASB and IASB to the presentation format of static financial statements. This is because users of interactive XBRL financial statements have a better chance to make the financial statements e.g. more cohesive and disaggregated for themselves by searching and acquiring related but dispersed information. It is also possible to transform the information from the traditional

formats to the proposed one, provided that the underlying data is disaggregated enough and available for users outside the firm.

TABLE 2: Experimental Studies on Interactivity and XBRL * indicates preliminary working paper results				
Reference	Research Question	Task/Method	Participants	Key Results
Hodge et al. (2004)	Does XBRL facilitate acquisition and integration of related financial information? (Link 3 in Figure 10))	Make an investment decision using financial statement information	MBAs	Participants who chose to use an XBRL-enhanced search engine are more likely to acquire footnote information and use it in making better investment decisions.
Ghani et al. (2008)*	Do digital presentation formats help financial statement users overcome functional fixation in recognition versus disclosure? (Link 3)	Make an investment decision using financial statement information	62 New Zealand public accounting practitioners	Functional fixation exists in the judgment stage but not in the other stages of information processing (information acquisition, evaluation and weighting). Presentation formats do not completely remove the concern of functional fixation in recognition versus disclosure.
Pinsker and Wheeler (2009)	Test the effects of providing XBRL or paper financial statements to users on their perceptions about their own efficiency and effectiveness at performing financial statement analysis tasks. (Link 2)	Analyze two companies using either XBRL or paper-based tools over a 2-year period and choose one as the 'better' investment choice.	64 MBA students as nonprofessional investors	Analyzing financial statements of firms that provide XBRL-enabled information is perceived more efficient by investors, who use XBRL, than by investors using paper-based information. Analyzing financial statements of firms that provide XBRL-enabled information is perceived as more effective and accurate by investors, who use XBRL, than by investors using paper-based information.
Ghani and Juzoff (2009)	Does public accounting practitioners' work experience and familiarity with a presentation format influence their preference towards certain presentation formats? (Link 2)	Try using XBRL, html, and pdf for an investment decision task, answer questionnaire.	62 New Zealand public accounting practitioners	Contrary to expectations based on studies in other fields , work experience or familiarity with a format were not found to be important determinants of preferred presentation format.

TABLE 2: Experimental Studies on Interactivity and XBRL * indicates preliminary working paper results				
Reference	Research Question	Task/Method	Participants	Key Results
Ghani et al. (2009)	Examine the link between users' perceived usefulness and ease of use of pdf, html, and XBRL, their preferred reporting format, and whether both perceptions correspond to decision accuracy and actual cognitive effort (Link 2, Link 3)	Make investment decision using pre-allocated pdf, html, or XBRL financial statement information	62 New Zealand public accounting practitioners	XBRL perceived as a more useful tool for investment decision tasks than pdf and html, all formats perceived equally easy to use, perceived ease of use is almost as important as perceived usefulness when determining preference, participants still preferred other formats than XBRL despite usefulness perception, perceived usefulness of html and XBRL did correspond to decision accuracy, but not for pdf. Perceived ease of use of pdf did correspond to cognitive effort, but not for html and XBRL.
Janvrin et al. (2011)*	Which reporting technology do nonprofessional investors choose and why, does investment decision "correctness" vary by technology choice. (Link 2, Link 3)	Choose one reporting technology from pdf, Excel or XBRL, calculate three financial statement analysis ratios and make investment decision	53 graduate business students	XBRL chosen by 66 percent, Excel by 34 percent, pdf by none. Efficiency (task takes less time) main reason to choose XBRL, prior experience to choose Excel, no support for perceived usefulness or perceived ease of use as choice criterion. No difference in decision "correctness" related to chosen technology.
Arnold et al. (2012)	Impact of presenting MD&A information in a tagged form (XBRL) on both nonprofessional and professional investors' ability to search and assimilate key qualitative financial information, and to incorporate that information into their performance predictions. (Link 3)	Search the MD&A for information on possible violation of anti-corruption act – with a risk of civil or criminal penalties and decline in stock price - assimilation of the risk information into risk assessments, and effects of the saliency of the risks in stock price predictions.	208 nonprofessional investors and 101 professional investors	Tagging narrative MD&A information with XBRL has important implications to investor search behavior. Nonprofessionals' information search is more directed with the tagged presentation, and the tagged presentation facilitates incorporating risk information into investment decisions. Tagging affects the already more directed search behavior of professional investors less, but even for them the saliency of risk information increases in both risk assessments and stock price predictions.

4.2.5 XBRL Financial Statements, Relevance, and Market Data Studies

Results from the studies above seem to provide some tentative support to the idea that XBRL may indeed, at least indirectly, help financial statement users make better decisions. This positive effect could be expected to be channeled through the enhancing characteristics, especially understandability. Because of the novelty of mandatory XBRL filings, it may be too early to determine whether the results of the laboratory experiments in the previous section, for instance, actually carry over to the stock market. Some studies related to the impact on stock market conditions in general have begun to emerge, mostly as working papers. See Table 3 for a list of studies discussed in this section.

Results from the SEC's Voluntary Filing Program 2005 - 2008

There do not seem to be many studies on the direct effects of XBRL on the relevance fundamental qualitative characteristic of useful financial information. However, the working paper by Efendi et al. (2010) studied, whether the XBRL filings furnished under the SEC's Voluntary Filing Program (VFP) in 2005 – 2008 had incremental information content beyond the official EDGAR filings in html format, as measured by daily excess market returns. The independent variables were earnings announcements, the amount, timeliness, and changes across time of information furnished in XBRL, together with firm size and institutional investor ownership. The results indicated that the market reaction was significant on the day when the XBRL reports were filed, even when the associated earnings announcement and customary EDGAR filing had been published earlier. The results also suggest that, depending on the length of the time window, approximately from 1.2 to 8.0 per cent of the total information content in earnings disclosures was associated with these XBRL filings. The market response was stronger for larger firms, more recent filings and more timely filings. The market reaction was clearer in instances where multiple reports were filed. Also, the decision to participate in the VFP made by the company may in itself have been interpreted as one type of new information that is disclosed.

A couple of studies analyzed the properties of the US companies that volunteered for the VFP. Premuroso and Bhattacharya (2008) investigated, whether early and voluntary filers of XBRL financial statements signaled superior corporate governance and operating performance. They used a sample of matched pairs of 20 US listed firms that furnished audited annual financial information in XBRL and those that did not, and regressed corporate governance indices against the decision of participating in the VFP while

controlling for some usual variables. They found that superior corporate governance was associated with a firm's decision to be an early filer of financial information in XBRL format. Firm performance factors such as liquidity and firm size were also associated with the early and voluntary XBRL filing decision.

A working paper by Efendi et al. (2009) studied the number and characteristics of voluntary XBRL filers together with the lag between the official paper filings and the VFP filings, and the extent of filings using 82 listed US firms that participated in the VFP at least once. The independent variables were the number of filing firms, their size, profitability, innovativeness (R&D/sales), XBRL filing date, number of XBRL lines reported, controlled by the equivalent variables for all filing firms and reports. The time lag became shorter, number of XBRL lines reported (unexpectedly) decreased and the still minimal proportion of XBRL filers related to all firms increased somewhat from 2005 to 2008. XBRL filers were larger and more innovative than all firms. This is no surprise considering that corporate members of XBRL US, for instance, with a stake in the development of XBRL might be expected to participate.

A working paper by Kaya (2011) analyzed the extent, nature and variability of voluntary disclosure in the XBRL Financial Statements of 51 Listed US firms that participated in the VFP using an un-weighted disclosure index of 54 items of overall disclosures and categorized the disclosures into financial statements, notes, and MD&A, together with some typical control variables. The results were that size and innovativeness explained the extent of overall disclosures in XBRL, while size explained the extent of financial disclosure and innovativeness explained the extent of XBRL disclosure in all categories.

Results from Studies Related to Market Conditions

A working paper by Kim et al. (2010) reports a study related to the effect of XBRL disclosure on financial information risk and uncertainty environment aspects in the US markets after the SEC 2009 mandate. They used a sample of 425 listed companies required to file XBRL financial statements in the first wave of US filers, together with a 326 filer/non-filer matched pair control. The independent variables in the OLS Regressions were market event returns volatility, information efficiency, and the change of standard deviation of stock returns. The control variables were the usual known risk factors: size, market-to book, leverage, loss indicator, return volatility, abnormal return and its sign, and earnings surprise. The preliminary results by Kim et al. suggest that XBRL disclosures do provide information that

enhances transparency and has the potential to decrease information risk and asymmetry. The results also indicate that XBRL filings marginally mitigate information risk associated with increased complexity of information. Moreover, Kim et al. (2010) suggest, that their results are consistent with the notion of value-relevance. However, once again, even these preliminary results were only available as a working paper, to be confirmed by peer-to-peer review.

In their working paper, Blankespoor et al. (2011) investigated the initial phase-in effects of the XBRL filing requirement on several aspects of US market formation using 626 mandatory firm-filings (313 firms with both a pre-XBRL filing and a post-XBRL filing) by firms listed in the USA. The variables studied were abnormal levels of trading volume, bid-ask spreads, and market depth, together with price discovery around 10-K filings. The control variables included variables related to e.g. presence of information intermediaries, market characteristics, information content and timing of the filing, and firm specific characteristics. Additional controls were matched pairs of XBRL filers (by trading volume, bid-ask spread, market depth, and price discovery) and non-filers.

The preliminary results by Blankespoor et al. suggest that the market formation initially worsened. There was lower trading volume, greater bid-ask spreads, lower depth and slower price discovery for mandatory XBRL adopters compared to the matched sets of firms. Moreover, the trading volume reduction was larger for small traders, suggesting that they became even further disadvantaged after the XBRL mandate. However, the results may not be surprising considering that XBRL is being implemented, to say the least, quite slowly among especially non-professional end-user investors. This is probably due to the start-up costs and learning time that are needed for an XBRL implementation, and there also seem to be few software programs available to end-user investors. Blankespoor et al. (2011) conclude by claiming that these results do not necessarily mean a lack of support for mandatory filings, but are a reason for further promoting the training and use of XBRL among investors.

The research question in the article by Yoon et al. (2011) was whether the adoption of XBRL has reduced the level of information asymmetry in the Korean stock market. They used OLS regressions with price data of 550 firms listed in South Korean Stock Exchange before and after the mandate. The independent variables were bid-ask spread, change in trading volume, and change in volatility. The control variables were firm size, trading activity,

volatility, and stock price. Even the results by Yoon et al. (2011) show, that XBRL adoption reduces information asymmetry, and that the effect of XBRL adoption is stronger for large-sized companies even after controlling for market wide changes in information asymmetry before and after the mandate.

As far as the financial statement information itself is concerned, there seem to be few (and even fewer peer-to-peer reviewed) market data studies from after the XBRL mandate in the USA into the direction by Kaya (2011) or Kim (2010) , who addressed the question whether the introduction or mandating of XBRL has led to changes in the relevance, amount or quality of the information content itself that the companies choose to provide, or whether the firms would even change their accounting policies in the fear of more transparency as visioned by Hodge et al. (2004).

It remains a matter of the future to see, whether the possible move to a new financial reporting paradigm such as the Enhanced Business Reporting (EBR) discussed by the AICPA (2008) will bring changes to the required or voluntary disclosure by firms. Another idea from perhaps a more distant future was presented in a working paper by Angel (2009). He sketched an idea of reporting the same economic phenomena using several measurement bases (such as historical cost, current market prices, and management's internal estimate of the fair value of the asset), because confining to just one of the measurement bases would be a waste of (in a statistical sense) useful information. Angel continued by claiming that XBRL could give the users of financial statements easy access to all these three dimensions of value. However, using XBRL to achieve this kind of usability and transparency would be far from simple, even though some research and development projects into this direction seem to be under way.

A summary of the above findings from the technical evaluations is provided in the second section of Chapter 5, after which some conclusions and further research suggestions are provided.

TABLE 3: Studies using market data related to XBRL * denotes a preliminary working paper result						
Reference	Research Questions	Data	Variables	Control Variables	Method	Key Results
Premuroso and Bhattacharya (2008)	Do early and voluntary filers of financial statements in the XBRL format signal superior corporate governance and operating performance	Matched pairs of 20 US listed firms that furnished audited annual financial information in XBRL and those that did not	Institutional Shareholder Service's Corporate Governance index , (Gomper's CG Index)	Liquidity, net profit margin, return on equity, auditor type, leverage, total assets	Binary logistic regression, multiple regression	Superior corporate governance is associated with a firm's decision to be an early filer of financial information in XBRL. Firm performance factors such as liquidity and firm size are associated with the early and voluntary XBRL filing decision.
Efendi et al. (2009) *	Number and characteristics of Voluntary XBRL Filers, lag and extent of filings	82 Listed US Firms participating in SEC's Voluntary Filing Program at least once	No. of filing firms, size, profitability, R&D/sales, XBRL filing date, No. of XBRL lines reported	No. of all listed firms, their size, profitability, innovativeness variables for all listed, regular filing date, all lines reported	OLS Regressions, descriptive statistics	During VFP period 2005-2008 filers/all listed increased, filers were larger and more innovative, time lag became shorter, number of XBRL lines reported unexpectedly decreased.
Kaya (2011)*	Extent, nature and variability of voluntary disclosure in XBRL Financial Statements	51 Listed US Firms Participating in SEC´s XBRL Voluntary Filing Program	Disclosure Index of 54 items overall and categorized to financial, notes, and MD&A	Size, leverage, Age, ROA, Liquidity, Innovativeness, Auditor type	Unranked OLS Regressions	Size and innovativeness explain extent of overall XBRL disclosure, size explains financial disclosure extent, innovativeness explains extent of XBRL disclosure in all categories.
Kim et al. (2010) *	Effect of XBRL disclosure on information risk and uncertainty environment aspects after SEC 2009 mandate	425 listed required first-wave US filers of financial statements in XBRL , 326-filer/non-filer matched pair control	Event returns volatility, information efficiency, std. deviation of returns	Size, market-to book, leverage, loss indicator, return volatility, abnormal return and its sign, earnings surprise	OLS Regressions	XBRL disclosures provide information that enhances transparency and has the potential to decrease information risk and asymmetry, marginally mitigate information risk from increased complexity of information, even consistent with value-relevance.

TABLE 3: Studies using market data related to XBRL * denotes a preliminary working paper result						
Reference	Research Questions	Data	Variables	Control Variables	Method	Key Results
Efendi et al. (2010) *	Do XBRL filings possess incremental information content beyond current EDGAR filings in html format, as measured by daily excess market returns	342 voluntary XBRL filings of firms listed in the US from the period of 2005 to Jun 30, 2008	Earnings announce-ment, amount, timeliness , and changes across time of information furnished in XBRL	Size, institutional investor ownership	Multivariate OLS regressions	Significant market reactions on the day XBRL reports are filed under VFP. The market response is stronger for larger firms, more recent filings and more timely filings. Market reaction is clearer in instances where multiple reports are filed. Approximately 1.2% to 8.0% out of total information content in earnings disclosures is associated with these XBRL filings.
Blankespoor et al. (2011)*	Initial phase-in effects of XBRL filing requirement on several aspects of US market formation	626 mandatory firm-filings (313 firms with both a pre-XBRL filing and a post-XBRL filing) of firms listed in the US	Abnormal levels of trading volume, bid-ask spreads, and market depth, price discovery around 10-K filings	Variables related to e.g. presence of information intermediaries, market characteristics, information content and timing of the filing, and firm specific characteristics	OLS Regressions, controls using matched pairs of XBRL filers and non-filers	Initially worsened market formation (lower trading volume, greater bid-ask spreads, lower depth and slower price discovery) for mandatory XBRL adopters. Trading volume reduction larger for small traders, suggesting that they are further disadvantaged by XBRL. User slowness to implement XBRL unsurprising given start-up costs.
Yoon et al. (2011)	Has the adoption of XBRL reduced the level of information asymmetry in the Korean stock market?	Price data of 550 firms listed in South Korean Stock Exchange before and after mandate	Bid-ask spread, change in trading volume , change in volatility	Firm size, trading activity, volatility, and stock price	OLS Regressions	XBRL adoption reduces information asymmetry, and the effect of XBRL adoption is stronger for large-sized companies even after controlling for market wide changes in information asymmetry before and after mandate.

5. SUMMARY, CONCLUSIONS AND FURTHER RESEARCH

In this study, the eXtensible Business Reporting Language (XBRL) has been evaluated as a solution to the "wicked" problem of designing an information systems artifact that would help investors locate, interpret and use the financial information of listed companies electronically available in the Internet for their investment decision making and other purposes. The Design Research (DR) process in Kanellis and Papadopoulos (2009) and Kasanen et al. (1993) was adapted to perform a review of scientific journal articles, recent research working papers, and other literature. Accordingly, the review was arranged by the DR process phases: awareness of problem, development of solution artifacts, evaluating the potential solutions, and providing conclusions, with potential feedback loops to the earlier phases.

As the most potential artifact for solution to these problems, the XBRL language, has already been developed, the main emphasis of this study was on the evaluation phase, where the XBRL was evaluated as a technical solution for the resource discovery and attribute recognition problems identified by Debreceny and Gray (2001). The third problem area presented by Debreceny and Gray, the standardization problems associated with the accounting standards themselves was analyzed in the light of the most pertinent of the qualitative characteristics of useful financial information (IASB 2010) - relevance and faithful representation as the fundamental characteristics, and comparability and understandability as the most pertinent of the enhancing characteristics.

5.1 Summary and Conclusions Related to Technological Issues

Results related to the technical problem of resource discovery seem to suggest, that the most feasible way to arrange for the easy availability of the electronic financial statements seems to be the provision of a single central database such as the EDGAR database of the SEC in the USA. This is mainly due to the fact that search engines and intelligent retrieval agents

are still unavailable to provide a reliable way to find the information in a diverse environment such as the Internet.

Solving the second technical problem, interpreting the financial statements in a meaningful way that is understandable to computers - Debreceny and Gray's (2001) attribute recognition problem - is far more difficult. While demonstrating relatively successful results in using automated software tools for interpreting and recognizing attributes from financial statements already available in text file formats, the usefulness of the tools has so far only been proved in analyzing limited parts or aspects of the financial statements, and the software and other tools required a great deal of preparatory configuration work before use. Moreover, even though the accuracy rates of 80 – 90 per cent achieved in these studies are quite high, in mass processing they leave quite a large amount of work to be completed manually, the cost of which can become prohibitive.

The XBRL language was developed for providing the attributes needed for the interpretation of financial statements data items embedded within the file itself. An XBRL taxonomy is a collection of data items called elements or tags, which provide an electronic reading software called parser with the information it needs for interpreting the financial information and its structure. The studies about the technical correctness of the XBRL instance documents demonstrated that, at least until present, the XBRL financial statements filed to regulator databases were still far from being reliable enough to be trusted as the (only) source of financial information, and that substantial improvement in quality is needed. However, these types of quality problems can be expected to decrease as the XBRL financial statement preparers, regulators, and each of the other relevant constituencies progress on their respective learning curves.

Studies about the degree of fit of XBRL taxonomies to actual reporting practices of firms suggest that even though the standard XBRL taxonomies provide a reasonably good fit, the fit was not even close to perfect, unless the underlying accounting standard itself has strict reporting template requirements. Preparers of XBRL financial statements can improve the fit by extending the base taxonomy to accommodate their specific reporting needs, but this leads to severe problems with interoperability and comparability between firms. Apart from the Italian study by Valentinetti and Rea (2011), the fit between the XBRL taxonomies and the financial statement notes have seemingly not been analyzed much yet. One reason may be, at least in the USA, that they were only required to be tagged as text blocks for the first

year of mandatory filing, with detailed tagging of notes being required from even the first-round filers only from after June 2010. The fit was far lower for the notes than for the financial statements proper in the Italian study, and similar results might be expected from tagging the far more complex American disclosure notes.

Studies about issues related to the way the XBRL taxonomies have been designed demonstrated, how difficult it is to balance the need for flexibility and extensibility with the desire for comparability. Companies have also been observed to change the extensions they make over time, which raises issues about the consistency of the filings (Debreceny et al, 2011). As concluded by Piehocki et al. (2009), there must be a clear understanding of the costs and benefits of flexibility at the outset, when XBRL-based business-reporting solutions are being designed and proposed. In practice, the regulators have taken one of two basic approaches to taxonomy design, either forbidding all extensions (closed approach) or allowing flexibility (open approach). According to Debreceny et al. (2011) and Piehocki et al. (2009), allowing flexibility imposes a cost for both information producers and consumers, often in the form of a loss of comparability of the instance documents and a need to use human resources for interpreting them - tasks that could be automated.

The interoperability and comparability problems brought about by the sheer number of taxonomy elements, together with the numerous extensions to the base taxonomies allowed for the preparers, have led at least one regulator (the EBA) to consider a third approach to taxonomy design (Piehocki et al, 2009). Here the idea would be to develop a so-called maximal data model, where the XBRL taxonomy provides support for as many different reporting practices as possible, but where no extensions would be allowed, only deletions. When all possible practices that are allowed to be used are known, there may be more chances to design systems that can interpret and compare the instance documents regardless the particular design and extension choices that have been made by the preparers.

A few studies have also demonstrated that automated software tools based on artificial intelligence, information extraction, and other sophisticated computer technologies are useful tools for taxonomy development and for developing assurance procedures related to XBRL.

5.2 Summary and Conclusions Related to Accounting Issues and XBRL

Results from the literature addressing the accounting aspects of XBRL suggest that a wide-scale use of XBRL will have effects on most or all of the qualitative characteristics of useful financial information.

The fundamental characteristic of faithful representation will be affected by XBRL, especially if the financial reporting paradigm as a whole shifts in the direction visioned by the AICPA (2008). Perhaps even before that, because the users are expected to demand assurance in order to be able to trust the reports mandatorily filed in XBRL. In addition to the traditional sources of potential deficiencies in financial statements, for which auditors are used to providing assurance, the XBRL language introduces numerous new ones. Development is under way in the USA for a framework of assertions that can be used by assurance providers for obtaining evidence about whether these deficiencies are present in the XBRL instance documents, and concrete proposals are being discussed and evaluated.

The comparability enhancing characteristic will also be affected. International accounting harmonization can help improve comparability of accounting information across jurisdictions, if the common standards are of a high enough quality. Harmonizing accounting rules is not enough, however, because despite uniform standards there remain differences among countries and companies in their application and enforcement of the standards, and because the standards themselves allow for options in the treatment of essentially the same economic situations.

XBRL brings another dimension to the already difficult accounting harmonization and comparability problems. The studies reviewed suggest that as long as there is flexibility in the accounting standards themselves, and as long as financial statement preparers can extend the standard XBRL taxonomy to fit their own needs, there will be severe comparability and interoperability problems between XBRL financial statements. Moreover, the study by Debreceny et al. (2011) demonstrated that there were changes in the extensions made by the same company over time. This also raises questions about the consistency of the XBRL financial statements, again a two-dimensional problem due to the fact that even accounting standards and the reporting practices of the firms tend to evolve over time.

To avoid causing unnecessary interoperability and comparability problems at the outset, i.e. at the taxonomy design stage, XBRL taxonomy designers must have a clear understanding of

the costs and benefits of the flexibility that they choose to offer to financial statement preparers. At the XBRL financial statement preparer level, some companies have adopted a peer review approach to XBRL tagging to help overcome the comparability and interoperability problems and make more informed tagging choices (Brands, 2011). As discussed in Section 4.2.3, another question (and research issue) altogether may be whether interoperability and accounting comparability are even needed at the single taxonomy element and financial statement line item levels, as long as the entire XBRL financial statement filing as a whole is of a high quality.

The more standardized presentation requirements in IAS 1 and the good fit obtainable using the even further standardized Italian template suggest, that the need for both standard and extension elements may be at least smaller for the IFRS taxonomy than that observed in the US GAAP case. This in turn might suggest that the technical interoperability and comparability problems would be less severe. However, the problems would probably not be negligible even in this case, unless perhaps when both the use of the template and the use of XBRL taxonomies are fixed and no true-and-fair-view overrides or taxonomy extensions are allowed.

Accounting comparability and interoperability between two or more XBRL instance documents remain problematic, but there seems to be support for the idea about XBRL being able to make one instance document more understandable for human users. This has been stated as one of the main reasons for developing the XBRL, another oft-cited reason is to help non-professional investors get more on par with professional and institutional investors. The understandability enhancing characteristic of useful financial information is likely to be affected by XBRL, mainly because it enables interactive navigation, searching, selection and display of financial statement data. This in turn makes it easier for the user to find related information dispersed in the financial statements, and to acquire and use it in their decision making for better results.

Most of the experimental studies that were available as peer-to-peer reviewed articles suggest that the use of XBRL does indeed improve decision accuracy quality and efficiency compared to other file formats. A couple of studies demonstrated that XBRL was the tool preferred by the users, when they were allowed to choose. The result of another study was that the users' work experience does not affect the preferred format. Results about user perceptions of usefulness and ease of use were mixed. XBRL may also reduce the need for

the changes proposed in 2008 by the FASB and IASB to the presentation format of static financial statements, because users of interactive XBRL financial statements have a better chance to make the financial statements cohesive and disaggregated for themselves by helping them search and acquire related but dispersed information. It is also possible to transform the information from the traditional formats to the format proposed by the FASB and IASB with the help of XBRL. It should again be reminded, though, that many of the results from these experiments were only available as working papers at this time.

There were few studies available related to the fundamental characteristic relevance, and even these were mostly working papers, which makes definite conclusions premature. One study seemed to find the XBRL filings in the voluntary filing program value relevant, and a couple of others seemed to find that XBRL filings helped reduce information asymmetry and risk on the markets. It remains a matter of the future developments and academic research to see, whether mandatory XBRL tagging will be extended to the narrative parts of the financial reports, or whether a move to new financial reporting paradigm such as the Enhanced Business Reporting (EBR) will bring changes to the actual content of the required or voluntary disclosure of information by firms.

5.3 Further Research and General Conclusions

Research and development should be continued to make the XBRL financial statements technically more reliable, together with providing better validation tools, training and guidance documents. Moreover, efforts to develop appropriate assertions and processes for XBRL assurance should be continued. Further research and development related to the Enhanced Business Reporting (AICPA, 2008) and equivalent initiatives is also needed to clarify the new reporting ideas and the need for them.

Many of the studies of the fit between XBRL taxonomies and actual reporting practices of firms are quite old, so an update of them may also be appropriate. According to Debreceny et al. (2011), detailed tagging of financial statement notes is required in the USA from the first-round XBRL filers after June 2010, and one year after the first time of mandatory filings from the rest. This means that there should already be actual data available for research studying the fit between the XBRL taxonomies and the financial statement notes, and the appropriateness of the taxonomy extensions made by the companies.

A large number of IFRS financial statements of foreign companies listed in the USA are also required to be filed in the XBRL format in the spring of 2012. This provides rich opportunities for timely empirical research, even with a view of a potential introduction of XBRL in the European Union. Studies on the quality and design of the IFRS taxonomy along the lines in Piehocki et al. (2009), Zhu and Wu (2011), and Debreceny et al. (2010, 2011) are also high on the list. These research ideas and product development suggestions are given just as examples of the many imaginable research issues related to XBRL and accounting, where the current level of understanding is limited.

XBRL is currently being adopted and required by regulators all over the world outside the European Union. Europe is partially lagging behind in XBRL matters. Judging by all the problematic technical and accounting issues discussed in this study, this may yet turn out to be beneficial. Learning from the experience of other countries and jurisdictions may help avoid costly mistakes, if the EU later decides to require XBRL filings from firms listed in Europe. On the other hand, as far as the harmonization of the US GAAP and IFRS accounting standards is concerned, there may be one drawback in the fact that especially the USA is running far ahead of the EU. Due to the recent substantial investment into the US GAAP taxonomy infrastructure made by American constituencies, it may also become more difficult than hitherto to persuade the Americans to ultimately adopt a common accounting standard such as the IFRS or a future one developed jointly with the rest of the world.

In general, the move towards XBRL looks like being driven by regulators. This is consistent with the conclusions by, for instance Chang and Järvenpää (2005) and Locke and Lowe (2007), who suspected that despite their great potential benefits, technologies like XBRL would not be adopted without being required by regulators. XBRL can be viewed as an infrastructure project, and that project is not complete yet. However, even a superior tool will not be automatically adopted for use. The ultimate adoption of XBRL is likely to depend on whether companies and investors (and the regulators themselves) can conveniently use it for other purposes than just complying with regulator filing requirements. Studies more focused on end-user, analyst, institutional investor, and regulator needs together with their characteristics and preferences, and perhaps experiments with using XBRL for more complex tasks are also needed for identifying factors that may affect the adoption of XBRL. Moreover, further studies are needed for addressing XBRL adoption among various constituencies using proven models and frameworks from other literatures, for instance the

technology acceptance model (TAM) or the critical success factors (CSF) framework, or sociological frameworks.

Apart from a few articles in accounting trade journals and blogs in the Internet, there has been limited discussion about concrete uses and software products for end users, so XBRL does not seem to have begun yet to deliver on the promise of a more level playing field between institutional and non-professional investors. Even though XBRL has been demonstrated to help make financial statements more understandable to individual users, and to help them in making investment decisions, the current XBRL viewer software programs and templates available do not seem appropriate for conducting deeper financial statement analyses automatically, especially when there is a need to compare several firms. In fact, just being able to view two XBRL financial statements side by side can be misleading, unless the user has some accounting knowledge and is aware of the potential need for adjusting the figures before use.

Another type of software that seems to be missing is one that would be able to understand the internal logic of one single XBRL filing in order to interpret the elements in their context, automatically adjust the financial statement figures, and calculate key ratios from the adjusted figures. The field is definitely open for developing applications that use XBRL. There were a few working papers, not included in this study, demonstrating the use of XBRL for many other, quite innovative financial and management accounting purposes.

Given the weak level of interoperability of the XBRL taxonomies, even a new layer of data processing may well be needed, this time for making the computers understand the "meaning" of the XBRL elements in the tagged instance documents. Research for this and other similar novelties is under way in the so-called semantic web field, using various already known technologies such as the Web Ontology Language (OWL). A couple of such projects are described in Núñez et al. (2008) and García and Gil (2010).

As to what Debreceny and Gray (2001) called the third problem with Internet financial reporting, the standardization problem (meaning the accounting standards themselves), little seems to have changed so far. The XBRL taxonomies have definitely been developed to support the reporting requirements laid down in the accounting standards and the actual reporting practices of the firms, not the other way around. This might be due to the traditional thinking of the accounting and auditing profession, where the issue may even have been considered trivial in the sense that accounting standards are regarded by

accountants to take strict precedence, and no changes to any standard under any regime seem to ever have been considered in order to make this or that reporting requirement interoperable.

However, according to Debreceny et al. (2011), there is some anecdotal evidence that some US companies are already beginning to change the reported financial statement information itself in order to bring it in line with the US GAAP taxonomy without having to make too many extensions to the base taxonomy. Moreover, Wagenhofer (2003) predicted, that developments in Internet reporting and especially the XBRL are likely to lead to a demand for more standardized financial information (that is interoperable). This does not seem to have happened yet, but some studies reviewed in this study suggest that a template-based accounting standard would make it easier to fit XBRL taxonomies and actual reporting practices together. Demands for changing accounting standards towards a template-based format might surface in the future.

Accounting standards setters are, after all, constantly under lobbying pressure from many constituencies with contradictory objectives, and a new one with an interest in making financial statements more interoperable may well come into being. After all, the accounting standards in force at any given time are a compromise and result from a multitude of tradeoffs. They are not a 'reality' carved in stone. In their 2006 article, Alexander and Jermakovich (2006, p. 134) had an objective to establish that: "...the contents of financial statements are inherently subjective, being intersubjective constructions rather than mind-independent realities. It follows from this that accounting information may be perceived, presented and interpreted by different people in different ways...". Alexander and Jermakovich seemed to find what they were seeking. They went on and stated (2006, p. 137): "...The essential point is that 'underlying economics of any company' as a 'reality', cannot exist independently of a conceptual scheme such as financial statement standards agreed between human actors...". Having regard to this quote about the non-existence of absolute truth, it would only be logical to expect that human actors - such as the standard setters - might at some point in the future be convinced to pragmatically change their conceptual schemes in order to re-balance the costs and benefits of useful financial statement information with the costs and benefits of interoperability and automation.

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